ANNEX - FOI 202200325717 – Information Released

1. email of 29 April 2021

From: [redacted]@ed.ac.uk>
Sent: 29 April 2021 15:57
To: [redacted]@lanarkshire.scot.nhs.uk; [redacted]; [redacted]@nhs.scot>; [redacted]@gov.scot>;
[redacted]<@gov.scot>; [redacted]

Dear all

As discussed I have attached the draft PfG document describing current and progressive stroke services. This will lead on to a detailed review of how current services compare with our ideal, and thus an implementation plan will hopefully emerge. I have highlighted in green some issues which the storke voices group may wish to consider in detail – but please disagree and identify others! I have attached comments from SA which I have reacted to.

We can perhaps discuss in detail on 13th May when [redacted] is back.

Bw [redacted]





2. emails of 18 November 2021

From: [redacted] Sent: 18 November 2021 16:46 To: [redacted]<@nhs.scot> Subject: RE: A progressive Stroke Pathway FINAL draft 0.2 151121

Hi [redacted],

These are the two references I was looking for in full and couldn't see - Tieges et al., 2015; Fini et al., 2017)

And updated the UN text to read *The United Nations has set out the right of people with disabilities to have access rehabilitation to enable full participation and inclusion in all aspects of life.*

Let me know if you're content with that wording? I'm probably being over-cautious on this one but I'm nervous of stating outright that's it's a 'human right' because they are enshrined in law in the UK through Human Rights Act and I'm not clear on how all of the different conventions/legislation links together. So am just trying to avoid saying something that might not be accurate from a UK legal point of view, though I don't understand it well enough to feel confident either way!

[redacted] [redacted] [redacted]

Clinical Priorities Team Healthcare Quality and Improvement Directorate DG Health & Social Care

From: [redacted]<@nhs.scot> Sent: 18 November 2021 12:59 To: [redacted]<@gov.scot>; [redacted]<@ed.ac.uk>; [redacted]<@ggc.scot.nhs.uk>; [redacted] <phs.scot>; [redacted]<@lanarkshire.scot.nhs.uk> Cc: [redacted]<@gov.scot>; [redacted]<@gov.scot> Subject: Re: A progressive Stroke Pathway FINAL draft 0.2 151121

Thank you [redacted]

Re the UN statement - the text inserted it doesnt say or have the impact as the original statement ie rehab is a human right' and the text on the UN website which describes the treaty does refer to it being agreed as a human rights treaty ie

'The Convention on the Rights of Persons with Disabilities and its Optional Protocol (A/RES/61/106) was adopted on 13 December 2006 at the United Nations Headquarters in New York, and was opened for signature on 30 March 2007. There were 82 signatories to the Convention, 44 signatories to the Optional Protocol, and 1 ratification of the Convention. This is the highest number of signatories in history to a UN Convention on its opening day. It is the first comprehensive human rights treaty of the 21st century and is the first human rights convention to be open for signature by regional integration organizations. The Convention entered into force on 3 May 2008.

St Andrew's House, Regent Road, Edinburgh EH1 3DG www.gov.scot



The Convention follows decades of work by the United Nations to change attitudes and approaches to persons with disabilities. It takes to a new height the movement from viewing persons with disabilities as "objects" of charity, medical treatment and social protection towards viewing persons with disabilities as "subjects" with rights, who are capable of claiming those rights and making decisions for their lives based on their free and informed consent as well as being active members of society.

The Convention is intended as a human rights instrument with an explicit, social development dimension. It adopts a broad categorization of persons with disabilities and reaffirms that all persons with all types of disabilities must enjoy all human rights and fundamental freedoms. It clarifies and qualifies how all categories of rights apply to persons with disabilities and identifies areas where adaptations have to be made for persons with disabilities to effectively exercise their rights and areas where their rights have been violated, and where protection of rights must be reinforced. The Convention was negotiated during eight sessions of an Ad Hoc Committee of the General Assembly from 2002 to 2006, making it the fastest negotiated human rights treaty.

Can we please replace this with original statement. Thanks.

Will discuss reference queries later too - thanks

[redacted] [redacted] [redacted] [redacted] Honorary Lecturer - The Robert Gordon University [redacted]





3. emails of 23 November 2021

From: [redacted]

Sent: 23 November 2021 12:40

To: [redacted]@chss.org.uk>; [redacted]@ed.ac.uk>; [redacted]; [redacted]<@gov.scot>; [redacted]@nhs.scot>; [redacted]>; [redacted]@aaaht.scot.nhs.uk>; [redacted]@ggc.scot.nhs.uk>; [redacted]@glasgow.ac.uk>; [redacted]@gov.scot>; [redacted]@nhs.scot>; [redacted]@nhs.scot>; [redacted]@chss.org.uk>; [redacted]@glasgow.ac.uk>; [redacted]@ggc.scot.nhs.uk>; [redacted]@stroke.org.uk>; [redacted]@chss.org.uk>; [redacted]@glasgow.ac.uk>; [redacted]@lanarkshire.scot.nhs.uk>; [redacted]@gov.scot>; [redacted]@ggc.scot.nhs.uk>; [redacted]@lanarkshire.scot.nhs.uk>; [redacted]@gov.scot>; [redacted]@phs.scot); [redacted]@lanarkshire.scot.nhs.uk>; [redacted]@phs.scot>; [redacted]@phs.scot); [redacted]@ed.ac.uk>; [redacted]@clinmed.gla.ac.uk>; [redacted]@nhslothian.scot.nhs.uk>; [redacted]@glasgow.ac.uk>; [redacted]@nhs.scot>; [redacted]@pov.scot> Subject: Progressive stroke pathway document for feedback - 17th December 2021 Importance: High

Dear Committee member,

You will be aware that we have been developing a document outlining a progressive stroke pathway for Scotland, to which many of you have contributed. We are very grateful for your input so far.

Attached is a draft version of this document, on which we seek your further comment and opinion. We would be grateful if you could provide feedback via this survey

(<u>https://response.questback.com/scottishgovernment/jegbcnbix5</u>) by the **17th of December 2021**. Kind Regards

[redacted]

[redacted] Clinical Priorities Team Healthcare Quality and Improvement Directorate DG Health & Social Care

From: [redacted]

Sent: 23 November 2021 12:39 To: [redacted]<@chss.org.uk> Subject: for circulation: Progressive stroke pathway document for feedback - 17th December 2021

Hi [redacted],

The progressive stroke pathway is now ready for feedback. Could you please circulate the attached and the below to the National Stroke Voices? Kind Regards [redacted] [redacted] [clinical Priorities Team Healthcare Quality and Improvement Directorate DG Health & Social Care

St Andrew's House, Regent Road, Edinburgh EH1 3DG www.gov.scot





Dear National Stroke Voices member,

You will be aware that we have been developing a document outlining a progressive stroke pathway for Scotland, to which many of you have contributed. We are very grateful for your input so far.

Attached is a draft version of this document, on which we seek your further comment and opinion. We will present on the document and seek your comment at the next NSV meeting on 8^{th} of December.

If you wish to provide written feedback in addition, then we would be grateful if you could provide feedback via this survey (<u>https://response.questback.com/scottishgovernment/jegbcnbix5</u>) by the **17th** of

December 2021.

Kind Regards

[redacted] [redacted] Clinical Priorities Team Healthcare Quality and Improvement Directorate DG Health & Social Care



4. email of 2 March 2022

From: [redacted] Sent: 02 March 2022 14:17 To: [redacted]@chss.org.uk>; [redacted]@ed.ac.uk>; [redacted]@gmail.com>; [redacted]@gov.scot>; [redacted]@nhs.scot>; [redacted]; [redacted]@aaaht.scot.nhs.uk>; [redacted]@ggc.scot.nhs.uk>; [redacted]@glasgow.ac.uk>; [redacted]@gov.scot>; [redacted]@nhs.scot>; [redacted]@nhs.scot>; [redacted]@chss.org.uk>; [redacted]@glasgow.ac.uk>; [redacted]@ggc.scot.nhs.uk>; [redacted]@stroke.org.uk>; [redacted]@chss.org.uk>; [redacted]@glasgow.ac.uk>; [redacted]@lanarkshire.scot.nhs.uk>; [redacted]@gov.scot>; [redacted]@ggc.scot.nhs.uk>; [redacted]@lanarkshire.scot.nhs.uk>; [redacted]@phs.scot>; [redacted]@phs.scot; [redacted]@ed.ac.uk>; [redacted]@clinmed.gla.ac.uk>; [redacted]@nhslothian.scot.nhs.uk>; [redacted]@glasgow.ac.uk>; [redacted]@nhs.scot>; [redacted]@gov.scot> Subject: Progressive Stroke Pathway - final version - in confidence Importance: High

Dear All,

Please find attached the final version of the Progressive Stroke Pathway document and also the foreword from Prof Dennis for information -Please note the draft is confidential and not for wider sharing.

The included Graphic will be optimised by publishers to comply with publishing guidelines.

If anyone has any concerns about the draft I would be very grateful if you can contact me by close of play on Friday 4 March -Kind regards, [redacted]

[redacted]

Clinical Priorities Team Healthcare Quality and Improvement Directorate DG Health & Social Care [redacted] Save a life For Scotland – Starting CPR Saves Lives – Let's Be Ready http://www.savealife.scot/





5. email of 11 March 2022

From: [redacted]@gov.scot> Sent: 11 March 2022 14:12

To: Cabinet Secretary for Health and Social Care <CabSecHSC@gov.scot> Cc: DG Health & Social Care <DGHSC@gov.scot>; Chief Medical Officer <CMO@gov.scot>; Chief Nursing Officer <CNO@gov.scot>; [redacted]@gov.scot>; Hutchison D (David) (Special Adviser) <David.Hutchison@gov.scot>; [redacted]@gov.scot>; [redacted]@gov.scot>; Communications Health & Social Care <CommunicationsHealth&SocialCare@gov.scot> Subject: FOR CLEARANCE: Progressive Stroke Pathway PO/ Cabinet Secretary for Health and Social Care Copy as above

Please find attached our submission requesting clearance of the Progressive Stroke Pathway (PDF attached) for publication by the end of March.

I would be grateful if you could provide clearance for publication by **Friday**, 18th March.

Please be advised that Annex B, which also appears in the Progressive Stroke Pathway, will be amended by the publishers to comply with accessibility guidelines prior to publication.

Kind Regards

[redacted] [redacted] [redacted] **Clinical Priorities Team** Healthcare Quality and Improvement Directorate DG Health & Social Care





6. email of 13 March 2022

From: [redacted]@gov.scot> On Behalf Of Cabinet Secretary for Health and Social Care Sent: 13 March 2022 16:43

To: [redacted]@gov.scot>; Cabinet Secretary for Health and Social Care <CabSecHSC@gov.scot> Cc: DG Health & Social Care <DGHSC@gov.scot>; Chief Medical Officer <CMO@gov.scot>; Chief Nursing Officer <CNO@gov.scot>; [redacted]@gov.scot>; Hutchison D (David) (Special Adviser) <David.Hutchison@gov.scot>; [redacted]@gov.scot>; [redacted]@gov.scot>; Communications Health & Social Care <CommunicationsHealth&SocialCare@gov.scot> Subject: RE: FOR CLEARANCE: Progressive Stroke Pathway

Hi [redacted],

Mr Yousaf is content with the recommendations, have we shared the progressive stroke pathway with external stakeholders? May be worth taking soundings from the 3rd sectors orgs involved as well as the likes of the BMA.

Regards,

[redacted]

Private Secretary for Minister for Public Health, Womans Health and Sport – Maree Todd Scottish Government | St Andrews House | EH1 3DG T: [redacted]| E: ministerPHWHS@gov.scot





7. email of 14 March 2022

From: [redacted]@gov.scot>

Sent: 14 March 2022 16:16 To: Cabinet Secretary for Health and Social Care <CabSecHSC@gov.scot>; [redacted]@gov.scot> Cc: DG Health & Social Care <DGHSC@gov.scot>; Chief Medical Officer <CMO@gov.scot>; Chief Nursing Officer <CNO@gov.scot>; [redacted]@gov.scot>; Communications Health & Social Care <CommunicationsHealth&SocialCare@gov.scot> Subject: RE: FOR CLEARANCE: Progressive Stroke Pathway

Hi [redacted],

Many thanks to the Cabinet Secretary and his team for providing approval so quickly on this, it is greatly appreciated.

I can confirm that the major third sector organisations, namely Chest Heart and Stroke Scotland and Stroke Association, have been involved in the process of developing the Progressive Stroke Pathway and have has sight of the final draft shared with the Cabinet Secretary.

As we move into the development of an implementation plan to address the recommendations made, we will continue to liaise with these organisations, as well as those with lived experience of stroke through the National Stroke Voices group.

The document has not been shared with the BMA. Our expectation would be to liaise with unions such as the BMA, as well as any other relevant union bodies, as we create our implementation plan. This will ensure any planned interventions to address the recommendations, particularly those which may have implications for the workforce, have been worked through with the unions. Kind regards,

[redacted] [redacted] [redacted]

Clinical Priorities Team Healthcare Quality and Improvement Directorate DG Health & Social Care

Yours sincerely





Introduction

The Scottish Government announced that stroke would be in its Programme for Government in 2019. Its commitments were to:

- 1. Appoint a Specialty Adviser to the Chief Medical Officer on Stroke Care
- 2. Review and improve the current stroke care bundle to improve outcomes for patients
- 3. Collaborate across Scottish Government on stroke prevention and raising awareness of the signs of stroke
- 4. Begin work to scope out and define what a progressive stroke service looks like
- 5. Ensure that a national planning framework is in place for a high quality and clinically safe thrombectomy (a procedure to unblock arteries in the brain) service.

This document specifically aims to present the work carried out in respect of commitments 2 and 4, but inevitably it touches upon the progress made with the other commitments.

Acknowledgements

This document has been put together by a very large number of individuals during the COVID pandemic. Their amazing contributions are acknowledged in Appendix 1.

Structure of this document:

- 1. Description of the components and functions of a modern comprehensive stroke service
- 2. Review of existing stroke services
 - methods
 - results
 - emerging overarching themes
 - areas for improvement for specific aspects of service delivery
- 3. What progressive stroke services should look like in the future
 - methods
 - overarching themes
 - recommendations to improve specific aspects of service delivery
- 4. Appendices

The components and functions of a comprehensive stroke service:

- Pre-hospital care including aspects of primary prevention, public awareness and appropriate triage by primary care and emergency services.
- Early assessment and diagnosis of suspected strokes and TIA whether requiring admission or not)
- Delivery of hyperacute treatments including thrombolysis (clot busting medications) and/or thrombectomy where appropriate and post treatment monitoring and care
- Care on a stroke unit to minimise the risk of complications, provide effective treatment of any which occur and provide an environment which facilitates rehabilitation.
- Provide rehabilitation in hospitals and the community to optimise the patient's physical, psychological and social function.

• Support the patient in the self-management of the stroke and provide help with the management of the longterm, physical, psychological and social consequences of the stroke.

These functions have been delivered in different ways and different locations depending on the patients' characteristics, needs and wishes, and geography.

The figure below illustrates the components of a comprehensive stroke service in relation to the typical patients' pathway.

Outline of components of a comprehensive stroke service:



Pre-hospital

This incorporates activities to:

- raise and maintain awareness of stroke in the population, its recognition and the need for urgent action which are key to optimising prevention and treatment.
- identify opportunities for prevention whilst healthy lifestyle (deprivation, smoking, alcohol, diet, obesity) and management of vascular risk factors reduce the risks of coronary heart disease, peripheral vascular disease and cancer prevention, the identification and treatment of atrial fibrillation (AF) is of specific importance to reduce the burden of stroke.
- ensure that people with symptoms of a stroke receive immediate assessment and appropriate triage to the most appropriate hospital service which can meet their immediate needs including imaging, thrombolysis and/or thrombectomy and treatments to minimise their risk of deterioration.

TIA services

Many people develop mild or transient symptoms which might represent a TIA or mild stroke do not require immediate admission to hospital but need specialist assessment, early access to investigations and same day initiation of treatment to reduce the risk of further problems. TIA services, which may be configured in many different ways, aim to offer these functions flexibly along with access to longer term support to reduce longterm risks and optimise the patient's physical, psychological and social outcomes

Hyperacute care

This typically refers to the first 48-72 hrs following stroke during which time critical interventions may be delivered and close monitoring is required to prevent early complications.

Treatment of stroke within the first few hours includes so called reperfusion treatments, (thrombolysis and thrombectomy, aimed at unblocking an artery causing an ischaemic stroke. It also includes treatments which aims to limit the bleeding causing a haemorrhagic stroke. Both have the potential to greatly reduce the brain damage caused, and thus improve survival and functional outcomes. The earlier these hyper-acute treatment are given, the better the patients' outcome. Patients receiving these treatments require more intensive observation and monitoring to minimise risks and identify complications early when they can be most effectively treated. Stroke services need to be configured to minimise any delays and maximise the proportion of patients suitable for these treatments.

Stroke Unit

Stroke unit care is the central feature of a modern stroke service (RCP 2016; Appendix Figure 1 - Purple box) which can result in more patients surviving, returning home, and regaining independence (Stroke Unit Trialists' Collaboration, 2020). As it can benefit most stroke patients, even those who do have hyperacute treatments, it is important that planners and policy makers recognize the important role of stroke unit care within hospitals.

Although the core features are well described, services have sought to deliver stroke unit care in a variety of different ways (Appendix Table 1 and 2). The size and configuration will depend on factors such as rurality and the other services and resources available (Cadilhac 2017, 2019, SSNAP 2016). However, clinicians and planners should ensure that every stroke patient receives the core service characteristics of stroke unit care (Stroke Unit Trialists' Collaboration, 2020) from initial assessment to discharge from hospital (Busingye 2018).

Key features of a stroke unit.

a geographically-defined unit;

 a co-ordinated multi-disciplinary team that meets at least once a week for the exchange of information about in-patients with stroke;

- information, advice and support for people with stroke and their family/carers;

- management protocols for common problems, based upon the best available evidence;

 – close links and protocols for the transfer of care with other in-patient stroke services, early supported discharge teams and community services;

- training for healthcare professionals in the specialty of stroke.

Rehabilitation and longterm support (life after stroke)

People who have had a stroke should have access to high quality, evidence based, person centred stroke rehabilitation which reflects their needs and preferences. Stroke rehabilitation services aim to optimise function, reduce disability, promote independence and autonomy, and work alongside people and their families to achieve meaningful outcomes. (Wright et al 2016)

Stroke rehabilitation is based on a truly holistic biopsychosocial approach which seeks to understand the interactions of a diverse range of factors in a person's presentation (i.e. biological, psychological and social factors). This is not only essential for defining the aims of rehabilitation but also to ensure that interventions are appropriate for, and meet the needs of the individual. This shared understanding promotes interdisciplinary working between health and social care professionals to support effective and efficient stroke rehabilitation services. (Wade 2017; Smith 2021).

Stroke rehabilitation service should be underpinned by a holistic rehabilitation model and appropriate service infrastructure, leadership and expertise. (Appendix1). The core elements of rehabilitation include person centred care, personal goals and self management support. Personalised and evidence based therapeutic interventions delivered by stroke specialists should be offered to support recovery, adaptation to new functional status, self management, and longer term health and well being.

Stroke rehabilitation plans should be agreed and initiated in hyperacute and acute stroke units and be available, according to need along the entire stroke pathway. This comprises acute inpatient settings; early supported discharge (ESD); in-patient stroke rehabilitation and in the community where, in addition to rehabilitation, long-term self management support needs to be provided.

Review of current stroke services across Scotland

Methods

It is important to recognise that regular reviews of stroke services in Scotland have taken place since the Scottish Stroke Improvement Plan (SSIP) was introduced in 2014 (web link). Since then each NHS Board has

- Provided data for the Scottish Stroke Care Audit (SSCA) to reflect their performance
- Rated their delivery of specific components of stroke services according to nationally agreed criteria
- Been visited by the SSIP team to discuss their performance and focus on local quality improvement work.

In 2020 this work proceeded, despite the COVID pandemic but was supplemented by:

- Analysis of linked data between the Scottish Ambulance Service and SSCA to provide insights into the performance of emergency pre-hospital services
- Virtual visits (via MS TEAMS) with all NHS Boards by the CMO advisor, SSIP and SSCA coordinators and a consultant allied health professional (AHP) seconded to the PfG team)
- Focused work on
 - readiness for thrombectomy and
 - services to provide prolonged monitoring to detect paroxysmal AF
 - review of access to rehabilitation
- Workforce surveys
 - Consultant stroke physicians (appendix)

To date more audit activity has taken place on acute hospital care (including thrombolysis, thrombectomy and stroke unit care), TIA services and secondary prevention than on pre-hospital care and rehabilitation. To some extent this reflects the complexity, and thus difficulties in measuring rehabilitation activities. However, the priorities team have provided additional support to identify methods to do so.

These reviews of stroke services have provided outputs which are divided into overarching themes which apply across all the components of stroke services and those which relate to specific parts of the services.

Overarching themes.

Access to stroke services, and their performance vary due to variation in:

• Workforce - Staffing levels and grades and specialisation

Inevitably more populous NHS Boards have larger numbers of clinicians, nurses and therapists who have specialised in stroke and can ensure access to those specialists for greater parts of the week, and on more sites. Smaller boards may have very limited or no access to specialists in certain locations, or at certain times. Staffing levels amongst all

professional groups (Nurses, AHPs, Psychologists and Doctors) are widely perceived to be too low to consistently meet the needs of patients – this reflects a large number of vacant posts, especially in nursing and consultants, insufficient establishments and lack of workforce planning. Perceptions of under staffing are exacerbated by lack of IT systems and support staff to optimise patient facing time by minimising time spent of administrative tasks.

• Education and training

The quality of stroke services provided is hugely dependent on the availability of knowledgeable, skilled and experienced healthcare professionals. This is influenced by access to high quality education and supported learning, and staff turnover. It is recognised that there is significant attrition of stroke trained staff from acute stroke rotas and services and retention of trained staff remains a challenge for future service provision. Whilst there are a wide range of both on-line and traditional learning resources available for staff, the staffing pressures mean that providing the time to allow them to participate remains a challenge. There is currently a national education template which outlines the training required for staff involved in the care of stroke patients. This has shown that there is a variation in the training that is available to stroke staff within health boards, this leads to inequity in service, as clinical staff are unable to update their skills. This is in part due to some health boards having dedicated trainers, these are employed by the health board or Chest Heart and Stroke Scotland currently.

• Access to investigations

There is very marked variation in patients' access to investigations such as MRI, vascular imaging, prolonged ECG monitoring and echocardiography which are important tools to allow the clinician to provide the most effective care. Whilst some of the variation relate to the capacity of the services delivering these investigations, the services often do not have robust systems to enable them to prioritise the important and urgent over elective work, or requests which are unlikely to alter management. Scanners are often fully booked with elective work, often to ensure arbitrary waiting times are met, so that urgent scans which may have a very significant impact on patients' treatment and outcome are not possible.

• Access to IT and specific applications

There is marked variation in the amount and type of IT available to stroke services. The adoption of a national Picture Archiving and Communication System (PACS), now with a platform to allow reporting anywhere, is very important to stroke services, but is the only obvious example where the mantra "once for Scotland" is applicable.

Other systems used in all NHS Boards (e.g. TRAKcare, SCI Gateway, SciStore) have been configured locally so their use varies hugely and useful development in one NHSBoard cannot be easily emulated in others. NHS Boards have implemented other systems – Portals, Patientrack, local lab, departmental systems which are specific to that NHS Boards or region. These differences are becoming an increasing problem with the introduction of Thrombectomy which involves patients moving between NHS Boards and even regions.

• Organisation, management and governance of the stroke services.

Since 2005 all NHS boards have had a Managed Clinical Networks (MCN) for stroke but since their establishment their structures and influence have diverged. In some NHS Board areas their management aligns with planning, operational management and quality improvement and straddle the secondary care and community services which provides the best environment in which to configure effective stroke services. In others the MCN has little influence and here it is more challenging to improve delivery of stroke care. Linking hospital based services with those in the community where the latter is overseen by integrated joint boards is a challenge to ensure clinical governance and performance is managed across the whole pathway. Where reporting mechanisms which are recognised and scrutinised as part of the NHS boards' priorities exist, boards perform better than those that do not have such structures in place.

• Priority given to stroke within the NHS Board

This seems to depend on the profile of the stroke services in the NHS Board. In some the senior management team (SMT) are aware of the performance of their stroke services and engage in the process of improvement. In others the SMT appear to have little awareness of performance of their stroke services and do not prioritise their improvement

The following section highlights issues which relate to specific parts of the of the pathway (see figure)

1. Pre hospital services

Raising and maintaining awareness of stroke in the population, its recognition and the need for urgent action are key to optimising prevention and treatment. However, there is no consistent coordinated approach to achieving this across Scotland. There are examples of good practice but these are not consistently delivered.

There continues to be a lack of timely data available from NHS boards and sites, concerning the number of patients with suspected hyperacute stroke that are pre alerted by the Scottish Ambulance Service (SAS). This in turn means that there is no robust measure to ensure the correct patients are being taken to the most suitable hospital, and then admitted onto the correct stroke pathway. In one case, hyper acute stroke patients were being admitted to a site which did not have a stroke service, or even an Accident and Emergency. This practice has now ceased, but it highlights the lack of a thorough national reporting tool for the SAS. In addition, if patients are not pre alerted, it results in a delay in receiving hyperacute treatment and the appropriate stroke care bundle, increasing the risk of a poor outcome.

Hospital clinicians have highlighted the value of the pre-alert including patient identifiers such as the Chi number, name and date of birth to facilitate rapid decision making on arrival and reduced door to needle (DTN) times for thrombolysis. The reviews identified that this information is included in only a minority of locations i.e. good practice was not be applied everywhere.

There is an acknowledgement, despite the lack of reliable data, that many patients without stroke are pre-alerted, and also that some with hyperacute stroke are not. There have been small pilot projects indicating that providing paramedics with access to a specialist via a Professional to Professional (Prof to Prof) call can enhance the pre

hospital diagnostic accuracy and decision making with respect to TIAs and stroke. However, these systems are not widely in place. Most ambulances/paramedics rely on the Airwaves systems for communicating with hospitals.

Paramedics across Scotland use the FAST test to identify possible strokes but are not using more detailed pre –hospital tools (e.g. RACE) or technologies which might improve diagnostic accuracy and triage.

In general SAS transport the patients with suspected hyperacute stroke to the nearest "thrombolysis ready" hospital.

2. TIA services

The performance of these services is monitored by SSCA which measures the proportion of patients seen in the TIA clinics (with TIAs and minor strokes) who are seen within 4 days of referral. Whilst the majority of services meet the standard of 80% this is not the case everywhere.

Also, with the risk of recurrent stroke highest in the first day or two one can certainly argue that the standard might be much higher (in England the standard is that patients are seen within 24 hours of referral). Earlier treatment will reduce the incidence of severe stroke. In some locations so called TIA hotlines are in place which allow paramedics, GPs and ED staff to talk directly to a stroke physician at the time of the patient first accessing healthcare. These means that patients can receive very early specialist intervention and treatment whilst waiting to have the diagnosis and treatment refined. A proportion of patients, are seen in ED dept. These, with either real-time access to stroke specialists and relevant investigations or backup from a TIA clinic can provide excellent care which minimises the risk of further stroke – however, currently this activity is not captured or monitored routinely.

Due to the ongoing pandemic, at the time of review, many NHS boards had started to incorporate virtual assessments using telephone and Near Me into their assessments. This more flexible approach has lead to reduced waiting times for specialist input in some areas but does not deal with the variable access to early investigations.

3. Hyperacute care

The current performance measures relating to hyperacute care focus on the delivery of thrombolysis, since at the time of the reviews no thrombectomies were being carried out in Scotland.

Patients outcomes are improved by minimising the delay from stroke onset to thrombolysis treatment. There is marked variation (19.5% to 6.4%) in the proportions of patients with acute ischaemic stroke receiving thrombolysis and also in meeting the standards for door to needle (DTN) time (50% within 30 minutes of arrival and 80% within 60 minutes of arrival) and the geometric mean (42.3 minutes to 130 minutes) between NHS boards, and even sites within those NHS boards. This may be due to

numbers of patient's receiving thrombolysis in each health board, but also as a consequence of variations in pathways, the governance model and the number and type of professionals involved in the decision making. In most places offering thrombolysis the DTN are much shorter during normal working hours, than at other times. However, in services where a stroke nurse was involved in "pulling "the patient through the pathway, or where specialist stroke doctors were available in person out of hours, we saw shorter DTN overall, and little difference between in and out of hours.

Whilst variation in patient pathways inevitably differs between hospitals because of variation in size, geography, facilities and staffing many hospitals were unable to admit acute stroke patients to a dedicated stroke unit where the staff were skilled and experienced in monitoring and treating stroke patients. Hyperacute patients are often managed in non-specialist high dependency areas, or even coronary care units.

4. Stroke unit

For the majority of stroke patients who require admission, but do not receive thrombolysis the emphasis of care is to deliver the stroke bundle. There are 4 components; swallow screen (100% within 4 hours of arrival, and before any food, fluids or oral medication is administered), brain imaging (90% within 12 hours accepting that hyperacute patients require a scan as soon as possible after arrival), aspirin for those with ischaemic stroke (95% on day or admission or following day) and admission to stroke unit (90% on day of admission or following day). In general, brain imaging and aspirin standards are met. However, there remains significant challenges in swallow screen and access to stroke units, and as a consequence the stroke bundle performance remains low.

It is known that care on a stroke unit is associated with reduced risk of dying, improved functional outcomes and reduced length of hospital stay. The bundle reflects access to stroke unit care and this is variable between health boards and sites. One health board routinely admits patients to high dependency following thrombolysis, some do so when stroke unit beds are full which both impact on their performance and the quality of care provided compared with hospitals where all patients are admitted directly to the stroke unit, post thrombolysis. For some hospitals the location of the stroke unit within the hospital or out of hours medical and nursing staffing levels make it potentially unsafe to admit acutely ill and unstable patients to the stroke unit.

For over 15 years we have been developing pathways, training staff, improving documentation and carrying out quality improvement projects. Despite this, in no hospital in Scotland does every patient receive the right care, at the right time, everytime. For this reason patients' outcomes are not optimised and it highlights the need to innovate to rectify this situation.

From our organisational audits we know that there are also marked variations in the size of stroke units, their staffing levels (medical, nursing and AHPs) and the training of those staff. Sprint audits within SSCA, and local audits have demonstrated very variable delivery of many potentially important aspects of stroke unit care (e.g. feeding, fluids, positioning, use of intermittent pneumatic compression, rehabilitation assessments and

treatments). These audits have had to rely on review of paper or electronic health records which are burdensome, time consuming and therefore failures in delivery are inevitably only identified in retrospect when any detriment to the patients is unavoidable. TRAKcare, the electronic health record used across Scotland does not support the sort of data capture, extraction and analysis to provide real-time data on delivery of important aspects of stroke unit care. This hinders quality improvement work There are examples where systems which do capture data real- time – for instance Patientrack used in VHK, Fife to prompt NEWS observations, facilitates recording of the observation, prompts appropriate escalation, and tracks the delivery of this in real-time across its medical wards, including the stroke unit. Failures of delivery are immediately identified, and can be rectified. However, these systems currently do not support improvement in delivering specialty specific aspects of care such as those in a stroke unit.

The majority of NHS Boards operate integrated stroke units, where patients receive acute care and their rehabilitation in one place. However, there are still several NHS boards where patients are transferred to stroke and on occasion general rehabilitation units.

One health board, boarded confirmed stroke patients to different wards, so that it could meet the standard for new admissions. This meant that their length of stay in the stroke unit was reduced but stroke patients were not receiving the most appropriate care, as stroke patient should be in a specialist stroke service until their stroke care has ended.

5. Rehabilitation and longterm support (Life after stroke)

Stroke rehabilitation services in Scotland are mostly unable to deliver sufficient intensity and or duration of therapy input to meet the needs of their patients due to therapists having insufficient time available for direct patient input. Most therapy is only available 5 days per week even where patients would benefit from daily input. Therapy input for patients in the community varied greatly depending on geography and local organisation.

For all components of the SSIP, it remains a significant challenge for some health boards to demonstrate that they are able to achieve the benchmarking criteria and provide the same level of service across the NHS board area. This is due largely to chronic under resourcing of rehabilitation services and how stroke rehabilitation services are set up forming part of another specialism, MOE or neurology. As these services have developed stroke rehabilitation has taken a different path in each board with variation in how rehabilitation delivered ranging from specialist stroke rehabilitation teams, to generic rehabilitation delivered by staff with little or no neurological or stroke specialist skills. This has been further complicated by engagement with integrated joint boards, who have different demands on their services, and are not fully engaged in the stroke pathway with stroke teams. This partly explains the high level of ambers on the self-assessment charts. However, some areas are capable of providing a consistent service, but this has taken considerable time and engagement across the whole pathway and

with the integrated joint boards. Where specialist community rehabilitation is in place this improves flow, discharge planning and access to suitable rehabilitation.

Only one health board in Scotland has a dedicated early supported discharge team across the whole NHS board, while some NHS boards are able to offer this over only part of their pathway.

Whilst the charitable sector is an important aspect of longer term support for people who have had a stroke there is variation is what is available across the country. Chest Heart and Stroke Scotland (CHSS) and the Stroke Association offer support for people in the longer term following stroke, such as nurse follow up, peer support groups and exercise classes but these are not available everywhere.

What should Progressive Stroke Services in Scotland look like?

Methods

At the outset we had planned for Health Improvement Scotland (HIS) to carry out a detailed systematic review of the evidence supporting the delivery of stroke services across the whole patient pathway. However, the resources of HIS were diverted onto COVID pandemic which forced us to adopt an alternative strategy. Therefore, this section has been developed using a pragmatic, multicomponent approach including:

- 1. Review of services to identify examples of good and novel practice (see above).
- Reference to existing national and international stroke guidelines which have adopted rigorous methods such as GRADE including the most recent comprehensive UK Clinical Guideline (RCP 2016) with updating of relevant recent major trials (published since 2016) and cross-referencing to other recent guidelines (NICE 2016, NICE 2019, Norrving 2018) from similar healthcare systems.
- Horizon scanning, carried out under the auspices of the National Planning Board over 2018/19 which benefitted from engagement with many healthcare professionals involved in stroke services and targeted reviews of evidence by HIS.
- 4. Involvement in international collaborations to produce up to date reviews of what should constitute stroke services in high-income countries (ref Langhorne et al Lancet 2020)
- 5. Reference to "Integrated Stroke Delivery Networks National Service Model (NHS England)" which was based on a recent review of the evidence by King's College, London

We established subgroups to focus on each part of the pathway: pre-hospital, TIA services and secondary prevention, hyperacute care, stroke units and rehabilitation and longterm support. Each was asked to provide a succinct list of characteristics which a progressive stroke service would have, taking account of the unique geography and healthcare system of NHS Scotland.

We have not attempted to describe in detail all of the evidence based interventions which patients should have access to since that is the purpose of guidelines. We have focussed on describing stroke services which should be available to deliver those interventions which are known to be effective, and others which may be shown to be effective in the future.

The recommendations may be relevant to

- a) Scottish Government
- b) National Planning Board
- c) Regional planning groups (to ensure appropriate networking of services) across NHS Boards.
- d) NHS Boards and
- e) Hospitals (where most services are currently provided.
- f) Integrated Joint Boards
- g) 3rd sector organisations

Specific challenges within the Scottish healthcare system are noted along with potential developments and roles for new technology.

The newly formed Patient Voices group have provided their input to the description of progressive stroke services to ensure that they reflect the needs and priorities of patients and their families.

Overarching themes which apply to all components of stroke services

Workforce

- A hyperacute/acute stroke service should provide specialist medical, nursing, and rehabilitation staffing levels matching the RCP Guideline.
- Workforce planning must match current and future demand. Working patterns and staffing levels, especially for healthcare staff contributing to out of hours care must be sustainable, to attract and retain staff.
- Where there are shortages of specific staff, the numbers trained should be reviewed but also we should explore imaginative solutions such as advanced clinical roles for nonmedically trained staff.
- Imperative that burnout risk is minimised in a speciality with a high mortality rate and unpredictable intensity with complex decision making.
- There should be adequate levels of support staff and access to IT to optimise the efficiency of clinical staff.
- Consider novel remuneration rates for unsociable hours which may save on external locum costs for rota gaps. <u>References (1,2)</u>
- AHP and nursing services should be able to offer specialised input at an appropriate intensity over a seven day week in inpatient and community services. Psychology and neuropsychology should be part of the core team and service provision throughout the patient journey from acute to longer term.

Education and training

- Introduce a period (or opportunity) within GIM training in Stroke Medicine that will widen the knowledge and skill of the General Medical trainees and potentially attract trainees into the speciality or to develop a stroke special interest. At the moment this is ad hoc e.g. from acute medicine.
- Publicise the training and career development opportunities within stroke nursing. Including roles such as specialist nurses, ANP's will give a career path for stroke nursing.
- Stroke services should have an education programme for all staff providing acute stroke care
 and should provide training for healthcare professionals in the specialty of stroke.
- Invest in developing and maintaining interactive online training which can be accessed at the convenience of the learner.
- Increase the efficiency of delivering live training sessions which can be delivered remotely
 via MS Teams to a large live audience across many NHS Boards, and also be recorded for
 others to access later.
- Coordinate national training programmes tailored to each group of healthcare staff involved in stroke services.
- NHS Boards should keep records of the staff working within stroke services, their training
 needs and training received. When new staff join a stroke service their training needs should
 be identified and a plan made to meet those needs promptly. Large NHS Boards might
 employ specific staff to coordinate training, whilst smaller ones might purchase this function
 from larger ones.

Commented [DM1]: Move to overarching to ensure covered there

Access to investigations

Hyperacute treatments (thrombolysis and thrombectomy) and treatments to reduce the risk of recurrence, or of other complications are all more effective if delivered earlier. However, many depend on brain or vascular imaging with CT or MRI or other investigations (e.g. prolonged ECG monitoring, echocardiography) to determine eligibility for treatment. Access to these investigations should therefore be prioritised accordingly.

- Stroke services, whether dealing with inpatients or outpatients, should have immediate
 access to both CT, CTA, CTP and MRI on a 24/7 basis where a stroke specialist confirms this is
 necessary. Whilst all modalities cannot reasonably be delivered in all locations there should
 be a plan for accessing these at another location if the gain in outcome makes a transfer
 worthwhile.
- Departments offering these investigations need to put in place systems which ensure that
 investigations which identify patients as suitable for time dependent, evidence based
 interventions are prioritised over those which are less urgent or which will not change
 management.

Access to IT

- Wherever possible IT systems should be the same in all NHS Boards to facilitate networking
 and movement of patients across NHS Board where necessary. This will also ensure that a
 development which improves service delivery in one place can be shared across all NHS
 Boards
- Stroke services should have access to systems which
 - Support shared electronic health record keeping to reduce duplication and allowing sharing across a network of care
 - Plan, prompt and record important aspects of care digitally to optimise delivery whilst making best use of clinicians time.
 - Support secure communication (voice, video, text, shared documents and images) between clinicians working across networks to ensure patients' access to timely treatment, especially hyperacute treatments but also to decision support from a specialist in remote and rural settings.
 - Alert a responsible clinician or team to referrals or abnormal investigations to maximise safety and minimise delays.
 - Capture data for audit/quality improvement and monitoring as a by-product of clinical care.
 - Support healthcare professionals in tailoring digital information which can be shared with patients and their families

Organisation, management and governance of the stroke services.

- NHS Boards should have a clear management structure for stroke services relating to the whole patient pathway covering inpatients, outpatients and community services.
- MCNs serve to coordinate professionals, services and organisations to ensure equitable, high quality clinical services. MCNs should operate with clear clinical and operational leadership to connect services via clear service pathways. Stroke services should coordinate across clinical, professional and service pathways, and be tailored to individual needs based on a range of personal, environmental and social factors.

- The services should capture data which reflects its performance in real-time, which supports quality improvement activities and monitoring by the organisation.
- The NHS Board senior management team should have responsibility for ensuring that stroke services meet all important quality indicators.

Priority given to stroke within the NHS Board

• The NHS Board should ensure that the priority it applies to stroke services mirrors that of the Scottish Government.

Recommendations to improve specific aspects of service delivery

Pre-hospital care

Most services in Scotland have some system in place to allow urgent patient referral for rapid specialist assessment. Potential areas of improvement include:

- Ongoing public awareness campaigns covering stroke symptoms, including those not currently covered by FAST, ensuring that the time critical nature of the public's response and knowing what to do (ring 999) are included. These campaigns should be shaped by evidence about what methods (e.g. TV/radio advertising, social media) reach populations, especially those including hard to reach groups (e.g. ethnic minorities, socially deprived)
- Education of GP reception staff and GPs to ensure appropriate referral of acute ongoing, acute but resolved and other stroke like events presenting to practices. Realistically bespoke on line training is likely to be the most practical means of reaching this very large group of staff.
- Systematic case finding in primary care to detect unrecognised atrial fibrillation, provide prompt assessment and where appropriate treatments including anticoagulation, radiofrequency ablation and left atrial appendage occlusion which will reduce the risk of future stroke.
- Introduction of more sophisticated algorithms to support NHS 24/999 Call Handlers to triage
 patients. These might be based on evidence from data captured on current triage versus
 actual diagnoses made in hospital using linked datasets.
- Training paramedics in use of clinical assessment tools to enhance their diagnostic accuracy for stroke and TIA and identification of subgroups potentially suitable for thrombolysis and thrombectomy where that can be shown to improve the performance of the pre-hospital pathways
- Introduce professional to professional calls to support paramedics in decision making in hyperacute stroke, for instance in decisions to
 - by-pass a local thrombolysis centre (spoke) to take a patient direct to a thrombectomy hub and
 - $\circ \quad \text{provide direct links into TIA services.}$

This will be dependent on implementing appropriate technologies to do this securely

• Communication of patient identifiers during any prof to prof calls or pre-alert to allow clinicians within the receiving hospital to access patient records prior to their arrival with the aim to reduce delays in decision making after arrival in hospital.

- Introduce a single communication platform to facilitate voice, data and video communication between paramedics, ambulance control, stroke physicians in spokes and hubs, stroke nurses and interventional radiologists.
- Deployment of any technologies into ambulances which have been demonstrated to be cost effective in refining the diagnosis and classification of stroke.
- Robust and transparent algorithms for the prioritisation of emergency calls and SAS
 resources, including air transfers, which take account of availability, of benefits and risks and
 urgency of the interventions and cost effectiveness to ensure the optimum improvement in
 outcomes from the available resources. These would be informed by analysis of linked data
 from SAS and hospital services.
- Artificial intelligence to help integrate information on location and status of patients, ambulance teams, travels times to ED depts. in spoke and hub hospitals, competing demands on SAS from other time critical conditions. This would help paramedics decide where to take the patients.
- Routine feedback of patients' final diagnosis and acute treatment to SAS personnel involved in the pre hospital journey to support personal development and improve performance.
- Integration of pre-hospital data capture with SSCA to provide real time data reflecting the performance of the pre-hospital stroke/TIA pathway.
- Establishing a Scottish steering group to guide the prioritisation of analyses of these linked data to answer the most important and pressing questions facing the stroke services.

TIA Services

Referral to TIA/Neurovascular Services

- The most common sources of referral to TIA services will be from Primary Care, Emergency Departments, Ophthalmology/Optometry services, Medical Wards and Scottish Ambulance Service. Systems should be in place for all referrers.
- An aspiration would be to have a single national electronic system for referral to TIA/neurovascular services, used locally by all NHS Boards.
- Where appropriate/beneficial 'Prof to Prof' support may be useful, using services such as Consultant Connect and more advanced systems incorporating various communication interfaces. Potentially this could be on a National or regional basis, although this might lead to a trade-off between increasing sustainability/availability versus decreasing local knowledge.
- Alternative pathways should be available for presumed non-neurovascular cases.
- There should be a system for rapid feedback to referrers when a patient is not suitable to attend neurovascular services.
- All patients referred to TIA/neurovascular services should be told not to drive (as per DVLA recommendations) at the point of referral, at least until seen by a stroke specialist.
- There should be a robust and rapid electronic referral system e.g. SCI gateway, TRAK workbench which should prompt driving advice and secondary prevention prescription. These referrals should be monitored, or have notification systems, to ensure prompt appointing to specialist review.
- Performance of neurovascular services should be monitored by the Scottish Stroke Care Audit and the Scottish Stroke Improvement Programme Team.

- Patients should be seen by a stroke specialist in the neurovascular service within the Scottish Stroke Standard time as recommended and monitored by the Scottish Stroke Care Audit (SSCA).
- Where in-person specialist review cannot always be rapidly available, stroke services should consider how targeted access to local or remote stroke specialists (for patients meeting agreed criteria) can minimise delay to time-sensitive interventions. Examples could include commencing increased secondary prevention as early as possible, or expediting additional imaging, for selected patients.

Model of Stroke Service

- TIA/neurovascular service can be provided in several ways including (but not limited to) Specialist TIA Clinic, Ambulatory Care Unit, Stroke Unit, rapid inpatient ward review or, where necessary/appropriate a Virtual Assessment.
- Where Virtual Assessments are performed, patients should have the same access to rapid investigations and immediate secondary prevention as a patient seen face-to-face.
- The specialist involved in assessment should be experienced in stroke care with ongoing access to relevant Continuing Professional Development (CPD).
- In areas that don't have local stroke specialist availability, then remote specialist support should be available.
- Where patients turn out to have minor stroke (as opposed to TIA) they should be able to rapidly access appropriate MDT support such as SLT, PT, OT, Optometry, Ophthalmology, orthoptics etc.
- TIA and minor stroke patients attending TIA/neurovascular services should have the
 opportunity to take part in clinical research.
- Follow up appointments will be available when needed, potentially through the clinic or a stroke liaison nurse team.

Medication/ Prescribing and Immediate Advice

- All NHS Boards should have accessible pathways and secondary prevention guidelines for TIA patient management.
- For TIA (with full recovery) antiplatelet agents and a statin should be commenced immediately (as per local guidance, including any necessary investigations) pending specialist review, unless specialist review is immediate.
- Guidelines should be up-to-date and responsive to change in the evidence base.
- Local guidelines will usually closely reflect any national guidance.
- Guidelines should recommend secondary prevention medication to prescribe but should also have a plan for situations where medication should not be deescalated (e.g. for some cases anticoagulants after TIA).
- Secondary preventative medications should be immediately available e.g. from ward stock, hospital pharmacy or written prescription to take straight to a 24/7 chemist.
- For virtual consultations there should also be a system in place for <u>immediate</u> access to secondary prevention if needed.

Documentation and Communication systems following TIA assessment

 There should be a rapid electronic communication system back to referrer following assessment in TIA/neurovascular service. Examples include secure email, TRAK created

eLetter (e.g. Lothian), Forth Valley System. Ideally, a single national electronic system for communication back to referrers, used by all NHS Boards.

- If using a traditional dictated letter system, then the letter should go rapidly electronically and certainly within 48 hours of the specialist assessment.
- Any request to referrer to make urgent prescribing changes or other key changes to management should be transmitted immediately.

Radiology

- If needed, there should be very early (same day) access to radiological imaging.
- Carotid Ultrasound +/- CTA or MRA should be used for Carotid Imaging when required.
- When the stroke specialist feels that brain imaging is required in patients attending the TIA/Neurovascular service, there should be same day access to this. MRI will usually be the preferred imaging modality in TIA/minor stroke patients who do require a brain scan so there should be increased availability to this in particular.
- High risk TIAs and uncertain presentations may be assessed as inpatients, and so rapid access to necessary radiology should be available both in outpatient and inpatient settings, depending on local service design. There should be a robust system in place to ensure that radiology results are available rapidly and that reports cannot be missed. Significantly abnormal results should be alerted/highlighted to the referrer.
- Where carotid imaging is positive, there should be rapid access to the vascular MDT. Carotid
 intervention should be performed within the Scottish Stroke Standard time as
 recommended and monitored by the SSCA. A carotid coordinator role may help this process.
- Performance of carotid intervention timing should be monitored by the Scottish Stroke Care Audit and the Scottish Stroke Improvement Programme Team.

Cardiac investigations

- When judged to be needed by the stroke specialist there should be early access to
 prolonged cardiac monitoring and transthoracic echocardiography, if necessary with bubble
 contrast.
- This should be within the timeframe for performing and reporting as laid out in the Scottish Stroke Action Plan (currently two weeks to receipt of report for prolonged cardiac monitoring).
- Cardiac rhythm monitoring systems should have real-time reporting of paroxysmal AF with immediate notification of the service to allow verification of the diagnosis and, if appropriate, immediate anticoagulation.
- Monitoring of Boards' ability to perform cardiac investigations within these time frames will be via the Stroke Action Plan and Scottish Stroke Improvement Program Team.
- For patient work up for Patent Foramen Ovale (PFO), there should be 'soon' access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal echocardiography with a pathway in place ensuring that PFO closure is carried out before 6 months of the index stroke.
- There should be a robust system in place to ensure that cardiology results are available rapidly and that reports cannot be lost. Significantly abnormal results should be alerted/highlighted to the referrer.

• Where patients need anticoagulation, following for instance identification of atrial fibrillation, there should be a pathway in place for early anticoagulation with counselling and monitoring systems.

The following services should be available from TIA/neurovascular service:

- Referral to addiction support teams
- Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
- Referral to exercise service
- Referral to Dietetics
- Vocational advice and support

Treatment targets

- A process for shared decision making re medical interventions should be incorporated into services. Specific shared decision making tools, such as 'Tailored Talks', may be useful resources.
- Referrers should be aware of individual treatment targets e.g. blood pressure and lipid targets.
- Remote blood pressure monitoring should be available for certain cases e.g. FLORENCE programme or 24 hour ambulatory monitoring
- Selected stroke patients may benefit from more aggressive lipid management aiming for lower LDL targets. Where appropriate pathways should be in place for this e.g. a pharmacist led stroke lipid clinic, primary care follow up system.

Long-term Management

- Patients with TIA/minor stroke should have access to self-management programmes/training/education. These will include access to tiered psychology support where needed.
- Following discharge from TIA/neurovascular services, patients with TIA or minor stroke should be followed up lifelong in primary care long-term conditions monitoring.

Recommendations relating to care of those patients requiring hospital admission

- Stroke services should provide all people with stroke with specialist multi-disciplinary care
 for the whole patient pathway including; diagnosis, hyperacute and acute treatments,
 normalisation of homeostasis, early rehabilitation, prevention of complications, secondary
 prevention, ongoing rehabilitation, and palliative care as required.
- People with stroke should be treated on a specialist stroke unit throughout their hospital stay.
- Treatment pathways for stroke patients in hospital should include:

- a defined hyperacute stroke unit/admission area with assessment by a stroke specialist;

- geographically-defined stroke unit(s) where patients are managed by a co-ordinated multidisciplinary team that fulfils the criteria of a stroke unit;

- close links, protocols and communication systems for the transfer of care with other inpatient stroke services, early supported discharge teams and community services.

- Rehabilitation of stroke patients in hospital should occur in a setting that meets the definition of a stroke rehabilitation unit; a single multi-disciplinary team of stroke specialists with easy access to all relevant supporting services and information, advice and support for people with stroke and their family/carers.
- Where small hospital size/ rurality prevents the establishment of a hyperacute stroke unit or separate stroke rehabilitation unit, arrangements should be in place to ensure equivalent specialist care through the acute stroke unit and/or remote consultation with stroke specialists.
- Staff working in stroke units should have completed the necessary training as outlined in the National Educational template and should follow standardised management protocols for the assessment & management of acute stroke according to Clinical guidelines.
- Stroke services should participate in national and local audit, multi-centre research and quality improvement programmes.

Hyperacute stroke management in hospital

Intravenous Thrombolysis (IVT)

Outcomes from ischaemic stroke treated with IVT are time critical. Regional and National variations in IVT use remain. All patients must have rapid and equitable access to 24/7 IVT irrespective of geographical location or local expertise. Eligible patients must receive IVT with the minimum delay.

In a progressive stroke service this will be achieved by:

- A sustained drive to improve DTN times and the proportion of eligible patients receiving treatment 24/7. Improving these systems will also optimise the care of those cases suitable for thrombectomy.
- Developing a culture where IVT is regarded as a routine treatment where indicated, supported by onsite stroke specialists or telemedicine.
- Widening access to Telestroke networks in areas of suboptimal treatment numbers and DTN times.
- Improving access to advanced imaging to maximise the number of patients who present on waking, or presenting late with favourable imaging, and who are not suitable for thrombectomy, to receive IVT
- Creating the necessary infrastructure at all sites to recruit suitable patients to ongoing thrombolysis trials across a national research network.
- Having systems that can be rapidly responsive and flex with best and emerging evidence.
- Regular audit and governance processes that monitor performance and provide transparent review of outcomes. Data is recorded within national and central registries.
 <u>References</u> (10-12)

Thrombectomy

Approximately 40% of acute ischaemic strokes are due to a large vessel occlusion (LVO).Restoring blood flow with early thrombectomy (sometimes referred to as clot retrieval) significantly reduces dependency. Approximately 800 cases per annum in Scotland, 10% of all stroke presentations, could be treated based on a 24/7 service.

Geographical modelling recommends 3 hubs serving spokes in a drip and ship model. There is a planned incremental development of services across the 3 centres aiming for 24/7 availability across Scotland by 2023? Diagram of hub and spoke model here or at the beginning of the section?

Features of an effective and safe thrombectomy service should include:

- Time efficient pathways and agreed processes at both spokes and hubs to optimise patient outcomes and limit patient exclusions in those with ischaemic stroke due to LVO.
- Specialist staff with recognised training experience, working within a service performing
- sufficient number of interventional procedures per annum to maintain competencies
 Ensuring patients eligible for thrombectomy are transferred to the Hub with minimal delay after IVT commenced.
- Optimised door to puncture time at hubs, as short as is safely possible.
- Sustainable and agreed rotas for anaesthetic staff, INRs/IRs, stroke physicians and theatre staff.
- Agreed pre and post interventional procedure pathways
- Improved ring fencing of beds from referring centres to facilitate bidirectional flow.
- Capacity to assess and triage increasing numbers of referrals from spokes as developing services and advancing neuroimaging technology continue to generate greater numbers of potential candidates for thrombectomy.
- Provision of adequate technology at stroke physician and INR/IRs homes to interpret hyperacute imaging and mobile communication platforms.
- Regular multi-professional governance meetings including cases discussed but not transferred in addition to those cases accepted by hubs. Optimising learning for all involved in the process and embraces a culture of quality improvement.
- Infrastructure to support patient entry into randomised clinical trials where indicated
- Economic analysis is fed back to health boards of bed days/social services/nursing home days saved per centre versus cost of cases treated.
- Continuous review of the service model, processes of care and referral criteria as the evidence base grows.

References (13-17)

Inter-hospital Patient Transfers to facilitate thrombectomy

The transfer of patients between hospitals can introduce delays to time critical treatments. Requirements and recommendations for safe and efficient transfers should incorporate:

- Agreed protocols and pathways for all centres.
- Nationally agreed documentation, in digital and paper format when required, to simplify
 processes across health boards and reduce repetition.
- Patients should be transferred by the quickest and safest transport means available to the appropriate hub as determined by their location.

- Agreed and robust communication processes and modalities for discussing cases between spokes, hubs and INR/IRs. Ensuring adequate infrastructure in place for effective and reliable communications between teams and health boards.
- Back-up systems (such as walkie talkies) in place for when primary modes of communication fail or become unreliable due to connectivity or unplanned downtime.
- Utilisation of electronic devices (using 4G/5G) during transfers capable of supporting upload
 of data and real time information sharing between the nurse escort to the spoke and hub
 consultants and INR's.
- Ambulance tracking technology that updates the hub of ETA.
- Mobile communication platforms supporting feedback to all involved in the process including SAS and ED staff.
- Agreed, safe and efficient repatriation protocols.
- Mechanisms for case reviews and lessons learnt. Promote a learning by experience and sharing culture
- Senior regional and local managerial agreement and cognisance of the importance of prioritising transfer of stroke patients.
- Patient repatriation identified as a KPI or is audited by SSCA to ensure hub flow and optimal bed and resource utilisation "hold a bed" for each transfer. ? Sustainable
- Manage expectation with early standardised information, digital resource, tailored talks etc. *Hyperlink* to thrombectomy eligibility criteria.
 - *Hyperlink* to pretransfer checklist *Hyperlink* to Readiness for repatriation checklist

Interventional Neuroradiology

There is a national shortage of trained INRs in the UK. Very few neuroscience centres in England are currently staffed to provide a 24/7 thrombectomy service. Imaginative and flexible workforce solutions will be essential in a globally competitive job market to address this. Incentivising rotas and job plans may be a partial solution if Scotland is to remain an attractive workplace for specialist trained staff. Features of a sustainable interventional neuroradiology/radiology service for thrombectomy will include:

- A volume of work at operational hubs that satisfies the agreed numbers for competency and training. Training may involve remote mentoring and simulation technology based teaching.
- Credentialing, supported by Interventional Neuroradiologists (INRs), may be necessary to train sufficient operators to populate 24/7 rotas across Scotland and enable cover of nonstroke INR work e.g. aneurysm coiling.
- Workforce planning futureproofed for the anticipated increase in workload once a service has commenced and the inevitable effect of extending time windows for intervention as advancements in therapies emerge.
- Cognisance that 50% of potential cases will present out of hours, work patterns, job plans and rotas will need to reflect this in order to provide equity of access and avoid the "weekend effect".
- Adoption of cutting-edge technological innovation including advancements in AI and neurointerventional robotic solutions.

References (18-20)

Interface with Emergency Departments

Seamless joint working with Emergency Departments (ED) is paramount for optimal patient care and outcomes in the hyperacute stage of the stroke pathway.

To minimise delays to assessment and treatment services should include:

- Pre-alert systems and protocols as determined by the availability of onsite stroke expertise. These may include pre-alerts incorporating pre-hospital scales to improve identification of patients with large vessel occlusions (LVO).
- Systems supporting pre-registered imaging requests from the stroke team clinicians.
- Staff competent in acute stroke management and familiar with thrombolysis and thrombectomy eligibility criteria and pre-transfer procedures, checklists and processes.
- Video links for optimal telehealth communication between the ED and stroke teams.
- Senior decision maker and senior leadership involvement at the front door to minimise DTN e.g. straight to CT protocols.
- Optimal door in door out (DIDO) times to minimise delays to Thrombectomy and maximise the opportunity for selected patients to access Thrombectomy where the Hub is offering only extended hours service
- Systems and resources to enable SAS to remain on spoke site until LVO confirmed or excluded to minimise DIDO.
- Efficient team working whilst maintaining sound and safe decision making. Concomitant goal of minimising inappropriate or futile transfers to the Hub.
- "Straight to MRI protocols" for some strokes where this is the most appropriate imaging modality.
- Establish agreed stroke mimic pathways where non stroke patients are cared for out with the stroke service when possible enabling efficient use of stroke beds and workforce.
- Provision of tailored information or signposting for relatives and carers relating to thrombectomy and repatriation processes where indicated.
- Performance and protocols should be robustly audited and cases examined when protocols not followed.

References (3)

Telestroke

Telestroke has a major role in improving access to hyperacute specialist care, decision making and the safe delivery of hyperacute treatments. (ref) Telestroke service should facilitate:

- Equitable access to stroke specialist assessment and advice during the hyperacute phase, irrespective of the patient's location.
- Filtering and triage of referrals from spokes and remote sites.
- Patient selection for reperfusion therapy or other hyperacute management.
- Reduced delays in time critical decisions and treatments and efficient identification of patients not suitable for intervention or transfer to another site.
- Where telemedicine is used for the rapid assessment of people with suspected stroke, the system should include a high-quality video link to enable the remote stroke physician to assess the patient according to Clinical Guidelines.
- Reliable connectivity at home and offsite for telestroke physicians is essential to reliably assess
 patients and access imaging outputs.

- Use in ambulances and air transport, providing real time status on patients,
- Rolling educational programmes locally and nationally. Audit and governance programmes ensuring all key users are trained and competent in using teletechnology to assess and manage patients.
- A progressive and adaptive telestroke service must be open to and embrace emerging technological advances e.g. mobile stroke units

References (4-7)

Imaging and Artificial Intelligence (AI)

The role of radiology and imaging in hyperacute stroke management is integral to achieving the best outcomes for patients by supporting time critical decision making. Features of such a service must include:

- Agreed imaging protocols at spokes and hubs for non contrast CT, CT Angiography (CTA) and CT perfusion (CTP)
- Urgent imaging acquisition, rapid transfer of images and interpretation to support acute treatment decisions
- Imaging interpretation supported with validated AI software.
- Agreed use of preauthorised acute advanced imaging to minimise delays.
- Advanced imaging to facilitate treatment of wake-up stroke and late or unknown onset presenting patients .e.g. CTP
- Adequate imaging resources in spokes and hubs to cope with increasing numbers of patients suitable for screening for reperfusion therapy.
- Use of CTP as a decision aid in triaging patients and identifying suitable patients for transfer to hubs from spokes.
- Swift access to MRI for specific patient groups e.g. using rapid access MRI to investigate and facilitate early discharge where indicated.
- Early identification of vascular pathology to inform appropriate secondary preventative strategies in ischaemic and haemorrhagic stroke.
- Al imaging processing role supported by radiology coupled with recognition by team members of the limitations and potential pitfalls of Al.
- Agreed processing and secure governance of patient data.
- Formal reporting of all radiology investigations during the following working day
- Ongoing analysis and audit of performance. <u>References</u> (8,9)

Hyperacute stroke unit (HASU)

- People with suspected acute stroke should be admitted directly to a HASU(or equivalent admission area) and be assessed for emergency stroke treatments by a specialist clinician (physician/nurse) without delay.
- A HASU (or equivalent admission area) should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week.
- A HASU (or equivalent hyperacute area) should have immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the hyperacute management of people

with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

- Patients with acute stroke should have their swallowing screened, and dysphagia managed, according to Clinical Guidelines.
- Healthcare professionals responsible for the assessment and management of patients with acute stroke should be trained in how to position and mobilise patients in a way that is safe and consistent with Clinical Guidelines.
- Patients with acute stroke should be managed according to Clinical Guidelines to minimise the risk of complications.
- The majority of acute stroke presentations will not be eligible for reperfusion therapy but all should receive rapid access to optimal acute stroke care and expert management. Features of an effective and safe HASU are:
 - Specialist staffing and technology that provide close clinical and continuous physiological monitoring for all and especially those at higher risk of early deterioration or complications
 - Tailored bed configurations with flexibility and staffing to reflect local need and demand.
 - Sufficient numbers of patients to maintain staff expertise.
 - Ring fenced beds for stroke patients alongside agreed processes for stroke mimic admissions that efficiently process their care through general medicine and neurology services.
 - A geographically located area regarded as distinct from acute medical admission beds, similar to CCU or HDU beds. This will maintain flow at the hub and spoke.
 - Where stroke performance indicators and stroke bundle are recognised as discrete from 4 hour emergency admission targets and given high priority by local Health boards.
 - Seamless working with ICU/HDU where required.
 - Structured specialist care for ICH patients.
 - Rapid access to appropriate imaging and diagnostics to facilitate treatment and discharge
 - Access to 7 day specialist allied health input both to increase rehabilitation potential and facilitate flow and discharge to protect capacity.

Management of Intracerebral Haemorrhage (ICH)

Intracerebral haemorrhage represented 12% of stroke admissions in Scotland in 2019. Mortality rates and disability remain disproportionately high within this group worldwide (ref). A progressive stroke service must aim to improve the outcomes for this group of patients.

Hyperacute stroke services for ICH should include:

- Expert supportive care on HASU or ASU. Aiming for consistent and optimal care and close observation for signs of deterioration.
- Care that reflects emerging best evidence for reducing secondary brain injury.
- Consideration of the adoption of care bundles to help consistency and reduce variation by standardising processes of care. Incorporate evidence based interventions if and when available.
- Early communication with local or regional neurosurgical teams in cases of ICH at risk of developing hydrocephalus.
- Rapid anticoagulant reversal protocols responsive to emerging evidence as up to 20% of ICH cases occur in patients taking anticoagulant medication.

 Avoidance of harm and unintended limitations of care by ensuring senior level decision making regarding advanced care planning. <u>References</u> (21-25)

Links with Neurosurgical Services

Hyperacute and acute stroke services should have protocols for the monitoring, referral and urgent transfer of patients where there is a risk of patients requiring neurosurgical intervention to regional neurosurgical centres.

Systems of joint working should be developed to:

- Establish broadly agreed referral criteria for carefully selected cases. g.g. decompressive hemicraniectomy for malignant MCA syndrome (MMCA).
- Support shared decision making to ensure treatments are delivered which are most likely to
 deliver the outcome valued by the patient and/or family. This is likely to be optimised by
 early involvement of senior clinicians with access to systems to share tailored information
 with patients and their family.
- Establish electronic documentation for remote consultation outcomes (e.g. Clinical Portal) when cases are referred and discussed. An audit trail of referrals, decisions and outcomes will help inform practice development and processes.

Education and Training

- All professional groups potentially dealing with hyperacute patients should have been trained in core stroke competencies. E.g. STAT+, ACTATS, STARS Advanced Modules.
- Training supported by rolling educational plans with blended learning, web based and simulation based training.
- Weekly national educational sessions , shared learning amongst professional groups
- Education development framework with clear progression opportunities important for retaining staff.
- Mentoring for junior staff, opportunities to rotate into other parts of the stroke pathway or undertake secondments and gain wider knowledge and appreciation of their role within the entire system

Stroke unit care after the hyperacute phase

- Acute stroke patients should be managed in an acute stroke unit that provides the following:
 - specialist medical and nursing staff trained in the acute stroke management;
 - stroke specialist rehabilitation staff;
 - access to diagnostic, imaging and cardiology services;
 - -access to tertiary services for neurosurgery and vascular surgery;
 - continuous access to a consultant with expertise in stroke medicine;
- People with communication problems after stroke should be assessed by a speech and language therapist and ongoing management planned according to Clinical Guidelines.

- Patients with severe stroke resulting in a high risk of death or poor functional outcome, should be involved at an early stage in shared decision making about the aims of treatments including cardiopulmonary resuscitation, critical care, hemicraniectomy, and treatment to reduce the risk of serious complications. Where the patient lacks capacity their proxies should be involved.
- Where patients are at risk of post stroke complications (e.g. infection, venous thromboembolism, dehydration, malnutrition, pressure sores), and depending on the established aims of treatment, patients should receive evidence based interventions such as parenteral fluids, early tube feeding, intermittent pneumatic compression and antibiotics.
- Services providing acute and ongoing care for people with stroke should provide high quality end-of-life care for those who need it, including timely access to specialist palliative care if required.
- People with stroke and their family/carers should be involved in decisions about the transfer
 of their care to receive rehabilitation in a different environment e.g. another hospital site or
 community. Any transfers of care should be carried out in accordance with national
 guidelines.

Rehabilitation, longterm support and services to optimise "life after stroke"

Rehabilitation should be considered to be a process that begins as soon as a stroke is diagnosed and continues as long as required.

Principles of a progressive stroke rehabilitation service

Person-centred

Person-centred care is about treating people as individuals and working with them to develop the knowledge skills and confidence to manage and make decisions about their own health and social care needs. It should be personalised, coordinated and enabling, and above all ensure that people are treated with dignity, compassion and respect. (The Health Foundation 2014; Scottish Government (2014). Stroke Improvement Plan.)

Person-centred rehabilitation considers the person's needs, preferences, wishes, values, lifestyle, environment, family and social circumstances. The rehabilitation team works in partnership with them to understand their priorities and to develop solutions.

To demonstrate that stroke services are person-centred in their approach evaluation should include;

- The systematic approach to activities that are deemed central to person-centred care, e.g. regular holistic assessment of need; goal setting; supported self management, family involvement, and
- Patient experience of these activities and the way in which they are treated and communicated with by the professionals working with them

Personal goals

Goal setting is the process by which the person with stroke (and their family or carers if they wish) and members of the stroke team identify individual goals which are meaningful, challenging and have personal value.

(RCP Stroke Clinical guidelines, 2016) Supported Self management
A person-centred approach in which the individual is empowered and has ownership over the management of their life and condition. (Gaun Yersel Self-Management Strategy, 2008)

Rehabilitation team

Expertise from an interdisciplinary team who collectively tailor rehabilitation input towards the person's goals is required. This should be in partnership with the person who has had a stroke and includes explicit involvement of family and carers.

Clinical Leadership

Robust clinical and service leadership provided by a range of professionals working across the stroke pathway is required, ensuring equitable representation and resourcing of stroke rehabilitation.

Equitable access

Access to rehabilitation services should be equally available to those in urban and remote and rural areas and across socio-demographic areas, using technology to deliver when appropriate

Appropriate care setting

In-patient rehabilitation is required for people with complex physical, cognitive, psychological and / or social needs, who could not be supported in a community setting. Rehabilitation of stroke patients in hospital should occur in a setting that meets the definition of a stroke unit;

- a single multi-disciplinary team of stroke specialists with easy access to all relevant supporting services and information, advice and support for people with stroke and their family/carers.
- who predominantly care for people with stroke.

Early supported discharge and stroke rehabilitation services should be offered in a community setting whenever that best meets the needs and wishes of the patient.

Stroke rehabilitation services should be organised to treat a sufficient number of patients to ensure that the specialist skills of the workforce are maintained. At the same time, the closer a rehabilitation service is to the person's home the more that family/carers can be engaged and the more targeted the rehabilitation can be.

Evaluation

Data on service delivery, patient outcomes and experiences should be collected systematically (Norrving et al., 2018). Outcome measures used should be standardised, valid and reliable (Kwakkel et al., 2017) as well as focused on what matters to patients (Duncan Millar et al., 2021). (Action Plan for Stroke in Europe 2018-2030)

Pathways and effectiveness of progressive stroke rehabilitation services will be reviewed via the Scottish Stroke Improvement Programme (SSIP) utilising data from the Scottish Stroke Care Audit (SSCA) and at least one annual review.

Stroke Rehabilitation services should reflect the range of rehabilitation needs for people who have had a stroke and be available in the right place and at the right time along the entire stroke pathway. Inpatient (acute and rehabilitation), community stroke rehabilitation and ESD services should be closely linked with social care and the voluntary sector as part of an integrated stroke rehabilitation service.

The duration of stroke rehabilitation services should be led by the needs of the person who has had a stroke and not time limited.

A clear life-long pathway for people to be able to re-engage with stroke rehabilitation services and re-access specialist support should be available to patients and families. (Norrving et al al 2018)

In-patient stroke rehabilitation

Strong evidence shows that a higher frequency and intensity of therapy than what is provided routinely, especially in the first six months post-stroke, can improve recovery rates and outcome (Brady et al. (2016), Kwakkel et al. (2004), Lohse et al. (2014), Schneider et al. (2016), Veerbeek et al. (2014)). This positive relationship between the amount of rehabilitation and the amount of recovery continues, even when patients are several years post stroke (Lohse et al., 2014) Provision of greater amounts of stroke therapy is associated with; higher therapy and nursing staffing levels; a weekend therapy service; and specialist stroke rehabilitation teams. (Gittins M et al 2020). Factors which impede the amount of therapy provision include time spent in information exchange and administration. Patient focussed reorganisation of working practices including shared documentation and individual patient therapy timetabling is recommended to enable therapy provision in line with clinical guideline recommendations. (Clarke et al 2018)

Stroke rehabilitation units should have a multi-disciplinary team including specialists in medicine; nursing; physiotherapy; occupational therapy; speech and language therapy; dietetics; clinical neuropsychology/clinical psychology; social work; orthoptics; and with easy access to pharmacy, orthotics, specialist seating, assistive technology and information, advice and support for people with stroke and their family/carers. (RCP 2.4.1J; Stroke Unit Trialists' Collaboration, 2020; NICE, 2016):

Acute therapy assessment should be provided by stroke specialists by day three of admission following stroke (Scottish Stroke Improvement Plan) and a personalised rehabilitation plan agreed with the person and their family/carers.

Rehabilitation and recovery should be embedded within all aspects of Stroke Unit care, by all team members, on a 24/7 basis. Interdisciplinary teams should engage people in as much therapeutic activity (including specialist therapy interventions and self practice) as required at a frequency and intensity that enables them to reach their rehabilitation goals. This should include a provision of no less than 45minutes of each required therapy per day, seven days a week if tolerated.

An enriched Stroke Unit environment should facilitate patient engagement in a range of physical, cognitive and social activities out with formal therapy time. This can be supported by staff, carers and volunteers. This whole system approach to Stroke Unit rehabilitation should be promoted to improve recovery and rehabilitation outcomes as well as patient experience. (Jones et al 2020; Clarke et al 2021; White et al 2015)

Evidence based stroke rehabilitation services should be available across the pathway seven days per week at an appropriate intensity with appropriate workforce skill mix.

Early Supported Discharge services (ESD)

Hospital in-patients with stroke who have mild to moderate disability should be offered access to a stroke specific multidisciplinary early supported discharge service which begins within one working

day of hospital discharge and at an intensity and frequency that would be provided if they remained in hospital. Strong links are required between the acute service and the ESD team, with both hospital staff and ESD team members identifying patients. (RCP 2.7.1A-E; Langhorne et al, 2017;Fisher et al 2011).

Community stroke rehabilitation

People who require stroke specific community rehabilitation should have this provided by specialist stroke teams up to seven days per week as required. (Scottish Stroke Improvement Plan).

All those who have had a stroke or TIA should be followed up by a community stroke nurse or other healthcare professional to provide specialist advice and support.

Longer term support and supported self management

Self management support and long term care and support should be an integral element of stroke rehabilitation pathways and should be provided in partnership with health, social care and voluntary sector. (Norrving et al 2018)

All those with residual difficulties following a stroke on discharge from hospital should be provided with a documented plan for community rehabilitation and self-management support.

All patients should have a six month review carried out by a member of the stroke team using a single shared review document.

Stroke rehabilitation pathways

Documented stroke rehabilitation service pathways should be available for evidence based interventions. Many aspects of stroke rehabilitation require a tiered approach (Fig) whereby aspects of care are the responsibility of the whole multidisciplinary team with specialists within the team focusing on more complex presentations. E.g. for those with emotional, psychological or cognitive impairments.

Key elements of a progressive stroke rehabilitation service are noted below however this list is not exhaustive and a person centred approach should allow for all interventions which meet individual needs and preferences e.g. leisure activities, parenting, financial management.

Figure. The WHO Rehabilitation in Health Framework highlights a tiered approach to rehabilitation which should be community based and focussed on the needs of the population. Integrated working is essential to deliver this approach with the individual and their family or carers at the centre and the right person at the right time available to support their needs

Commented [DM2]: If we are putting a time scale on this review we need to stipulate whether this is from the stroke, the admission, hospital discharge or discharge from any community rehab services?



https://apps.who.int/iris/bitstream/handle/10665/325607/9789241515986-eng.pdf?ua=1

Activities of Daily Living

People who have difficulties managing personal, domestic and extended (e.g. work and driving) daily living activities should be assessed by an occupational therapist and provided with a personalised rehabilitation programme. Evidence supports continued ADL training from occupational therapy and includes activity based therapeutic interventions, adaptive techniques, assistive technology and environmental adaptations. (Legg 2017)

Arm function

Impaired arm function after a stroke affects independence, mental health and quality of life. It can be persistent, but rehabilitation interventions that comprise intensive, graded practice of tasks and activities that focus on an individual's goals have been shown to be effective (Pollock et al., 2014a; Bosomworth et al., 2020). Progressive arm rehabilitation, usually provided by occupational therapists and physiotherapists, comprises comprehensive assessment, person-centred goal setting and the provision of a structured, goal-orientated programme of intensive practice. This may include assistive technologies (e.g. functional electrical stimulation, mirror-box therapy and virtual reality (Pollock et al., 2014)) as appropriate. In addition to undertaking scheduled arm rehabilitation, people who have had a stroke should be encouraged by all members of the healthcare team to involve their affected arm in activities of daily living as much as possible in order to increase the intensity of meaningful practice and to improve outcomes.

Bowel and Bladder rehabilitation

Bladder and bowel dysfunction (including urinary incontinence, faecal incontinence, constipation and nocturia) are common and persistent following stroke but amenable to rehabilitation intervention. Progressive rehabilitation will feature structured assessment by a nurse to identify the type of bladder/bowel dysfunction; agreement of individual goals and a programme of mainly behavioural interventions targeted to the type of dysfunction, to support active recovery of bladder/bowel function and use of the toilet. Regular review of the rehabilitation programme and avoidance of containment approaches (including indwelling catheters) are key to recovery of independent bladder/bowel functioning and toilet use. (RCP 2016; Australian Stroke clinical) Guidelines

Balance, walking and mobility

Problems with balance, walking and mobility are likely to increase the risk of falls, deconditioning, becoming housebound and social isolation. People who have had a stroke should have their mobilisation needs assessed as soon as possible following stroke onset. Once medically stable, they should be assisted to mobilise (with appropriate equipment if needed) usually within 48 hours of the stroke and where possible overseen by a physiotherapist. Walking training should be task specific and include a cardiovascular component. Treadmill training with or without body weight support can improve walking for those who are able to walk independently (Mehrholz et al., 2017) and should be available. For those who are not able to walk independently after stroke, electromechanical-assisted gait training devices (i.e. automated electromechanical gait machines) together with physiotherapy can improve the ability to walk independently (Mehrholz et al., 2020) and this technology should be made available. Early access to orthotic assessment for the provision of an Ankle Foot Orthosis (AFO) for those with lack of control around the knee, foot and ankle should be available with reassessment when necessary in order to facilitate walking and prevent falls. Functional Electrical Stimulation (FES) should be available to facilitate gait and prevent falls in those with persistent mild lower limb weakness.

Carer needs

Families and carers should be included in rehabilitation planning and goal setting, if agreed by the person who has had the stroke. Carers should be included in assessments to identify needs and provided with information about stroke and the caring role. Carers should be provided with advice, access to emotional support to adjust to their caring role and maintain their wellbeing, and peer support to reduce the impact of loneliness and social isolation, particularly for those with communication difficulties, if required.

Communication

Post-stroke communication disorders occur frequently. Aphasia and dysarthria each affect around a third of people following a stroke. People who are identified as having a communication disorder after a stroke should be assessed by a speech and language therapist and provided with an individualised rehabilitation programme using evidence-based interventions (Brady et al 2016) to reduce the impairment and/or support functional improvement and long-term adaptation. Such interventions may include group work, computer-based therapy, assistive technology and conversation partner training.

Community support

Community support and life after stroke services are often delivered in partnership with the voluntary sector (incl. Chest Heart and Stroke Scotland and The Stroke Association) and should be made available to all those affected by stroke. This includes information provision, community based support and advice.

Cognition

Up to sixty percent of patients experience significant cognitive impairment and is often considered the greatest barrier to social recovery and re-integration following stroke with overall poorer rehabilitation outcomes. Services should have a documented pathway for the identification and assessment of cognitive problems, and provision for cognitive rehabilitation integrated into the broader rehabilitation programme.

Driving

A documented pathway should be available to advise on national and local services for further assessment and advice with regard to resuming driving or alternative mobility options. Stroke

service should ensure that driver status and intention to return to driving should be ascertained and advice / information is made available.

Physical activity, exercise and fitness training

In a progressive stroke service, physical activity, exercise and fitness training should be provided throughout the stroke pathway through partnerships between health and exercise professionals, the third sector and council services. Exercise and fitness training should begin in hospital (Billinger et al., 2014) and continue in the community (Norrving et al., 2018). It should be provided by therapists or exercise professionals who have evidence of stroke specific knowledge and skills to adapt and tailor exercise programmes for people after stroke.

In addition to scheduled exercise, physical activity should be encouraged. Many people who have had a stroke experience barriers to becoming more active (Nicholson et al., 2013) and sedentary behaviour tends to persist after stroke (Tieges et al., 2015; Fini et al., 2017). Members of the healthcare team should actively promote physical activity as soon as possible after stroke and raise awareness of the WHO guidelines on physical activity and sedentary behaviour (2020). These include aerobic activity, muscle strengthening and balance and also recommend limiting the amount of time spent sedentary, replacing this with physical activity where possible. Evidence-based counselling strategies are effective to encourage stroke survivors to engage and maintain physical activity after stroke (Morris et al., 2014) and these should be provided as required along the entire stroke pathway.

Pain management

Pain following stroke can be due to several causes including neuropathic pain, musculoskeletal pain and shoulder pain and subluxation. Each element requires specialised assessment and a range of evidence based interventions which should be available in documented pathway.

Posture and movement – spasticity services

Stroke services will implement a systematic approach to identify all those who need specialist spasticity assessment and treatment. Stroke services should implement a documented programme for prevention and management, including self management, of post stroke spasticity. All those who need it will have access to a specialist spasticity service (Botulinum toxin injections, EEG or ultrasound guided approach, appropriate clinical expertise to deliver, and coordinated multidisciplinary community follow up including occupational therapy, orthotics and physiotherapy). Psychological Care (cognitive and emotional)

In the aftermath of stroke, patients and families experience a wide range of psychological difficulties, cognitive and emotional, which impact profoundly on function and rehabilitation. Stroke services should implement a documented programme for promoting awareness, screening and treatment of psychological consequences of stroke, under the lead of a specialist clinical/neuropsychologist as detailed in the National Model of Psychological care for stroke (NMPCS: Scottish Stroke Psychology Forum 2020). Psychological care should be available to all patients in line with local delivery plans

Relationships and sexuality

Sexuality includes physical and psychosocial aspects of intimacy. Approximately 50% of individuals experience sexual dysfunction following stroke.(Stratton 2020) however it is not commonly included as part of a rehabilitation programme. (Winstein et al 2016). Services to address these aspects of life after stroke is variable and professional education is lacking. Education with regards to sexuality

following stroke should be provided to the stroke rehabilitation team and specialised support should be made available to those who require it.

Technology and telerehabilitation

Access to a shared electronic record keeping systems is necessary to ensure teams can spend more time treating patients. Stroke rehabilitation services should integrate technology into service delivery and treatment programmes e.g. use of video conference facilities for assessment, specific interventions, meetings and follow up; and use of robotics, IT and computer software for rehabilitation interventions as appropriate.

Vision

Comprehensive assessment and rehabilitation services should be provided to all those with visual problems due to their stroke including:- Comprehensive visual screening, completed before discharge; Direct referral to appropriate professionals for assessment of suspected visual problems; Follow up to determine the level of spontaneous recovery of visual problems; Provision of treatment and rehabilitation, tailored to the specific visual problems by the most suitable profession in that locality (this may vary across NHS and Social Care areas); Provision of information and clear explanation of visual problems, and their possible impact, at each possible opportunity; Ensuring individuals have knowledge of, and access to, relevant low vision services initiating direct referral if required. (Pollock et al. 2019; Rowe F. 2013)

Vocational rehabilitation

Stroke rehabilitation services should identify work status and signpost and /or refer on for specialised intervention as appropriate. A documented pathway should identify local access to a specialised vocational rehabilitation service.

Appendix 1.

Acknowledgement of contributions made to this report

Priorities team

Kylie Barclay

Susan Wallace

John Wilson

PfG team

Katrina Brennan, Martin Dennis, Therese Lebedis, Neil Muir, Fiona Wright, Susan Wallace, Kylie Barclay

Pre- Hospital Group

Martin Dennis, Craig Henderson, Stephen Makin, Karen Garrott, Alison Brooks, Gareth Clegg

TIA Group

Hyperacute stroke

Stroke Unit

Rehabilitation and longterm support

Patient voices

Input from CHSS and Stroke Association

Allan Cowie/ Joanne Graham /

Andrea ail / Karen Garrott

Members of

NACS MCN subgroup

SSCA subgroup

Thrombectomy Advisory Group and subgroups

References for the Hyperacute section

References

- 1. <u>https://www.basp.org/wp-content/uploads/2019/07/BASP-Stroke-Medicine-Workforce-</u> <u>Requirements-Report-FINAL.pdf</u>
- 2. <u>https://bsnr.org.uk/_userfiles/pages/files/bsnrtrainingresponsetomtevidencefinal23116.pdf</u>
- 3. https://informme.org.au/en/Guidelines/Clinical-Guidelines-for-Stroke-Management
- 4. https://journals.sagepub.com/doi/pdf/10.1177/2396987321989865
- Demaerschalk BM, Boyd EL, Barrett KM, et al. Comparison of stroke outcomes of hub and spoke hospital treated patients in Mayo Clinic telestroke program. J Stroke Cerebrovasc Dis. 2018;27(11):2940-2942.
- Sharma R, Zachrison KS, Viswanathan A, et al. Trends in telestroke care delivery: a 15-year experience of an academic hub and its network of spokes. Circ Cardiovasc Qual Outcomes. 2020;13(3): 005903. doi:10.1161/CIRCOUTCOMES.119.005903
- Kim, J; Easton, D; Zhao, H; Coote, S; Sookram, G; Smith, K; Stephenson, M; Bernard, S; Parsons, M; Yan, B; Desmond, P; Mitchell, P; Campbell, B; Donnan, G; Davis, S; Cadilhac, D. Economic evaluation of the Melbourne Mobile Stroke Unit. International Journal of Stroke 2020 Jun 14. Online Ahead of print
- Hassan AE, Ringheanu VM, Rabah RR, et al. Early experience utilizing artificial intelligence shows significant reduction in transfer times and length of stay in a hub and spoke model. Interv. Neuroradiol., 2020, doi: 10.1177/1591019920953055.
- Murray NM, Unberath M, Hager GD, et al. Artificial intelligence to diagnose ischemic stroke and identify large vessel occlusions: A systematic review. Jf NeuroInterv Surg. 2020, doi: 10.1136/neurintsurg-2019-015135.
- 10. ESO Guidelines https://journals.sagepub.com/doi/pdf/10.1177/2396987321989865
- Thomalla G, Boutitie F, Ma H, et al. Intravenous alteplase for stroke with unknown time of onset guided by advanced imaging: systematic review and meta-analysis of individual patient data. Lancet 2020; 396:1574–1584.
- 12. McDermott M ,Skolarus LE ,Burke JF A systematic review and meta-analysis of interventions to increase stroke thrombolysis.BMC Neurol. 2019; 19: 86
- McMeekin P, White P, James MA, Price CI, Flynn D, Ford GA. Estimating the number of UK stroke patients eligible for endovascular thrombectomy. Eur Stroke J. 2017 Dec;2(4):319-326. doi: 10.1177/2396987317733343. Epub 2017 Oct 4. PMID: 29900409; PMCID: PMC5992738.
- 14. BASP/BSNR/UKNG Draft Thrombectomy consensus guideline
- Kim BM, Baek JH, Heo JH, Kim DJ, Nam HS, Kim YD. Effect of Cumulative Case Volume on Procedural and Clinical Outcomes in Endovascular Thrombectomy. Stroke. 2019 May;50(5):1178-1183.
- Zhang L, Ogungbemi A, Trippier S, Clarke B, Khan U, Hall C, Ji Q, Clifton A, Cluckie G. Huband-spoke model for thrombectomy service in UK NHS practice. Clin Med (Lond). 2021 Jan;21(1):e26-e31. doi: 10.7861/clinmed.2020-0579. PMID: 33479080; PMCID: PMC7850178.
- 17. <u>https://www.nice.org.uk/guidance/ng128/chapter/Recommendations#thrombectomy-for-people-with-acute-ischaemic-stroke</u>

- 18. <u>https://www.rcr.ac.uk/system/files/publication/field_publication_files/bfcr198-provision-interventional-radiology-services-second-ed.pdf</u>
- 19. https://bsnr.org.uk/_userfiles/pages/files/bsnrtrainingresponsetomtevidencefinal23116.pdf
- 20. DRAFT BASP /BSNR Thrombectomy guideline document
- Feigin VL, Krishnamurthi RV, Parmar P, et al. Update on the global burden of ischemic and hemorrhagic stroke in 1990-2013: the GBD 2013 study. Neuroepidemiology 2015;45:161–76. 10.1159/000441085
- 22. https://www.strokebestpractices.ca/recommendations/management-of-intracerebralhemorrhage/emergency-management-of-intracerebral-hemorrhage
- Hemphill JC, Greenberg SM, Anderson CS, et al. Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American heart Association/American stroke association. Stroke 2015;46:2032–60. 10.1161/STR.000000000000069
- Parry-Jones AR, Sammut-Powell C, Paroutoglou K, et al. An intracerebral hemorrhage care bundle is associated with lower case fatality. Ann Neurol 2019;86:495–503. 10.1002/ana.25546
- Parry-Jones AR, Moullaali TJ, Ziai WC. Treatment of intracerebral hemorrhage: From specific interventions to bundles of care. Int J Stroke. 2020 Dec;15(9):945-953. doi: 10.1177/1747493020964663. Epub 2020 Oct 15. PMID: 33059547; PMCID: PMC7739136.

Appendix documents Transfer checklist Thrombectomy suitability document Readiness for repatriation checklist

Appendices (copied from Stroke Unit)

Appendix - Table 1. Terminology used for different types of stroke unit.

Stroke unit model	'Typical' timings		'Typical' route	Objectives	Comments
	Admission	Discharge	of admission		
Hyperacute	<6 hrs	Usually 1– 2 days	Direct from Emergency department	Provides specialist medical and nursing care during the hyperacute period when revascularisation (spontaneous or interventional) might occur. Monitoring and interventionfocus on physiological variables and early complications	No supporting evidence from RCTs. Supported by observational studies (Morris 2019). Should be integrated with rehabilitation phase service.
Acute	<24 hrs	Usually several days	From hyperacute unit or medical admissions unit	Provides stroke unit care in the first few days after stroke; including assessment, investigation and intervention (but usually beyond the time window for revascularisation). Monitoring and intervention focus on physiological variables and early complications. Provides appropriate early rehabilitation activities in patients with acute medical problems.	Evidence of effectiveness from two RCTs. Support from observational studies (Cadilhac 2017). Should be integrated with rehabilitation phase service.
Rehabilitation	Days– weeks	Weeks	From acute or integrated unit	Provides stroke unit care, with an emphasis on rehabilitation, but not involved in acute medical care. Usually begins several days after stroke onset and continues rehabilitation for several weeks to months as required.	Evidence of effectiveness from four RCTs. Often provided 'off-site' to support larger hospitals.
Comprehensive (combined)	<24 hrs	Days- weeks	From hyperacute unit or medical admissions unit	Combines both acute and rehabilitation phases in one unit. Overlap of characteristics with "acute" above.	Supporting evidence of effectiveness from 16 RCTs (Stroke Unit Trialists' Collaboration, 2020).

		Useful model for	
		smaller hospitals.	
		1	

Appendix - Table 2. Recommended staffing levels for stroke units

Staff	Hyperacute Stroke Unit	Acute Stroke Unit
Nurso	2.0	1 25
Whole-time equivalent (WTE) per	(80.20	(65:35
bed	registered: unregistered)	registered: unregistered)
Physiotherapist (WTE per 5 beds)	0.73	0.84
Occupational Therapist	0.68	0.81
(WTE per 5 beds)		
Speech and language therapist	0.34	0.40
(WTE per 5 beds)		
Clinical neuropsychologist/	0.20	0.20
Clinical psychologist		
(WTE per 5 beds)		
Dietitian (WTE per 5 beds)	0.15	0.15
Consultant stroke physician	24/7	Consultant led ward
	availability;	round 5 days/week
	minimum 6 thrombolysis	
	trained physicians on rota	

The evidence regarding the optimum size of a hyperacute stroke unit is similarly confined to observational studies, reflecting a level of institutional experience and competence in the provision of specialist hyperacute treatments such as intravenous thrombolysis (Bray et al, 2013) that corresponds with a volume of at least 500 acute stroke admissions per year.

Appendix – Table 3. Recommendations with details of implementation and supporting references

Recommendations – NHS Board level

Recommendation	How to achieve this
Stroke services should provide all people	Stroke services should provide all people with stroke
with stroke with specialist multi-disciplinary	with specialist multi-disciplinary care the whole
care for the whole patient pathway	patient pathway including; diagnosis, hyperacute
including; diagnosis, hyperacute and acute	and acute treatments, normalisation of homeostasis,
treatments, normalisation of homeostasis,	early rehabilitation, prevention of complications,
early rehabilitation, prevention of	secondary prevention, ongoing rehabilitation, and
complications, secondary prevention,	palliative care as required. (RCP 2.3.1C; RCP Sections
ongoing rehabilitation, and palliative care as	3.5-3.7, 3.10).
required.	
Treatment pathways for stroke patients in	Treatment pathways for stroke patients in hospital
hospital should include:	should include (RCP 2.4.1K; NICE, 2016; Stroke Unit
 – a defined hyperacute stroke 	Trialists' Collaboration, 2020):
unit/admission area with assessment by a	 – a defined hyperacute stroke unit/designated
stroke specialist;	admission area with assessment (local or remote) by
 geographically-defined stroke unit(s) 	a stroke specialist;
where patients are managed by a co-	 geographically-defined stroke unit(s) which
ordinated multi-disciplinary team that fulfils	includes;
the criteria of a stroke unit;	 patient management by a co-ordinated multi-
 – close links, protocols and communication 	disciplinary team that meets at least once a week for
systems for the transfer of care with other	the exchange of information and care planning
in-patient stroke services, early supported	about in-patients with stroke;
discharge teams and community services.	 information, advice and support for people with
	stroke and their family/carers;
	 management protocols for common problems,
	based upon the best available evidence;
	 training for healthcare professionals in the
	specialty of stroke (cross refer?)
	 – close links, protocols and communication systems
	for the transfer of care with other in-patient stroke
	services, early supported discharge teams and
	community services.
Where small hospital size/ rurality prevents	Where small hospital size and/or rurality prevents
the establishment of a hyperacute stroke	the establishment of a hyperacute stroke unit,
unit, arrangements should be in place to	arrangements should be in place to ensure
ensure equivalent specialist care through	equivalent specialist assessment and monitoring (in
remote consultation with stroke specialists.	a defined admission area) through remote
	consultation (such as telemedicine) with stroke
	specialists (PfG Group Consensus).
Rehabilitation of stroke patients in hospital	Rehabilitation of stroke patients in hospital should
should occur in a setting that meets the	occur in a setting that meets the definition of a
definition of a stroke rehabilitation unit; a	stroke rehabilitation unit; a single multi-disciplinary
single multi-disciplinary team of stroke	team including specialists in the following (RCP
specialists with easy access to all relevant	2.4.1J; Stroke Unit Trialists' Collaboration, 2020;
supporting services and information, advice	NICE, 2016):
and support for people with stroke and their	– meaicine;
ramily/carers.	– nursing;
	– pnysiotherapy;

	 occupational therapy;
	 speech and language therapy;
	– dietetics;
	 – clinical neuropsychology/clinical psychology;
	– social work;
	– orthoptics;
	- with easy access to pharmacy, orthotics, specialist
	seating, assistive technology and information, advice
	and support for people with stroke and their
	family/carers.
Where small hospital size/ rurality prevents	Where small hospital size/ rurality prevents the
the establishment of a separate stroke	establishment of a separate stroke rehabilitation
rehabilitation unit, arrangements should be	unit, arrangements should be in place to ensure
in place to ensure equivalent specialist care	equivalent specialist care through the acute stroke
through the acute stroke unit and/or remote	unit and/or remote consultation (such as
consultation with stroke specialists.	telemedicine) with stroke specialists (PfG Group
	Consensus).
Stroke services should participate in national	Stroke services should participate in national and
and local audit, multi-centre research and	local audit, multi-centre research and quality
quality improvement programmes.	improvement programmes (RCP 2.3.1K; Working
	Party consensus).

Recommendations – Hospital level

General recommendations

People with stroke should be treated on a specialist stroke unit throughout their hospital stay.	People with stroke should be treated on a specialist stroke unit throughout their hospital stay unless their stroke is not the predominant clinical problem (RCP 2.4.1A; Stroke Unit Trialists' Collaboration, 2020).
A hyperacute/acute stroke service should provide specialist medical, nursing, and rehabilitation staffing levels matching the RCP Guideline.	A hyperacute/acute stroke service should provide staffing levels matching the recommendations in Appendix Table 2 (RCP 2.4.1B; Table 2.1. (Bray et al, 2014; Ramsay et al, 2015; Working Party consensus). Examples of good practice (eg. Educational Templates) are available.
Stroke services should have an education programme for all staff providing acute stroke care and should provide training for healthcare professionals in the specialty of stroke.	Stroke services should have an education programme for all staff providing acute stroke care (including ambulance services and the emergency department as appropriate) and should provide training for healthcare professionals in the specialty of stroke (Follows from the evidence concerning specialist stroke units (RCP - Section 2.4).
Stroke services should participate in national and local audit, multi-centre research and quality improvement programmes.	Stroke services should participate in national and local audit, multi-centre research and quality improvement programmes (RCP 2.3.1K; Working Party consensus).

Details of the Patient Journey

Hyperacute phase (approximately stroke onset to 24 hours)

People with suspected acute stroke should be admitted directly to a hyperacute stroke unit (or equivalent admission area) and be assessed for emergency stroke treatments by a specialist clinician (physician/nurse) without delay.	People with suspected acute stroke (including people already in hospital) should be admitted directly to a hyperacute stroke unit (or equivalent designated admission area) and be assessed for emergency stroke treatments by a specialist clinician (physician/nurse) without delay (RCP 2.3.1B; RCP Sections 3.4-3.7; Morris 2019).
A hyperacute stroke unit (or equivalent admission area) should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week.	A hyperacute stroke unit (or equivalent admission area) should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week. (RCP 2.4.1D; Working Party consensus).
A hyperacute stroke unit (or equivalent hyperacute area) should have immediate access to specialist medical, nursing, rehabilitation, and diagnostic	A hyperacute stroke unit should have immediate access to the following (RCP 2.4.1C; Follows from the evidence and recommendations concerning emergency treatments and monitoring):
staff trained in the hyperacute management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular	 specialist medical staff trained in the hyperacute and acute management of people with stroke, including the diagnostic and administrative procedures needed for the safe and timely delivery of emergency stroke treatments;
Suigery.	 specialist nursing staff trained in the hyperacute and acute management of people with stroke, covering neurological, general medical and rehabilitation aspects;
	 stroke specialist rehabilitation staff;
	 diagnostic, imaging and cardiology services (cross-refer to hyperacute and prevention section?);
	 tertiary services for endovascular therapy, neurosurgery and vascular surgery.
Where telemedicine is used for the rapid assessment of people with suspected stroke, the system should include a high-quality video link to enable the remote stroke physician to assess the patient according to Clinical Guidelines.	Where telemedicine is used for the rapid assessment of people with suspected stroke by a specialist physician, the system should include a high-quality video link to enable the remote physician to observe the clinical examination, discuss with the assessing clinician, talk to the patient and/or carers directly and review radiological investigations (RCP 2.4.1G; Meyer et al, 2008; RCP Working Party consensus).
Staff providing care via telemedicine should be appropriately trained in the hyperacute assessment of suspected acute stroke, the delivery of thrombolysis and the use of this approach and technology. The quality of care using telemedicine should be regularly audited.	Staff providing care via telemedicine (at both ends of the system) should be appropriately trained in the hyperacute assessment of people with suspected acute stroke, in the delivery of thrombolysis and the use of this approach and technology. The quality of care and decision-making using telemedicine should be regularly audited (RCP 2.4.1H; Meyer et al, 2008; RCP Working Party consensus).
Hyperacute and acute stroke services should have protocols for the monitoring, referral and urgent transfer	Hyperacute and acute stroke services should have protocols for the monitoring, referral and transfer of patients to regional neurosurgical centres for

of patients to regional neurosurgical centres.	decompressive hemicraniectomy, surgical management of intracranial haemorrhage and the management of symptomatic hydrocephalus including external ventricular drain insertion (RCP 2.3.1F; Follows from the evidence concerning emergency stroke treatments).
Patients with acute stroke should have their clinical status monitored closely and managed according to Clinical Guidelines.	Patients with acute stroke should have their clinical status monitored closely and managed according to Clinical Guidelines; including level of consciousness; blood glucose; blood pressure; oxygen saturation; hydration and nutrition; temperature; cardiac rhythm and rate (3.10.1D; Working Party consensus, Middleton et al, 2011).
Patients with acute stroke should have their swallowing screened, and patients with dysphagia managed, according to Clinical Guidelines.	Patients with acute stroke should have their swallowing screened, using a validated screening tool, by a trained healthcare professional within four hours of arrival at hospital and before being given any oral food, fluid or medication (RCP 3.10.1E; NICE, 2016; Kertscher 2014; Martino et al, 2014; Bray et al, 2016).
	Until a safe swallowing method is established, patients with dysphagia after acute stroke should:
	– be immediately considered for alternative fluids;
	 have a comprehensive specialist assessment of their swallowing;
	 be considered for nasogastric tube feeding within 24 hours;
	 be referred to a dietitian for specialist nutritional assessment, advice and monitoring;
	 receive adequate hydration, nutrition and medication by alternative means. (RCP 3.10.1F, RCP 3.10.1G; NICE, 2006a, 2008b; Geegenage et al, 2012, Working Party consensus).
Healthcare professionals responsible for the assessment and management of patients with acute stroke should be trained in how to position and mobilise patients in a way that is safe and consistent with Clinical Guidelines.	Healthcare professionals responsible for the initial assessment of patients with acute stroke should be trained in how to position patients appropriately, taking into account the degree of their physical impairment after stroke (RCP 3.11.1B; Working Party consensus).
	Patients within the first 24 hours of onset can be safely managed in the lying-flat head position or the sitting-up position according to their preference (Anderson 2017).
	Patients with difficulty moving after stroke should be assessed as soon as possible within the first 24 hours of onset by an appropriately trained healthcare professional to determine the most appropriate and safe methods of transfer and mobilisation (RCP 3.12.1A; Working Party consensus).

тт
Mobilisation within 24 hours of onset should only be for patients who require little or no assistance to mobilise (RCP 3.12.1B; AVERT Trial Collaboration group 2015; Bernhardt et al, 2016). Patients with difficulty moving early after stroke who are medically stable should be offered frequent, short daily mobilisations (sitting out of bed, standing or walking) by appropriately trained staff with access to appropriate equipment, typically beginning between 24 and 48 hours of stroke onset. Particular care should be taken when mobilising patients who are elderly (>80 years) or have intracerebral haemorrhage (Bernhardt 2020). When lying or sitting, patients with acute stroke should be positioned to minimise the risk of aspiration and other respiratory complications, shoulder pain and subluxation, contractures and skin pressure ulceration (RCP 3.11.1C; Working Party consensus)
Patients with immobility after acute stroke should be offered intermittent pneumatic compression within 3 days of admission to hospital for the prevention of deep vein thrombosis. Treatment should be continuous for 30 days or until the patient is mobile or discharged, whichever is sooner (RCP 3.13.1A; CLOTS Trials Collaboration. 2014).

NB. Telemedicine is used in some centres to support decision-making in hyperacute stroke because of significant practical or geographical obstacles. However, unless telemedicine is used as part of an otherwise well-developed acute stroke service, there is concern that outcomes may suffer (Heffner et al, 2015). Observational evidence suggests that telemedicine is associated with more protocol violations and longer treatment times (Meyer et al, 2008, Dutta et al, 2015) compared with face-to-face assessment but video assessment is associated with better process outcomes than telephone assessment (Handschu et al 2008, Demaerschalk 2011).

Acute stroke patients should be	An acute stroke unit should provide the following (RCP
managed in an acute stroke unit that	2.4.1E; Follows from the evidence and recommendations
provides the following:	concerning emergency treatments and monitoring
 specialist medical and nursing staff 	(Sections 3.4-3.7, 3.10):
trained in the acute stroke	- specialist medical staff trained in the acute management
management;	of people with stroke;
 stroke specialist rehabilitation staff; 	- specialist nursing staff trained in the acute management
 access to diagnostic, imaging and 	of people with stroke, covering neurological, general
cardiology services;	medical and rehabilitation aspects;
 access to tertiary services for 	 stroke specialist rehabilitation staff;
neurosurgery and vascular surgery;	 access to diagnostic, imaging and cardiology services
 – continuous access to a consultant 	(cross-refer to prevention section?);
with expertise in stroke medicine;	 access to tertiary services for neurosurgery and vascular
Staffing should be provided as per	surgery.
Clinical Guidelines.	

Acute phase (approximately first 1-2 weeks)

	An acute stroke unit should have continuous access to a
	consultant with expertise in stroke medicine, with
	consultant review 5 days per week.
Staff working in acute stroke units	Staff working in acute stroke units should have completed
should have completed the necessary	the necessary training as outlined in the National
training as outlined in the National	Educational template and should follow standardised
Educational template and should	management protocols for the assessment & management
follow standardised management	of acute stroke according to Clinical guidelines. This should
protocols for the assessment &	include management protocols for urinary and faecal
management of acute stroke	incontinence and constipation in people with stroke (RCP
according to Clinical guidelines.	2.5.1A: Working Party consensus).
	People with stroke should not have an indwelling (urethral)
	catheter inserted unless indicated to relieve urinary
	retention or when fluid balance is critical (PCP 2.5.1B)
	Morking Dorty concensus)
	Working Party consensus).
	People with stroke who have continued loss of bladder
	and/or bowel control 2 weeks after onset should be
	reassessed to identify the cause of incontinence, and be
	involved in deriving a treatment plan (with their
	family/carers if appropriate). The treatment plan (Thomas
	et al, 2008; Working Party consensus) should include:
	 treatment of any identified cause of incontinence;
	 training for the person with stroke and/or their
	family/carers in the management of incontinence;
	- referral for specialist treatments and behavioural
	adaptations if the person is able to participate;
	 adequate arrangements for the continued supply of
	continence aids and services.
	D People with stroke with continued loss of urinary
	continence should be offered behavioural interventions
	and adaptations (NICE, 2013c, 2015a) such as:
	- timed toileting:
	- prompted voiding:
	– review of caffeine intake:
	– bladder retraining:
	– pelvic floor exercises:
	– external equipment
	prior to considering pharmaceutical and long-term
	catheter options.
	People with stroke with constipation should be should be
	offered (RCP 2.5.1E; NICE, 2007b; Coggrave et al, 2006;
	Working Party consensus):
	- advice on diet, fluid intake and exercise;
	 – a regulated routine of toileting;
	- a prescribed drug review to minimise use of constipating
	drugs;
	– oral laxatives;
	 – a structured bowel management programme which
	includes nurse-led bowel care interventions;
	– education and information for the person with stroke
	and their family/carers;

	 – rectal laxatives if severe problems persist.
People with communication problems	People with communication problems after stroke should
after stroke should be assessed by a	be assessed by a speech and language therapist to
speech and language therapist and	diagnose the problem and to explain the nature and
ongoing management planned	implications to the person, their family/carers and the
according to Clinical Guidelines.	multidisciplinary team. (RCP 4.4.1.1A; Brady et al, 2016;
	Working Party consensus).
Services providing acute and ongoing	Services providing acute and long-term care for people
care for people with stroke should	with stroke should provide high quality end-of-life care for
provide high quality end-of-life care	those who need it.
for those who need it, including timely	Staff caring for people dying of stroke should be trained in
access to specialist palliative care if	the principles and practice of end-of-life care, including the
required.	recognition of people who are approaching the end of life.
	(RCP 2.15.2; NICE, 2015c; Working Party consensus).

Rehabilitation phase

Rehabilitation should be considered to be a process that begins as soon as a	Rehabilitation should be considered to be a process that begins as soon as a stroke is diagnosed and continues as
stroke is diagnosed and continues as	long as required. (the PfG group considered that this
long as required.	principle was important to ensure high-quality holistic
	care).
Rehabilitation of stroke patients in	A stroke rehabilitation unit should have a multi-
hospital should occur in a setting that	disciplinary team including specialists in the following
meets the definition of a stroke	(RCP 2.4.1J; Stroke Unit Trialists' Collaboration, 2020;
rehabilitation unit staffed by a single	NICE 2013b, NICE, 2016):
multi-disciplinary team of stroke	– medicine;
specialists (with easy access to all	– nursing;
relevant supporting services and	– physiotherapy;
information, advice and support for	 occupational therapy;
people with stroke and their	 speech and language therapy;
family/carers) who predominantly	– dietetics;
care for people with stroke.	 – clinical neuropsychology/clinical psychology;
	– social work;
	– orthoptics;
	 – with easy access to pharmacy, orthotics, specialist
	seating, assistive technology and information, advice and
	support for people with stroke and their family/carers.
	A stroke rehabilitation unit should predominantly care
	for people with stroke (RCP 2.4.1I; Stroke Unit Trialists'
	Collaboration, 2020; NICE, 2016).
Where small hospital size/ rurality	Where small hospital size and/or rurality prevents the
prevents the establishment of a	establishment of a rehabilitation stroke unit,
separate stroke rehabilitation unit,	arrangements should be in place to ensure equivalent
arrangements should be in place to	specialist assessment and rehabilitation through generic
ensure equivalent specialist care	rehabilitation services supported by stroke specialists
through the acute stroke unit and/or	(PfG Group Consensus).
remote consultation with stroke	
specialists.	
	Staff caring for stroke patients should be trained in
	the principles and practice of end of-life care,

	including the recognition of people who are approaching the end of life and the current Clinical Guidelines of best practice (NICE, 2015c; Working Party consensus).
People with stroke and their	People with stroke and their family/carers should be
family/carers should be involved in	involved in decisions about the transfer of their care out
decisions about the transfer of their	of hospital, and the care that will be provided (RCP
care out of hospital.	2.7.1F; Working Party consensus).
Transfer of care should be organised	Transfer of care should be organised and run in
and run in accordance with Clinical	accordance with clinical guidelines (NICE, 2013b, NICE
Guidelines.	2016; Working Party consensus).
	Hospital in-patients with stroke who have mild to moderate disability should be offered access to an early supported discharge service, organised and run in accordance with the clinical guidelines (RCP 2.7.1A-E; Langhorne et al, 2017; NICE 2013b, NICE 2016; Working Party consensus).

References

RCP 2016. Rudd AG, Bowen A, Young G, James MA. National clinical guideline for stroke : 5th edition 2016. In: Clinical Medicine. 2017.

Stroke Unit Trialists' Collaboration, 2020. Langhorne P, Ramachandra S. Organised inpatient (stroke unit) care for stroke: network meta-analysis. Cochrane Database of Systematic Reviews 2020, Issue 4. Art. No.: CD000197. DOI: 10.1002/14651858.CD000197.pub4.

Cadilhac, DA, Kilkenny, MF, Andrew, NE et al. Hospitals admitting at least 100 patients with stroke a year should have a stroke unit: a case study from Australia. BMC Health Serv Res 2017; 17:212. https://doi.org/10.1186/s12913-017-2150-2

Cadilhac D, Andrew N, Lannin N, et al. Quality of acute care and long-term quality of life and survival: the Australian Stroke Clinical Registry. Stroke 2017; 48(4):1026–1032.

SSNAP 2017. Royal College of Physicians. Sentinel Stroke National Audit Programme (SSNAP) Clinical Audit, Public Report. London: Royal College of Physicians, 2016.

Busingye D, Kilkenny MF, Purvis T, et al. Is length of time in a stroke unit associated with better outcomes for patients with stroke in Australia? An observational study. BMJ Open 2018; 8:e022536. doi: 10.1136/bmjopen-2018-022536

National Institute for Health and Care Excellence, 2016. Quality Standard 2: Stroke in adults [Online].Available: https://www.nice.org.uk/guidance/QS2.

National Institute for Health and Care Excellence (2019) Stroke and transient ischaemic attack in over 16s: diagnosis and initial management (NICE guideline 128). Available at: http://www.nice.org.uk/guidance/ng128 Published: 1 May 2019

Norrving B, Barrick J, Davalos A, et al; on behalf of the Action Plan for Stroke in Europe Working Group. Action Plan for Stroke in Europe 2018–2030. ESJ 2018; Vol. 3(4) 309–336.

Bray BD, Ayis S, Campbell J, Cloud GC, et al, 2014. Associations between stroke mortality and weekend working by stroke specialist physicians and registered nurses: prospective multicentre cohort study. PLoS Med, 11, e1001705.

Ramsay Al, Morris S, Hoffman A, Hunter RM, et al, 2015. Effects of Centralizing Acute Stroke Services on Stroke Care Provision in Two Large Metropolitan Areas in England. Stroke, 46, 2244-51.

Morris S, Ramsay AIG, Boaden RJ, et al. Impact and sustainability of centralising acute stroke services in English metropolitan areas: retrospective analysis of hospital episode statistics and stroke national audit data. BMJ 2019; 364: 11.

Meyer BC, Raman R, Hemmen T, Obler R, et al, 2008. Efficacy of site-independent telemedicine in the STRokE DOC trial: a randomised, blinded, prospective study 13. Lancet Neurology, 7, 787-795.

Middleton S, McElduff P, Ward J, Grimshaw JM, et al, 2011. Implementation of evidence-based treatment protocols to manage fever, hyperglycaemia, and swallowing dysfunction in acute stroke (QASC): a cluster randomised controlled trial. Lancet, 378, 1699-706.

Kertscher B, Speyer R, Palmieri M & Plant C, 2014. Bedside screening to detect oropharyngeal dysphagia in patients with neurological disorders: an updated systematic review. Dysphagia, 29, 204-12.

Martino R, Maki E & Diamant N, 2014. Identification of dysphagia using the Toronto Bedside Swallowing Screening Test (TOR-BSST©): are 10 teaspoons of water necessary? International Journal of SpeechLanguage Pathology, 16, 193-8

Bray BD, Smith CJ, Cloud GC, Enderby P, et al, 2016. The association between delays in screening for and assessing dysphagia after acute stroke, and the risk of stroke-associated pneumonia. Journal of Neurology, Neurosurgery & Psychiatry, [Epub ahead of print].

National Institute for Health and Care Excellence, 2006a. Clinical Guideline 32: Nutrition support in adults: oral nutrition support, enteral tube feeding and parenteral nutrition [Online]. Available: http://guidance.nice.org.uk/CG32.

National Institute for Health and Care Excellence, 2008b. Public Health Guidance 10: Stop smoking services [Online]. Available: http://guidance.nice.org.uk/PH10.

Geeganage C, Beavan J, Ellender S & Bath Philip MW, 2012. Interventions for dysphagia and nutritional support in acute and subacute stroke. Cochrane Database of Systematic Reviews, 10, CD000323.

Anderson CS, Arima H, Lavados P, Billot L, Hackett ML, Olavarría VV, Muñoz Venturelli P, Brunser A, Peng B, Cui L, Song L, Rogers K, Middleton S, Lim JY, Forshaw D, Lightbody CE, Woodward M, Pontes-Neto O, De Silva HA, Lin RT, Lee TH, Pandian JD, Mead GE, Robinson T, Watkins C; HeadPoST Investigators and Coordinators. Cluster-Randomized, Crossover Trial of Head Positioning in Acute Stroke. N Engl J Med. 2017 Jun 22;376(25):2437-2447. doi: 10.1056/NEJMoa1615715. PMID: 28636854.

AVERT Trial Collaboration group, 2015. Efficacy and safety of very early mobilisation within 24 hours of stroke onset (AVERT): a randomised controlled trial. Lancet, 386, 46-55.Bernhardt et al, 2016

Bernhardt J, Borschmann K, Collier JM, Thrift AG, Langhorne P, Middleton S, Lindley RI, Dewey HM, Bath PM, Said CM, Churilov L, Ellery FL, Bladin C, Reid CM, Frayne JH, Srikanth VK, Read SJ, Donnan

GA. Fatal and non-fatal events within 14 days after early, intensive mobilization post stroke. NEUROLOGY/2019/035063

Bernhardt J, Churilov L, Ellery F, Collier J, Chamberlain J, Langhorne P, Lindley RI, Moodie M, Dewey H, Thrift AG, Donnan G; AVERT Collaboration Group. Prespecified dose-response analysis for A Very Early Rehabilitation Trial (AVERT). Neurology. 2016 Jun 7;86(23):2138-45.

CLOTS Trials Collaboration, 2014. Effect of intermittent pneumatic compression on disability, living circumstances, quality of life, and hospital costs after stroke: secondary analyses from CLOTS 3, a randomised trial. Lancet Neurology, 13, 1186-92.

Brady MC, Kelly H, Godwin J, Enderby P, et al, 2016. Speech and language therapy for aphasia following stroke. Cochrane Database of Systematic Reviews, 6, CD000425.

Thomas LH, Cross S, Barrett J, French B, et al, 2008. Treatment of urinary incontinence after stroke in adults. Cochrane Database of Systematic Reviews, CD004462

National Institute for Health and Care Excellence, 2013c. Clinical Guideline 171: Urinary incontinence: the management of urinary incontinence in women [Online]. Available: http://guidance.nice.org.uk/CG171.

National Institute for Health and Care Excellence, 2015a. Clinical Guideline 97: Lower urinary tract symptoms in men: management [Online]. Available: https://www.nice.org.uk/guidance/cg97.

National Institute for Health and Care Excellence, 2007b. Clinical Guideline 49: Faecal incontinence: the management of faecal incontinence in adults [Online]. Available: https://www.nice.org.uk/CG49.

National Institute for Health and Care Excellence, 2013b. Clinical Guideline 162: Stroke rehabilitation in adults [Online]. London. Available: http://www.nice.org.uk/guidance/CG162

Coggrave M, Wiesel PH, Norton C. Management of faecal incontinence and constipation in adults with central neurological diseases. Cochrane Database Syst Rev. 2006 Apr 19;(2):CD002115. doi: 10.1002/14651858.CD002115.pub3. Update in: Cochrane Database Syst Rev. 2013;12:CD002115. PMID: 16625555.

National Institute for Health and Care Excellence, 2015c. NICE Guidelines 31: Care of Dying Adults in the Last Days of Life [Online]. Available: <u>https://www.nice.org.uk/guidance/ng31</u>. Langhorne P, Baylan S, Early Supported Discharge Trialists. Early supported discharge services for people with acute stroke. Cochrane Database of Systematic Reviews 2017, Issue 7. Art. No.: CD000443. DOI: 10.1002/14651858.CD000443.pub4.

Langhorne P, Audebert HJ, Cadilhac DA, Kim J, Lindsay P. Stroke systems of care in high-income countries: what is optimal? Lancet. 2020 Oct 31;396(10260):1433-1442. doi: 10.1016/S0140-6736(20)31363-5. PMID: 33129394.

Heffner DL, Thirumala PD, Pokharna P, Chang YF, Wechsler L. Outcomes of Spoke-Retained Telestroke Patients Versus Hub-Treated Patients After Intravenous Thrombolysis. Stroke. 2015;46:3161–316.

Meyer BC, Raman R, Hemmen T, Obler R, et al, 2008. Efficacy of site-independent telemedicine in the STRokE DOC trial: a randomised, blinded, prospective study 13. Lancet Neurology, 7, 787-795.

Dutta D, Kendall J, Holmes C, Murphy P, et al, 2015. Evaluation of a telephone advice system for remote intravenous thrombolysis in ischemic stroke: data from a United Kingdom network. Stroke, 46, 867-9.

Handschu R, Scibor M, Willaczek B, et al. Telemedicine in acute stroke: remote video-examination compared to simple telephone consultation. Journal of Neurology. 2008 Nov;255(11):1792-1797. DOI: 10.1007/s00415-008-0066-9.

Demaerschalk, B.M. Telemedicine or Telephone Consultation in Patients with Acute Stroke. Curr Neurol Neurosci Rep 11, 42–51 (2011). https://doi.org/10.1007/s11910-010-0147-x

Rehabilitation is a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in interaction with their environment". Rehabilitation helps people "to be as independent as possible in everyday activities and enables participation in education, work, recreation and meaningful life roles such as taking care of family. It does so by addressing underlying conditions and improving the way an individual functions in everyday life. WHO - <u>https://www.who.int/news-room/fact-sheets/detail/rehabilitation</u>

The United Nations Convention on the rights of persons with disabilities recognises rehabilitation as a human right<u>https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html</u>

Introduction

The Scottish Government announced that stroke would be in its Programme for Government in 2019. Its commitments were to:

- 1. Appoint a Specialty Adviser to the Chief Medical Officer on Stroke Care
- 2. Review and improve the current stroke care bundle to improve outcomes for patients
- 3. Collaborate across Scottish Government on stroke prevention and raising awareness of the signs of stroke
- 4. Begin work to scope out and define what a progressive stroke service looks like
- 5. Ensure that a national planning framework is in place for a high quality and clinically safe thrombectomy (a procedure to unblock arteries in the brain) service.

This document specifically aims to present the work carried out in respect of commitments 2 and 4, but inevitably it touches upon the progress made with the other commitments. The next steps will be to

- a. Review the stroke services delivered by each of the NHS Boards to determine how they compare with the description of a "progressive stroke service". This will identify the gap between the current services available and where we would like to be in the future.
- Develop an implementation plan which will describe how we might move from our current position to having our vision of progressive stroke services in place across Scotland. Our aim would be to have this draft by the end of 2021.

Acknowledgements

This document has been put together by a very large number of individuals during the COVID pandemic. Their amazing contributions are acknowledged in Appendix 1.

Structure of this document:

- 1. Description of the components and functions of a modern comprehensive stroke service
- 2. Review of existing stroke services based on information available in 2020.
 - methods
 - results
 - emerging overarching themes
 - areas for improvement for specific aspects of service delivery
- 3. What progressive stroke services should look like in the future
 - methods
 - overarching themes
 - recommendations to improve specific aspects of service delivery
- 4. Appendices

The components and functions of a comprehensive stroke service:

- a) Pre-hospital care including aspects of primary prevention, public awareness and appropriate triage by primary care and emergency services including the Scottish Ambulance Service (SAS).
- b) Early assessment and diagnosis of suspected strokes and TIA whether requiring admission or not.

- c) Delivery of hyperacute treatments, including thrombolysis (clot busting medications) and/or thrombectomy for ischaemic stroke, and early blood pressure lowering for haemorrhagic stroke where appropriate and post treatment monitoring and care.
- Care on a stroke unit to minimise the risk of complications, provide effective treatment of any which occur and provide an environment which facilitates rehabilitation.
- e) Provide rehabilitation in hospitals and the community to optimise the patient's physical, psychological and social function. Also support for the patient in the self-management of their stroke and provide help with the management of the longterm, physical, psychological and social consequences of the stroke, to optimise their "life after stroke".

These functions have been delivered in different ways and different locations depending on the patients' characteristics, needs and wishes, and geography. The figure illustrates how these components of stroke services aim to deliver care along the patients' pathways.



a. Pre-hospital care

This incorporates activities to:

- raise and maintain awareness of stroke in the population, its recognition and the need for urgent action which are key to optimising prevention and treatment.
- identify opportunities for prevention whilst healthy lifestyle (deprivation, smoking, alcohol, diet, obesity) and management of vascular risk factors reduce the risks of coronary heart disease, peripheral vascular disease and cancer prevention, the identification and treatment of atrial fibrillation (AF) is of specific importance to reduce the burden of stroke.
- ensure that people with symptoms of a stroke receive immediate assessment and appropriate triage to the most appropriate hospital service which can meet their immediate

needs including imaging, thrombolysis and/or thrombectomy and treatments to minimise their risk of deterioration.

TIA services

Many people develop mild or transient symptoms which might represent a TIA or mild stroke do not require immediate admission to hospital but need specialist assessment, early access to investigations and same day initiation of treatment to reduce the risk of further problems. TIA services, which may be configured in many different ways, aim to offer these functions flexibly along with access to longer term support to reduce longterm risks and optimise the patient's physical, psychological and social outcomes

Hyperacute care

This typically refers to the first 48-72 hrs following stroke during which time critical interventions may be delivered and close monitoring is required to prevent early complications.

Treatment of stroke within the first few hours includes so called reperfusion treatments, (thrombolysis and thrombectomy, aimed at unblocking an artery causing an ischaemic stroke. It also includes treatments, such as early blood pressure lowering which aim to limit the bleeding causing a haemorrhagic stroke. Both have the potential to greatly reduce the brain damage caused, and thus improve survival and functional outcomes. The earlier these hyper-acute treatment are given, the better the patients' outcome. Patients receiving these treatments require more intensive observation and monitoring to minimise risks and identify complications early when they can be most effectively treated. Stroke services need to be configured to minimise any delays and maximise the proportion of patients suitable for these treatments.

Stroke unit care

Stroke unit care is the central feature of a modern stroke service (RCP 2016; Appendix Figure 1 - Purple box) which can result in more patients surviving, returning home, and regaining independence (Stroke Unit Trialists' Collaboration, 2020). As it can benefit most stroke patients, even those who do have hyperacute treatments, it is important that planners and policy makers recognize the important role of stroke unit care within hospitals.

Although the core features are well described, services have sought to deliver stroke unit care in a variety of different ways (Appendix Table 1 and 2). The size and configuration will depend on factors such as rurality and the other services and resources available (Cadilhac 2017, 2019, SSNAP 2016). However, clinicians and planners should ensure that every stroke patient receives the core service characteristics of stroke unit care (Stroke Unit Trialists' Collaboration, 2020) from initial assessment to discharge from hospital (Busingye 2018).

Key features of a stroke unit which emerged from the randomised trials RCTs included:

a geographically-defined unit;

 a co-ordinated multi-disciplinary team that meets at least once a week for the exchange of information about in-patients with stroke;

- information, advice and support for people with stroke and their family/carers;

- management protocols for common problems, based upon the best available evidence;

 – close links and protocols for the transfer of care with other in-patient stroke services, early supported discharge teams and community services;

-training for healthcare professionals in the specialty of stroke.

Other features which we would emphasise, but which did not emerge from the RCTs included:

- the provision of holistic assessment of need for every patient which incorporates the views of patients and their families, which informs decisions about care
- all interactions and interventions are carried out under a person-centred approach

Rehabilitation and longterm support (life after stroke)

The United Nations Convention on the rights of persons with disabilities recognises rehabilitation as a human right (<u>https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html</u>). Rehabilitation is a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in interaction with their environment. Rehabilitation helps people "to be as independent as possible in everyday activities and enables participation in education, work, recreation and meaningful life roles such as taking care of family. It does so by addressing underlying conditions and improving the way an individual functions in everyday life.(<u>https://www.who.int/news-room/fact-sheets/detail/rehabilitation</u>)

The WHO Rehabilitation in Health Framework highlights a tiered approach to rehabilitation which should be community based and focussed on the needs of the population. Integrated working is essential to deliver this approach with the individual and their family or carers at the centre and the right person at the right time available to support their needs



https://apps.who.int/iris/bitstream/handle/10665/325607/9789241515986-eng.pdf?ua=1

People who have had a stroke should have access to high quality, evidence based, person centred stroke rehabilitation which reflects their needs and preferences. Stroke rehabilitation services aim to optimise function, reduce disability, promote independence and autonomy, and work alongside people and their families to achieve meaningful outcomes. (Wright et al 2016)

Stroke rehabilitation is based on a truly holistic biopsychosocial approach which seeks to understand the interactions of a diverse range of factors in a person's presentation (i.e. biological, psychological and social factors). This is not only essential for defining the aims of rehabilitation

but also to ensure that interventions are appropriate for, and meet the needs of the individual. This shared understanding promotes interdisciplinary working between health and social care professionals to support effective and efficient stroke rehabilitation services. (Wade 2017; Smith 2021).

Stroke rehabilitation service should be underpinned by a holistic rehabilitation model and appropriate service infrastructure, leadership and expertise. (Appendix). The core elements of rehabilitation include person centred care, personal goals and self management support. Personalised and evidence based therapeutic interventions delivered by stroke specialists should be offered to support recovery, adaptation to new functional status, self management, and longer term health and well being.

Stroke rehabilitation plans should be agreed and initiated in hyperacute and acute stroke units and be available, according to need along the entire stroke pathway. This comprises acute inpatient settings; early supported discharge (ESD); in-patient stroke rehabilitation and in the community where, in addition to rehabilitation, long-term self management support needs to be provided. It is important that people who have had a stroke are provided with the necessary skills, resources and support to continue self-management in the longer term along with management of other long-term conditions they may have such as diabetes or hypertension. They should have access to generalised medical care through primary care services including regular reviews of their health status and ongoing needs. Primary and secondary care services should communicate effectively to enable the provision of patient-centred care, for example primary care may identify a further rehabilitation need and refer the person back to the community rehabilitation team.

Review of current stroke services across Scotland

Methods

It is important to recognise that regular reviews of stroke services in Scotland have taken place since the Scottish Stroke Improvement Plan (SSIP) was introduced in 2014 (web link). Since then each NHS Board has

- Provided data for the Scottish Stroke Care Audit (SSCA) to reflect their performance
- Rated their delivery of specific components of stroke services according to nationally agreed criteria
- Been visited by the SSIP team to discuss their performance and focus on local quality improvement work.

In 2020 this work proceeded, despite the COVID pandemic but was supplemented by:

- Analysis of linked data between the Scottish Ambulance Service and SSCA to provide insights into the performance of emergency pre-hospital services
- Virtual visits (via MS TEAMS) with all NHS Boards by the CMO advisor, SSIP and SSCA coordinators and a consultant allied health professional (AHP) seconded to the PfG team)
- Focused work on
 - readiness for thrombectomy and
 - services to provide prolonged monitoring to detect paroxysmal AF
 - review of access to rehabilitation
- Workforce surveys
 - Consultant stroke physicians (appendix)

To date more audit activity has taken place on acute hospital care (including thrombolysis, thrombectomy and stroke unit care), TIA services and secondary prevention than on pre-hospital care and rehabilitation. To some extent this reflects the complexity, and thus difficulties in measuring rehabilitation activities. However, the priorities team have provided additional support to identify methods to do so.

These reviews of stroke services have provided outputs which are divided into overarching themes which apply across all the components of stroke services and those which relate to specific parts of the services.

Overarching themes.

Access to stroke services, and their performance vary due to variation in:

• Workforce - Staffing levels and grades and specialisation

Inevitably more populous NHS Boards have larger numbers of clinicians, nurses and therapists who have specialised in stroke and can ensure access to those specialists for greater parts of the week, and on more sites. Smaller boards may have very limited or no access to specialists in certain locations, or at certain times. Staffing levels amongst all

professional groups (Nurses, AHPs, Psychologists and Doctors) are widely perceived to be too low to consistently meet the needs of patients – this reflects a large number of vacant posts, especially in nursing and consultants, insufficient establishments and lack of workforce planning. Perceptions of under staffing are exacerbated by lack of IT systems and support staff to optimise patient facing time by minimising time spent of administrative tasks. Also, primary care workload is very high throughout the country, particularly in urban settings, and this could affect access to assessment for those presenting with stroke / TIA as well as limit the capacity for primary care to support people who have had a stroke in the longer-term.

• Education and training

The quality of stroke services provided is hugely dependent on the availability of knowledgeable, skilled and experienced healthcare professionals. This is influenced by access to high quality education and supported learning, and staff turnover. It is recognised that there is significant attrition of stroke trained staff from acute stroke rotas and services and retention of trained staff remains a challenge for future service provision. Whilst there are a wide range of both on-line and traditional learning resources available for staff, the staffing pressures mean that providing the time to allow them to participate remains a challenge. There is currently a national education template which outlines the training required for staff involved in the care of stroke patients. This has shown that there is a variation in the training that is available to stroke staff within health boards, this leads to inequity in service, as clinical staff are unable to update their skills. This is in part due to some health boards having dedicated trainers, these are employed by the health board or Chest Heart and Stroke Scotland currently.

• Access to investigations

There is very marked variation in patients' access to investigations such as MRI, vascular imaging, prolonged ECG monitoring and echocardiography which are important tools to allow the clinician to provide the most effective care. Whilst some of the variation relate to the capacity of the services delivering these investigations, the services often do not have robust systems to enable them to prioritise the important and urgent over elective work, or requests which are unlikely to alter management. Scanners are often fully booked with elective work, often to ensure arbitrary waiting times are met, so that urgent scans which may have a very significant impact on patients' treatment and outcome are not possible.

Access to IT and specific applications

There is marked variation in the amount and type of IT available to stroke services. The adoption of a national Picture Archiving and Communication System (PACS), now with a platform to allow reporting anywhere, is very important to stroke services, but is the only obvious example where the mantra "once for Scotland" is applicable.

Other systems used in all NHS Boards (e.g. TRAKcare, SCI Gateway, SciStore) have been configured locally so their use varies hugely and useful development in one NHSBoard cannot be easily emulated in others. NHS Boards have implemented other systems – Portals, Patientrack, local lab, departmental systems which are specific to that NHS Boards or region.

Commented [WL1]: I'm glad this is in – so very important to identify this barrier

These differences are becoming an increasing problem with the introduction of Thrombectomy which involves patients moving between NHS Boards and even regions.

• Organisation, management and governance of the stroke services.

Since 2005 all NHS boards have had a Managed Clinical Networks (MCN) for stroke but since their establishment their structures and influence have diverged. In some NHS Board areas their management aligns with planning, operational management and quality improvement and straddle the secondary care and community services which provides the best environment in which to configure effective stroke services. In others the MCN has little influence and here it is more challenging to improve delivery of stroke care. Linking hospital based services with those in the community where the latter is overseen by integrated joint boards is a challenge to ensure clinical governance and performance is managed across the whole pathway. Where reporting mechanisms which are recognised and scrutinised as part of the NHS boards' priorities exist, boards perform better than those that do not have such structures in place.

Priority given to stroke within the NHS Board

This seems to depend on the profile of the stroke services in the NHS Board. In some the senior management team (SMT) are aware of the performance of their stroke services and engage in the process of improvement. In others the SMT appear to have little awareness of performance of their stroke services and do not prioritise their improvement

The following section highlights issues which relate to specific parts of the of the pathway (see figure)

1. Pre hospital services

Raising and maintaining awareness of stroke in the population, its recognition and the need for urgent action are key to optimising prevention and treatment. However, there is no consistent coordinated approach to achieving this across Scotland. There are examples of good practice but these are not consistently delivered.

Whilst most aspects of primary prevention of stroke coincide with those for other vascular diseases and cancer, the detection of atrial fibrillation, and its effective treatment are of particular relevance to stroke. Whilst, this has been the focus of recent planning activities, this has not yet translated into a consistent approach to detection and treatment across Scotland. This is undoubtedly resulting in a greater stroke burden.

There continues to be a lack of timely data available from NHS boards and sites, concerning the number of patients with suspected hyperacute stroke that are pre alerted by the Scottish Ambulance Service (SAS). This in turn means that there is no robust measure to ensure the correct patients are being taken to the most suitable hospital, and then admitted onto the correct stroke pathway. In one case, hyper acute stroke patients were being admitted to a site which did not have a stroke service, or even an Accident and Emergency. This practice has now ceased, but it highlights the lack of a thorough national reporting tool for the SAS. In addition, if patients are not pre alerted, it results in a delay in receiving hyperacute treatment and the appropriate stroke care bundle, increasing the risk of a poor outcome.

Hospital clinicians have highlighted the value of the pre-alert including patient identifiers such as the Chi number, name and date of birth to facilitate rapid decision making on arrival and reduced door to needle (DTN) times for thrombolysis. The reviews identified that this information is included in only a minority of locations i.e. good practice was not be applied everywhere.

There is an acknowledgement, despite the lack of reliable data, that many patients without stroke are pre-alerted, and also that some with hyperacute stroke are not. There have been small pilot projects indicating that providing paramedics with access to a specialist via a Professional to Professional (Prof to Prof) call can enhance the pre hospital diagnostic accuracy and decision making with respect to TIAs and stroke. However, these systems are not widely in place. Most ambulances/paramedics rely on the Airwaves systems for communicating with hospitals.

Paramedics across Scotland use the FAST test to identify possible strokes but are not using more detailed pre –hospital tools (e.g. RACE) or technologies which might improve diagnostic accuracy and triage.

In general SAS transport the patients with suspected hyperacute stroke to the nearest "thrombolysis ready" hospital.

2. TIA services

The performance of these services is monitored by SSCA which measures the proportion of patients seen in the TIA clinics (with TIAs and minor strokes) who are seen within 4 days of referral. Whilst the majority of services meet the standard of 80% this is not the case everywhere.

Also, with the risk of recurrent stroke highest in the first day or two one can certainly argue that the standard might be much higher (in England the standard is that patients are seen within 24 hours of referral). Earlier treatment will reduce the incidence of severe stroke. In some locations so called TIA hotlines are in place which allow paramedics, GPs and ED staff to talk directly to a stroke physician at the time of the patient first accessing healthcare. These means that patients can receive very early specialist intervention and treatment whilst waiting to have the diagnosis and treatment refined. A proportion of patients, are seen in ED dept. These, with either real-time access to stroke specialists and relevant investigations or backup from a TIA clinic can provide excellent care which minimises the risk of further stroke – however, currently this activity is not captured or monitored routinely.

Due to the ongoing pandemic, at the time of review, many NHS boards had started to incorporate virtual assessments using telephone and Near Me into their assessments. This more flexible approach has lead to reduced waiting times for specialist input in some areas but does not deal with the variable access to early investigations.

3. Hyperacute care

The current performance measures relating to hyperacute care focus on the delivery of thrombolysis, since at the time of the reviews no thrombectomies were being carried out in Scotland.

Patients outcomes are improved by minimising the delay from stroke onset to thrombolysis treatment. There is marked variation (19.5% to 6.4%) in the proportions of patients with acute ischaemic stroke receiving thrombolysis and also in meeting the standards for door to needle (DTN) time (50% within 30 minutes of arrival and 80% within 60 minutes of arrival) and the geometric mean (42.3 minutes to 130 minutes) between NHS boards, and even sites within those NHS boards. This may be due to numbers of patient's receiving thrombolysis in each health board, but also as a consequence of variations in pathways, the governance model and the number and type of professionals involved in the decision making. In most places offering thrombolysis the DTN are much shorter during normal working hours, than at other times. However, in services where a stroke nurse was involved in "pulling "the patient through the pathway, or where specialist stroke doctors were available in person out of hours, we saw shorter DTN overall, and little difference between in and out of hours.

Whilst variation in patient pathways inevitably differs between hospitals because of variation in size, geography, facilities and staffing many hospitals were unable to admit acute stroke patients to a dedicated stroke unit where the staff were skilled and experienced in monitoring and treating stroke patients. Hyperacute patients are often managed in non-specialist high dependency areas, or even coronary care units.

4. Stroke unit care

For the majority of stroke patients who require admission, but do not receive thrombolysis the emphasis of care is to deliver the stroke bundle. There are 4 components; swallow screen (100% within 4 hours of arrival, and before any food, fluids or oral medication is administered), brain imaging (90% within 12 hours accepting that hyperacute patients require a scan as soon as possible after arrival), aspirin for those with ischaemic stroke (95% on day or admission or following day) and admission to stroke unit (90% on day of admission or following day). In general, brain imaging and aspirin standards are met. However, there remains significant challenges in swallow screen and access to stroke units, and as a consequence the stroke bundle performance remains low.

It is known that care on a stroke unit is associated with reduced risk of dying, improved functional outcomes and reduced length of hospital stay. The bundle reflects access to stroke unit care and this is variable between health boards and sites. One health board routinely admits patients to high dependency following thrombolysis, some do so when stroke unit beds are full which both impact on their performance and the quality of care provided compared with hospitals where all patients are admitted directly to the stroke unit, post thrombolysis. For some hospitals the location of the stroke unit within the hospital or out of hours medical and nursing staffing levels make it potentially unsafe to admit acutely ill and unstable patients to the stroke unit.

For over 15 years we have been developing pathways, training staff, improving documentation and carrying out quality improvement projects. Despite this, in no hospital in Scotland does every patient receive the right care, at the right time, everytime. For this reason patients' outcomes are not optimised and it highlights the need to innovate to rectify this situation.

From our organisational audits we know that there are also marked variations in the size of stroke units, their staffing levels (medical, nursing, allied health professionals (AHPs), clinical psychologists and social work staff) and the training of those staff. Sprint audits within SSCA, and local audits have demonstrated very variable delivery of many potentially important aspects of stroke unit care (e.g. feeding, fluids, positioning, use of intermittent pneumatic compression, rehabilitation assessments and treatments). These audits have had to rely on review of paper or electronic health records which are burdensome, time consuming and therefore failures in delivery are inevitably only identified in retrospect when any detriment to the patients is unavoidable. TRAKcare, the electronic health record used across Scotland does not support the sort of data capture, extraction and analysis to provide real-time data on delivery of important aspects of stroke unit care. This hinders quality improvement work There are examples where systems which do capture data real- time - for instance Patientrack used in VHK, Fife to prompt NEWS observations, facilitates recording of the observation, prompts appropriate escalation, and tracks the delivery of this in real-time across its medical wards, including the stroke unit. Failures of delivery are immediately identified, and can be rectified. However, these systems currently do not support improvement in delivering specialty specific aspects of care such as those in a stroke unit.

The majority of NHS Boards operate integrated stroke units, where patients receive acute care and their rehabilitation in one place. However, there are several NHS boards where patients are transferred to stroke specific, neuro or general rehabilitation units.

One health board, boarded confirmed stroke patients to different wards, so that it could meet the standard for new admissions. This meant that their length of stay in the stroke unit was reduced but stroke patients were not receiving the most appropriate care, as stroke patient should be in a specialist stroke service until their stroke care has ended.

5. Rehabilitation and longterm support (Life after stroke)

The holistic biopsychosocial approach to stroke rehabilitation relies in part on having the right infrastructures in place, which includes sufficient access to rehabilitation professionals.

Historically, rehabilitation services have been widely acknowledged to be under resourced. Stroke rehabilitation services in Scotland are mostly unable to deliver sufficient intensity and or duration of therapy input to meet the needs of their patients due to therapists having insufficient time available for direct patient input. Many areas are unable to offer a basic five day service and very few are able to offer a seven day

service with appropriate intensity, even where patients would benefit from daily input. When they do, with appropriate skill mix, effectiveness and efficiency are improved. Therapy input for patients in the community varied greatly depending on geography and local organisation. The nursing profession often lacks capacity to offer specialised nursing aspects of stroke care and rehabilitation.

For all components of the SSIP, it remains a significant challenge for some health boards to demonstrate that they are able to achieve the benchmarking criteria and provide the same level of service across the NHS board area. This is due largely to chronic under resourcing of rehabilitation services and how stroke rehabilitation services are set up forming part of another specialism, MOE or neurology. As these services have developed stroke rehabilitation has taken a different path in each board with variation in how rehabilitation delivered ranging from specialist stroke rehabilitation teams, to generic rehabilitation delivered by staff with little or no neurological or stroke specialist skills. This has been further complicated by engagement with integrated joint boards, who have different demands on their services, and are not fully engaged in the stroke pathway with stroke teams. This partly explains the high level of ambers on the self-assessment charts. However, some areas are capable of providing a consistent service, but this has taken considerable time and engagement across the whole pathway and with the integrated joint boards. Where specialist community rehabilitation is in place this improves flow, discharge planning and access to suitable rehabilitation.

Only one health board in Scotland has a dedicated early supported discharge team across the whole NHS board, while some NHS boards are able to offer this over only part of their pathway.

Primary care services are the main source of medical care for stroke survivors in the longer-term after their stroke. It is common practice that routine annual reviews take place alongside reviews of other long-term conditions. In addition, people who have had a stroke identify health issues that arise and contact primary care services for assessment. Ease of access to primary care services varies throughout the country. Delays and issues with the implementation of the 2018 GP contract have left primary care services with a high workload which may affect access to care for some people after a stroke, particularly in areas with an older population or socio-economic deprivation, where practices may be struggling with workload the most.

There is considerable variation across the country in the longer term support for people who have had a stroke. This may comprise nurse follow up, peer support groups and exercise classes. In some places these aspects of care are provided directly by NHS stroke services, in others they are commissioned from the charities including Chest Heart and Stroke Scotland (CHSS) and the Stroke Association.

What should Progressive Stroke Services in Scotland look like?

Methods

At the outset we had planned for Health Improvement Scotland (HIS) to carry out a detailed systematic review of the evidence supporting the delivery of stroke services across the whole patient pathway. However, the resources of HIS were diverted onto COVID pandemic which forced us to adopt an alternative strategy. Therefore, this section has been developed using a pragmatic, multicomponent approach including:

- 1. Review of services to identify examples of good and novel practice (see above).
- Reference to existing national and international stroke guidelines which have adopted rigorous methods such as GRADE including the most recent comprehensive UK Clinical Guideline (RCP 2016) with updating of relevant recent major trials (published since 2016) and cross-referencing to other recent guidelines (NICE 2016, NICE 2019, Norrving 2018) from similar healthcare systems.
- Horizon scanning, carried out under the auspices of the National Planning Board over 2018/19 which benefitted from engagement with many healthcare professionals involved in stroke services and targeted reviews of evidence by HIS.
- 4. Involvement in international collaborations to produce up to date reviews of what should constitute stroke services in high-income countries (ref Langhorne et al Lancet 2020)
- 5. Reference to "Integrated Stroke Delivery Networks National Service Model (NHS England)" which was based on a recent review of the evidence by King's College, London

We established subgroups to focus on each part of the pathway: pre-hospital, TIA services and secondary prevention, hyperacute care, stroke units and rehabilitation and longterm support. Each was asked to provide a succinct list of characteristics which a progressive stroke service would have, taking account of the unique geography and healthcare system of NHS Scotland.

We have not attempted to describe in detail all of the evidence based interventions which patients should have access to since that is the purpose of guidelines. We have focussed on describing stroke services which should be available to deliver those interventions which are known to be effective, and others which may be shown to be effective in the future.

The recommendations may be relevant to

- a) Scottish Government
- b) National Planning Board
- c) Regional planning groups (to ensure appropriate networking of services) across NHS Boards.
- d) NHS Boards and
- e) Hospitals (where most services are currently provided.
- f) Integrated Joint Boards
- g) 3rd sector organisations

Specific challenges within the Scottish healthcare system are noted along with potential developments and roles for new technology.
The newly formed Patient Voices group have provided their input to the description of progressive stroke services to ensure that they reflect the needs and priorities of patients and their families.

Overarching themes which apply to all components of stroke services

Workforce

- A hyperacute/acute stroke service should provide specialist medical, nursing, and rehabilitation staffing levels matching the RCP Guideline.
- Workforce planning must match current and future demand. Working patterns and staffing levels, especially for healthcare staff contributing to out of hours care must be sustainable, to attract and retain staff.
- Where there are shortages of specific staff, the numbers trained should be reviewed but also we should explore imaginative solutions such as advanced clinical roles for nonmedically trained staff.
- Imperative that burnout risk is minimised in a speciality with a high mortality rate and unpredictable intensity with complex decision making.
- There should be adequate levels of support staff and access to IT to optimise the efficiency
 of clinical staff, the optimise patient facing time.
- Consider novel remuneration rates for unsociable hours which may save on external locum costs for rota gaps. <u>References (1,2)</u>
- AHP and nursing services should be able to offer specialised input at an appropriate intensity
 over a seven day week in inpatient and community services. Clinical psychology and
 neuropsychology should be part of the core team and service provision throughout the
 patient journey from acute to longer term.
- A move to drive forward the 2018 GP contract including allocation of a wider workforce to aid the delivery of primary care services, to ease workload pressures and allow practices to focus on chronic disease management.

Education and training

- Introduce a period (or opportunity) within GIM training in Stroke Medicine that will widen the knowledge and skill of the General Medical trainees and potentially attract trainees into the speciality or to develop a stroke special interest. At the moment this is ad hoc e.g. from acute medicine.
- Publicise the training and career development opportunities within stroke nursing. Including roles such as specialist nurses, ANP's will give a career path for stroke nursing.
- Stroke services should have an education programme for all staff providing acute stroke care and should provide training for healthcare professionals in the specialty of stroke.
- Invest in developing and maintaining interactive online training which can be accessed at the convenience of the learner.
- Increase the efficiency of delivering live training sessions which can be delivered remotely via MS Teams to a large live audience across many NHS Boards, and also be recorded for others to access later.
- Coordinate national training programmes tailored to each group of healthcare staff involved in stroke services.
- NHS Boards should keep records of the staff working within stroke services, their training
 needs and training received. When new staff join a stroke service their training needs should
 be identified and a plan made to meet those needs promptly. Large NHS Boards might

Commented [DM2]: Move to overarching to ensure covered there

employ specific staff to coordinate training, whilst smaller ones might purchase this function from larger ones.

Access to investigations

Hyperacute treatments (thrombolysis and thrombectomy) and treatments to reduce the risk of recurrence, or of other complications are all more effective if delivered earlier. However, many depend on brain or vascular imaging with CT or MRI or other investigations (e.g. prolonged ECG monitoring, echocardiography) to determine eligibility for treatment. Access to these investigations should therefore be prioritised accordingly.

- Stroke services, whether dealing with inpatients or outpatients, should have immediate
 access to both CT, CTA, CTP and MRI on a 24/7 basis where a stroke specialist confirms this is
 necessary. Whilst all modalities cannot reasonably be delivered in all locations there should
 be a plan for accessing these at another location if the gain in outcome makes a transfer
 worthwhile.
- Departments offering these investigations need to put in place systems which ensure that
 investigations which identify patients as suitable for time dependent, evidence based
 interventions are prioritised over those which are less urgent or which will not change
 management.

Access to IT

- Wherever possible IT systems should be the same in all NHS Boards to facilitate networking
 and movement of patients across NHS Board where necessary. This will also ensure that a
 development which improves service delivery in one place can be shared across all NHS
 Boards
 - Stroke services should have access to systems which
 - Support shared electronic health record keeping to reduce duplication and allowing sharing across a network of care
 - Plan, prompt and record important aspects of care digitally to optimise delivery whilst making best use of clinicians time.
 - Support secure communication (voice, video, text, shared documents and images) between clinicians working across networks to ensure patients' access to timely treatment, especially hyperacute treatments but also to decision support from a specialist in remote and rural settings.
 - Alert a responsible clinician or team to referrals or abnormal investigations to maximise safety and minimise delays.
 - Capture data for audit/quality improvement and monitoring as a by-product of clinical care.
 - Support healthcare professionals in tailoring digital information which can be shared with patients and their families

Organisation, management and governance of the stroke services.

 NHS Boards should have a clear management structure for stroke services relating to the whole patient pathway covering inpatients, outpatients and community services.

- MCNs serve to coordinate professionals, services and organisations to ensure equitable, high quality clinical services. MCNs should operate with clear clinical and operational leadership to connect services via clear service pathways. Stroke services should coordinate across clinical, professional and service pathways, and be tailored to individual needs based on a range of personal, environmental and social factors.
- The services should capture data which reflects its performance in real-time, which supports quality improvement activities and monitoring by the organisation.
- The NHS Board senior management team should have responsibility for ensuring that stroke services meet all important quality indicators.

Priority given to stroke within the NHS Board

• The NHS Board should ensure that the priority it applies to stroke services mirrors that of the Scottish Government.

Recommendations to improve specific aspects of service delivery

Pre-hospital care

Most services in Scotland have some system in place to allow urgent patient referral for rapid specialist assessment. Potential areas of improvement include:

- Ongoing public awareness campaigns covering stroke symptoms, including those not currently covered by FAST, ensuring that the time critical nature of the public's response and knowing what to do (ring 999) are included. These campaigns should be shaped by evidence about what methods (e.g. TV/radio advertising, social media) reach populations, especially those including hard to reach groups (e.g. ethnic minorities, socially deprived)
- Education of GP reception staff and GPs to ensure appropriate referral of people with stroke events presenting to practices; acute ongoing symptoms, acute but resolved symptoms and other stroke like events. Realistically bespoke on line training is likely to be the most practical means of reaching this very large group of staff.
- Systematic case finding in primary care to detect unrecognised atrial fibrillation, provide prompt assessment and where appropriate treatments including anticoagulation, radiofrequency ablation and left atrial appendage occlusion which will reduce the risk of future stroke.
- Optimise the detection and management of other vascular risk factors, including raised blood pressure to reduce the risk of future stroke.
- Introduction of more sophisticated algorithms to support NHS 24/999 Call Handlers to triage
 patients. These might be based on evidence from data captured on current triage versus
 actual diagnoses made in hospital using linked datasets.
- Training paramedics in use of clinical assessment tools to enhance their diagnostic accuracy for stroke and TIA and identification of subgroups potentially suitable for thrombolysis and thrombectomy where that can be shown to improve the performance of the pre-hospital pathways
- Introduce professional to professional calls to support paramedics in decision making in hyperacute stroke, for instance in decisions to

- by-pass a local thrombolysis centre (spoke) to take a patient direct to a thrombectomy hub and
- o provide direct links into TIA services.

This will be dependent on implementing appropriate technologies to do this securely

- Communication of patient identifiers during any prof to prof calls or pre-alert to allow clinicians within the receiving hospital to access patient records prior to their arrival with the aim to reduce delays in decision making after arrival in hospital.
- Introduce a single communication platform to facilitate voice, data and video communication between paramedics, ambulance control, stroke physicians in spokes and hubs, stroke nurses and interventional radiologists.
- Deployment of any technologies into ambulances which have been demonstrated to be cost effective in refining the diagnosis and classification of stroke.
- Robust and transparent algorithms for the prioritisation of emergency calls and SAS
 resources, including air transfers, which take account of availability, of benefits and risks and
 urgency of the interventions and cost effectiveness to ensure the optimum improvement in
 outcomes from the available resources. These would be informed by analysis of linked data
 from SAS and hospital services.
- Artificial intelligence to help integrate information on location and status of patients, ambulance teams, travels times to ED depts. in spoke and hub hospitals, competing demands on SAS from other time critical conditions. This would help paramedics decide where to take the patients.
- Routine feedback of patients' final diagnosis and acute treatment to SAS personnel involved in the pre hospital journey to support personal development and improve performance.
- Integration of pre-hospital data capture with SSCA to provide real time data reflecting the performance of the pre-hospital stroke/TIA pathway.
- Establishing a Scottish steering group to guide the prioritisation of analyses of these linked data to answer the most important and pressing questions facing the stroke services.

TIA Services

Referral to TIA/Neurovascular Services

- The most common sources of referral to TIA services will be from Primary Care, Emergency Departments, Ophthalmology/Optometry services, Medical Wards and Scottish Ambulance Service. Systems should be in place for all referrers.
- An aspiration would be to have a single national electronic system for referral to TIA/neurovascular services, used locally by all NHS Boards.
- Where appropriate/beneficial 'Prof to Prof' support may be useful, using services such as Consultant Connect and more advanced systems incorporating various communication interfaces. Potentially this could be on a National or regional basis, although this might lead to a trade-off between increasing sustainability/availability versus decreasing local knowledge.
- Alternative pathways should be available for presumed non-neurovascular cases.
- There should be a system for rapid feedback to referrers when a patient is not suitable to attend neurovascular services.
- All patients referred to TIA/neurovascular services should be told not to drive (as per DVLA recommendations) at the point of referral, at least until seen by a stroke specialist.

- There should be a robust and rapid electronic referral system e.g. SCI gateway, TRAK workbench which should prompt driving advice and secondary prevention prescription. These referrals should be monitored, or have notification systems, to ensure prompt appointing to specialist review.
- Performance of neurovascular services should be monitored by the Scottish Stroke Care Audit and the Scottish Stroke Improvement Programme Team.
- Patients should be seen by a stroke specialist in the neurovascular service within the Scottish Stroke Standard time as recommended and monitored by the Scottish Stroke Care Audit (SSCA).
- Where in-person specialist review cannot always be rapidly available, stroke services should consider how targeted access to local or remote stroke specialists (for patients meeting agreed criteria) can minimise delay to time-sensitive interventions. Examples could include commencing increased secondary prevention as early as possible, or expediting additional imaging, for selected patients.

Model of Stroke Service

- TIA/neurovascular service can be provided in several ways including (but not limited to) Specialist TIA Clinic, Ambulatory Care Unit, Stroke Unit, rapid inpatient ward review or, where necessary/appropriate a Virtual Assessment.
- Where Virtual Assessments are performed, patients should have the same access to rapid investigations and immediate secondary prevention as a patient seen face-to-face.
- The specialist involved in assessment should be experienced in stroke care with ongoing access to relevant Continuing Professional Development (CPD).
- In areas that don't have local stroke specialist availability, then remote specialist support should be available.
- Where patients turn out to have minor stroke (as opposed to TIA) they should be able to rapidly access appropriate MDT support such as SLT, PT, OT, clinical psychology, Optometry, Ophthalmology, orthoptics etc.
- TIA and minor stroke patients attending TIA/neurovascular services should have the
 opportunity to take part in clinical research.
- Follow up appointments will be available when needed, potentially through the clinic or a stroke liaison nurse team.

Medication/ Prescribing and Immediate Advice

- All NHS Boards should have accessible pathways and secondary prevention guidelines for TIA patient management.
- For TIA (with full recovery) antiplatelet agents and a statin should be commenced immediately (as per local guidance, including any necessary investigations) pending specialist review, unless specialist review is immediate.
- Guidelines should be up-to-date and responsive to change in the evidence base.
- Local guidelines will usually closely reflect any national guidance.
- Guidelines should recommend secondary prevention medication to prescribe but should also have a plan for situations where medication should not be deescalated (e.g. for some cases anticoagulants after TIA).
- Secondary preventative medications should be immediately available e.g. from ward stock, hospital pharmacy or written prescription to take straight to a 24/7 chemist.

For virtual consultations there should also be a system in place for <u>immediate</u> access to secondary prevention if needed.

Documentation and Communication systems following TIA assessment

- There should be a rapid electronic communication system back to referrer following assessment in TIA/neurovascular service. Examples include secure email, TRAK created eLetter (e.g. Lothian), Forth Valley System. Ideally, a single national electronic system for communication back to referrers, used by all NHS Boards.
- If using a traditional dictated letter system, then the letter should go rapidly electronically and certainly within 48 hours of the specialist assessment.
- Any request to referrer to make urgent prescribing changes or other key changes to management should be transmitted immediately.

Radiology

- If needed, there should be very early (same day) access to radiological imaging.
- Carotid Ultrasound +/- CTA or MRA should be used for Carotid Imaging when required.
- When the stroke specialist feels that brain imaging is required in patients attending the TIA/Neurovascular service, there should be same day access to this. MRI will usually be the preferred imaging modality in TIA/minor stroke patients who do require a brain scan so there should be increased availability to this in particular.
- High risk TIAs and uncertain presentations may be assessed as inpatients, and so rapid access to necessary radiology should be available both in outpatient and inpatient settings, depending on local service design. There should be a robust system in place to ensure that radiology results are available rapidly and that reports cannot be missed. Significantly abnormal results should be alerted/highlighted to the referrer.
- Where carotid imaging is positive, there should be rapid access to the vascular MDT. Carotid intervention should be performed within the Scottish Stroke Standard time as
- recommended and monitored by the SSCA. A carotid coordinator role may help this process.
 Performance of carotid intervention timing should be monitored by the Scottish Stroke Care Audit and the Scottish Stroke Improvement Programme Team.

Cardiac investigations

- When judged to be needed by the stroke specialist there should be early access to prolonged cardiac monitoring and transthoracic echocardiography, if necessary with bubble contrast.
- This should be within the timeframe for performing and reporting as laid out in the Scottish Stroke Action Plan (currently two weeks to receipt of report for prolonged cardiac monitoring).
- Cardiac rhythm monitoring systems should have real-time reporting of paroxysmal AF with immediate notification of the service to allow verification of the diagnosis and, if appropriate, immediate anticoagulation.
- Monitoring of Boards' ability to perform cardiac investigations within these time frames will be via the Stroke Action Plan and Scottish Stroke Improvement Program Team.
- For patient work up for Patent Foramen Ovale (PFO), there should be 'soon' access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal

echocardiography with a pathway in place ensuring that PFO closure is carried out before 6 months of the index stroke.

- There should be a robust system in place to ensure that cardiology results are available rapidly and that reports cannot be lost. Significantly abnormal results should be alerted/highlighted to the referrer.
- Where patients need anticoagulation, following for instance identification of atrial fibrillation, there should be a pathway in place for early anticoagulation with counselling and monitoring systems.

The following services should be available from TIA/neurovascular service:

- Referral to addiction support teams
- Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
- Referral to exercise service
- Referral to Dietetics
- Vocational advice and support

Treatment targets

- A process for shared decision making re medical interventions should be incorporated into services. Specific shared decision making tools, such as 'Tailored Talks', and involvement of specific healthcare staff such as speech and language therapy for patients with communication difficulties, and clinical psychology for those with cognitive problems may be useful.
- Referrers should be aware of individual treatment targets e.g. blood pressure and lipid targets.
- Remote blood pressure monitoring should be available for certain cases e.g. FLORENCE programme or 24 hour ambulatory monitoring
- Selected stroke patients may benefit from more aggressive lipid management aiming for lower LDL targets. Where appropriate pathways should be in place for this e.g. a pharmacist led stroke lipid clinic, primary care follow up system.

Long-term Management

- Patients with TIA/minor stroke should have access to self-management programmes/training/education. These will include access to tiered psychology care where needed.
- Access to a named person in stroke services that people who have had a stroke can contact after discharge from community services, enabling the provision of advice / support / signposting.
- Following discharge from TIA/neurovascular services, patients with TIA or minor stroke should be followed up lifelong in primary care long-term conditions monitoring.
- Education for GPs and practice nurses on current best practice for longer-term care of stroke survivors, managing stroke in multimorbid patients and how and when to refer back to stroke services.

Recommendations relating to care of those patients requiring hospital admission

- Stroke services should provide all people with stroke with specialist multi-disciplinary care
 for the whole patient pathway including; diagnosis, hyperacute and acute treatments,
 normalisation of homeostasis, early rehabilitation, prevention of complications, secondary
 prevention, ongoing rehabilitation, and palliative care as required.
- People with stroke should be treated on a specialist stroke unit throughout their hospital stay.
- Treatment pathways for stroke patients in hospital should include:
 - a defined hyperacute stroke unit/admission area with assessment by a stroke specialist;

 geographically-defined stroke unit(s) where patients are managed by a co-ordinated multidisciplinary team that fulfils the criteria of a stroke unit;

- close links, protocols and communication systems for the transfer of care with other inpatient stroke services, early supported discharge teams and community services.

- Rehabilitation of stroke patients in hospital should occur in a setting that meets the definition of a stroke rehabilitation unit; a single multi-disciplinary team of stroke specialists with easy access to all relevant supporting services and information, advice and support for people with stroke and their family/carers.
- Where small hospital size/ rurality prevents the establishment of a hyperacute stroke unit or separate stroke rehabilitation unit, arrangements should be in place to ensure equivalent specialist care through the acute stroke unit and/or remote consultation with stroke specialists.
- Staff working in stroke units should have completed the necessary training as outlined in the National Educational template and should follow standardised management protocols for the assessment & management of acute stroke according to Clinical guidelines.
- Stroke services should participate in national and local audit, multi-centre research and quality improvement programmes.

Hyperacute stroke management in hospital

Intravenous Thrombolysis (IVT)

Outcomes from ischaemic stroke treated with IVT are time critical. Regional and National variations in IVT use remain. All patients must have rapid and equitable access to 24/7 IVT irrespective of geographical location or local expertise. Eligible patients must receive IVT with the minimum delay.

In a progressive stroke service this will be achieved by:

- A sustained drive to improve DTN times and the proportion of eligible patients receiving treatment 24/7. Improving these systems will also optimise the care of those cases suitable for thrombectomy.
- Developing a culture where IVT is regarded as a routine treatment where indicated, supported by onsite stroke specialists or telemedicine.
- Widening access to Telestroke networks in areas of suboptimal treatment numbers and DTN times.

- Improving access to advanced imaging to maximise the number of patients who present on waking, or presenting late with favourable imaging, and who are not suitable for thrombectomy, to receive IVT
- Creating the necessary infrastructure at all sites to recruit suitable patients to ongoing thrombolysis trials across a national research network.
- Having systems that can be rapidly responsive and flex with best and emerging evidence.
- Regular audit and governance processes that monitor performance and provide transparent review of outcomes. Data is recorded within national and central registries. <u>References</u> (10-12)

Thrombectomy

Many acute ischaemic strokes are due to a large vessel occlusion (LVO). Restoring blood flow with early thrombectomy (sometimes referred to as clot retrieval) significantly reduces dependency. Approximately 800 cases per annum in Scotland, 10% of all stroke presentations, could be treated based on a 24/7 service.

Geographical modelling recommends 3 hubs serving spokes in a drip and ship model. There is a planned incremental development of services across the 3 centres aiming for 24/7 availability across Scotland by 2023? Diagram of hub and spoke model here or at the beginning of the section?

Features of an effective and safe thrombectomy service should include:

- Time efficient pathways and agreed processes at both spokes and hubs to optimise patient outcomes and limit patient exclusions in those with ischaemic stroke due to LVO.
- Specialist staff with recognised training experience, working within a service performing sufficient number of interventional procedures per annum to maintain competencies
- Ensuring patients eligible for thrombectomy are transferred to the Hub with minimal delay after IVT commenced.
- Optimised door to puncture time at hubs, as short as is safely possible.
- Sustainable and agreed rotas for anaesthetic staff, INRs/IRs, stroke physicians and theatre staff.
- Agreed pre and post interventional procedure pathways
- Improved ring fencing of beds from referring centres to facilitate bidirectional flow.
- Capacity to assess and triage increasing numbers of referrals from spokes as developing services and advancing neuroimaging technology continue to generate greater numbers of potential candidates for thrombectomy.
- Provision of adequate technology at stroke physician and INR/IRs homes to interpret hyperacute imaging and mobile communication platforms.
- Regular multi-professional governance meetings including cases discussed but not transferred in addition to those cases accepted by hubs. Optimising learning for all involved in the process and embraces a culture of quality improvement.
- Infrastructure to support patient entry into randomised clinical trials where indicated
- Economic analysis is fed back to health boards of bed days/social services/nursing home days saved per centre versus cost of cases treated.
- Continuous review of the service model, processes of care and referral criteria as the evidence base grows.
 <u>References</u> (13-17)

Commented [WL3]: Effective and safe also includes provision of psychological due to high levels of trauma and anxiety identified in successfully thrombolysed patients

Commented [DM4R3]: I don't think it is relevant to focus on this here.

Inter-hospital Patient Transfers to facilitate thrombectomy

The transfer of patients between hospitals can introduce delays to time critical treatments. Requirements and recommendations for safe and efficient transfers should incorporate:

- Agreed protocols and pathways for all centres.
- Nationally agreed documentation, in digital and paper format when required, to simplify
 processes across health boards and reduce repetition.
- Patients should be transferred by the quickest and safest transport means available to the appropriate hub as determined by their location.
- Agreed and robust communication processes and modalities for discussing cases between spokes, hubs and INR/IRs. Ensuring adequate infrastructure in place for effective and reliable communications between teams and health boards.
- Back-up systems (such as walkie talkies) in place for when primary modes of communication fail or become unreliable due to connectivity or unplanned downtime.
- Utilisation of electronic devices (using 4G/5G) during transfers capable of supporting upload
 of data and real time information sharing between the nurse escort to the spoke and hub
 consultants and INR's.
- Ambulance tracking technology that updates the hub of ETA.
- Mobile communication platforms supporting feedback to all involved in the process including SAS and ED staff.
- Agreed, safe and efficient repatriation protocols.
- Mechanisms for case reviews and lessons learnt. Promote a learning by experience and sharing culture
- Senior regional and local managerial agreement and cognisance of the importance of prioritising transfer of stroke patients.
- Patient repatriation identified as a KPI or is audited by SSCA to ensure hub flow and optimal bed and resource utilisation "hold a bed" for each transfer. ? Sustainable
- Manage expectation with early standardised information, digital resource, tailored talks etc. *Hyperlink* to thrombectomy eligibility criteria.
 - Hyperlink to pretransfer checklist
 - Hyperlink to Readiness for repatriation checklist

Interventional Neuroradiology

There is a national shortage of trained INRs in the UK. Very few neuroscience centres in England are currently staffed to provide a 24/7 thrombectomy service. Imaginative and flexible workforce solutions will be essential in a globally competitive job market to address this. Incentivising rotas and job plans may be a partial solution if Scotland is to remain an attractive workplace for specialist trained staff. Features of a sustainable interventional neuroradiology/radiology service for thrombectomy will include:

- A volume of work at operational hubs that satisfies the agreed numbers for competency and training. Training may involve remote mentoring and simulation technology based teaching.
- Credentialing, supported by Interventional Neuroradiologists (INRs), may be necessary to train sufficient operators to populate 24/7 rotas across Scotland and enable cover of non-stroke INR work e.g. aneurysm coiling.

- Workforce planning futureproofed for the anticipated increase in workload once a service has commenced and the inevitable effect of extending time windows for intervention as advancements in therapies emerge.
- Cognisance that 50% of potential cases will present out of hours, work patterns, job plans and rotas will need to reflect this in order to provide equity of access and avoid the "weekend effect".
- Adoption of cutting-edge technological innovation including advancements in AI and neurointerventional robotic solutions.
 <u>References</u> (18-20)

Interface with Emergency Departments

Seamless joint working with Emergency Departments (ED) is paramount for optimal patient care and outcomes in the hyperacute stage of the stroke pathway.

To minimise delays to assessment and treatment services should include:

- Pre-alert systems and protocols as determined by the availability of onsite stroke expertise. These may include pre-alerts incorporating pre-hospital scales to improve identification of patients with large vessel occlusions (LVO).
- Systems supporting pre-registered imaging requests from the stroke team clinicians.
- Staff competent in acute stroke management and familiar with thrombolysis and
- thrombectomy eligibility criteria and pre-transfer procedures, checklists and processes.Video links for optimal telehealth communication between the ED and stroke teams.
- Senior decision maker and senior leadership involvement at the front door to minimise DTN e.g. straight to CT protocols.
- Optimal door in door out (DIDO) times to minimise delays to Thrombectomy and maximise the opportunity for selected patients to access Thrombectomy where the Hub is offering only extended hours service
- Systems and resources to enable SAS to remain on spoke site until LVO confirmed or excluded to minimise DIDO.
- Efficient team working whilst maintaining sound and safe decision making. Concomitant goal of minimising inappropriate or futile transfers to the Hub.
- "Straight to MRI protocols" for some strokes where this is the most appropriate imaging modality.
- Establish agreed stroke mimic pathways where non stroke patients are cared for out with the stroke service when possible enabling efficient use of stroke beds and workforce.
- Provision of tailored information or signposting for relatives and carers relating to thrombectomy and repatriation processes where indicated.
- Performance and protocols should be robustly audited and cases examined when protocols not followed.
 - References (3)

<u>Telestroke</u>

Telestroke has a major role in improving access to hyperacute specialist care, decision making and the safe delivery of hyperacute treatments. (ref) Telestroke service should facilitate:

- Equitable access to stroke specialist assessment and advice during the hyperacute phase, irrespective of the patient's location.
- Filtering and triage of referrals from spokes and remote sites.
- Patient selection for reperfusion therapy or other hyperacute management.
- Reduced delays in time critical decisions and treatments and efficient identification of patients not suitable for intervention or transfer to another site.
- Where telemedicine is used for the rapid assessment of people with suspected stroke, the system should include a high-quality video link to enable the remote stroke physician to assess the patient according to Clinical Guidelines.
- Reliable connectivity at home and offsite for telestroke physicians is essential to reliably assess
 patients and access imaging outputs.
- Use in ambulances and air transport, providing real time status on patients,
- Rolling educational programmes locally and nationally. Audit and governance programmes
 ensuring all key users are trained and competent in using teletechnology to assess and manage
 patients.
- A progressive and adaptive telestroke service must be open to be able to embrace emerging technological advances e.g. mobile stroke units

References (4-7)

Imaging and Artificial Intelligence (AI)

The role of radiology and imaging in hyperacute stroke management is integral to achieving the best outcomes for patients by supporting time critical decision making. Features of such a service must include:

- Agreed imaging protocols at spokes and hubs for non contrast CT, CT Angiography (CTA) and CT perfusion (CTP)
- Urgent imaging acquisition, rapid transfer of images and interpretation to support acute treatment decisions
- Imaging interpretation supported with validated AI software.
- Agreed use of preauthorised acute advanced imaging to minimise delays.
- Advanced imaging to facilitate treatment of wake-up stroke and late or unknown onset presenting patients .e.g. CTP
- Adequate imaging resources in spokes and hubs to cope with increasing numbers of patients suitable for screening for reperfusion therapy.
- Use of CTP as a decision aid in triaging patients and identifying suitable patients for transfer to hubs from spokes.
- Swift access to MRI for specific patient groups e.g. using rapid access MRI to investigate and facilitate early discharge where indicated.
- Early identification of vascular pathology to inform appropriate secondary preventative strategies in ischaemic and haemorrhagic stroke.
- Al imaging processing role supported by radiology coupled with recognition by team members of the limitations and potential pitfalls of Al.
- Agreed processing and secure governance of patient data.
- Formal reporting of all radiology investigations during the following working day

 Ongoing analysis and audit of performance. <u>References</u> (8,9)

Hyperacute stroke unit (HASU)

- People with suspected acute stroke should be admitted directly to a HASU(or equivalent admission area) and be assessed for emergency stroke treatments by a specialist clinician (physician/nurse) without delay.
- A HASU (or equivalent admission area) should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week.
- A HASU (or equivalent hyperacute area) should have immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the hyperacute management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.
- Patients with acute stroke should have their swallowing screened, and dysphagia managed, according to Clinical Guidelines.
- Healthcare professionals responsible for the assessment and management of patients with acute stroke should be trained in how to position and mobilise patients in a way that is safe and consistent with Clinical Guidelines.
- Patients with acute stroke should be managed according to Clinical Guidelines to minimise the risk of complications.
- The majority of acute stroke presentations will not be eligible for reperfusion therapy but all should receive rapid access to optimal acute stroke care and expert management. Features of an effective and safe HASU are:
 - Specialist staffing and technology that provide close clinical and continuous physiological monitoring for all and especially those at higher risk of early deterioration or complications
 - Tailored bed configurations with flexibility and staffing to reflect local need and demand.
 - Sufficient numbers of patients to maintain staff expertise.
 - Ring fenced beds for stroke patients alongside agreed processes for stroke mimic admissions that efficiently process their care through general medicine and neurology services.
 - A geographically located area regarded as distinct from acute medical admission beds, similar to CCU or HDU beds. This will maintain flow at the hub and spoke.
 - Where stroke performance indicators and stroke bundle are recognised as discrete from 4 hour emergency admission targets and given high priority by local Health boards.
 - Seamless working with ICU/HDU where required.
 - Structured specialist care for ICH patients.
 - Rapid access to appropriate imaging and diagnostics to facilitate treatment and discharge
 - Access to 7 day specialist allied health input and tiered psychological care to both optimise rehabilitation potential and facilitate flow and discharge to protect capacity.

Management of Intracerebral Haemorrhage (ICH)

Intracerebral haemorrhage represented 12% of stroke admissions in Scotland in 2019. Mortality rates and disability remain disproportionately high within this group worldwide (ref). A progressive stroke service must aim to improve the outcomes for this group of patients.

Hyperacute stroke services for ICH should include:

- Expert supportive care on HASU or ASU. Aiming for consistent and optimal care and close observation for signs of deterioration.
- Care that reflects emerging best evidence for reducing secondary brain injury.
- Consideration of the adoption of care bundles to help consistency and reduce variation by standardising processes of care. Incorporate evidence based interventions if and when available.
- Early communication with local or regional neurosurgical teams in cases of ICH at risk of developing hydrocephalus.
- Rapid anticoagulant reversal protocols responsive to emerging evidence as up to 20% of ICH cases occur in patients taking anticoagulant medication.
- Avoidance of harm and unintended limitations of care by ensuring senior level decision making regarding advanced care planning. <u>References</u> (21-25)

Links with Neurosurgical Services

Hyperacute and acute stroke services should have protocols for the monitoring, referral and urgent transfer of patients where there is a risk of patients requiring neurosurgical intervention to regional neurosurgical centres.

Systems of joint working should be developed to:

- Establish broadly agreed referral criteria for carefully selected cases. g.g. decompressive hemicraniectomy for malignant MCA syndrome (MMCA).
- Support shared decision making to ensure treatments are delivered which are most likely to deliver the outcome valued by the patient and/or family. This is likely to be optimised by early involvement of senior clinicians with access to systems to share tailored information with patients and their family.
- Establish electronic documentation for remote consultation outcomes (e.g. Clinical Portal) when cases are referred and discussed. An audit trail of referrals, decisions and outcomes will help inform practice development and processes.

Education and Training

- All professional groups potentially dealing with hyperacute patients should have been trained in core stroke competencies. E.g. STAT+, ACTATS, STARS Advanced Modules.
- Training supported by rolling educational plans with blended learning, web based and simulation based training.
- Weekly national educational sessions , shared learning amongst professional groups
- Education development framework with clear progression opportunities important for retaining staff.
- Mentoring for junior staff, opportunities to rotate into other parts of the stroke pathway or undertake secondments and gain wider knowledge and appreciation of their role within the entire system

Stroke unit care after the hyperacute phase

• Acute stroke patients should be managed in an acute stroke unit that provides the following:

- specialist medical and nursing staff trained in the acute stroke management;
- stroke specialist rehabilitation staff;
- access to diagnostic, imaging and cardiology services;
- access to tertiary services for neurosurgery and vascular surgery;
- continuous access to a consultant with expertise in stroke medicine;
- People with communication problems after stroke should be assessed by a speech and language therapist and ongoing management planned according to Clinical Guidelines.
- Patients with severe stroke resulting in a high risk of death or poor functional outcome, should be involved at an early stage in shared decision making about the aims of treatments including cardiopulmonary resuscitation, critical care, hemicraniectomy, and treatment to reduce the risk of serious complications. Where the patient lacks capacity their proxies should be involved.
- Where patients are at risk of post stroke complications (e.g. infection, venous thromboembolism, dehydration, malnutrition, pressure sores), and depending on the established aims of treatment, patients should receive evidence based interventions such as parenteral fluids, early tube feeding, intermittent pneumatic compression and antibiotics.
- Services providing acute and ongoing care for people with stroke should provide high quality end-of-life care for those who need it, including timely access to specialist palliative care if required.
- People with stroke and their family/carers should be involved in decisions about the transfer
 of their care to receive rehabilitation in a different environment e.g. another hospital site or
 community. Any transfers of care should be carried out in accordance with national
 guidelines.

Rehabilitation, longterm support and services to optimise "life after stroke"

Rehabilitation should be considered to be a process that begins as soon as a stroke is diagnosed and continues as long as required.

Principles of a progressive stroke rehabilitation service

Person-centred

Person-centred care is about treating people as individuals and working with them to develop the knowledge skills and confidence to manage and make decisions about their own health and social care needs. It should be personalised, coordinated and enabling, and above all ensure that people are treated with dignity, compassion and respect. (The Health Foundation 2014; Scottish

Government (2014). Stroke Improvement Plan.)

Person-centred rehabilitation considers the person's needs, preferences, wishes, values, lifestyle, environment, family and social circumstances. The rehabilitation team works in partnership with them to understand their priorities and to develop solutions.

To demonstrate that stroke services are person-centred in their approach evaluation should include;

 The systematic approach to activities that are deemed central to person-centred care, e.g.
regular holistic assessment of need; goal setting; supported self management, family
involvement, and
 Patient experience of these activities and the way in which they are treated and
communicated with by the professionals working with them
Personal goals
Goal setting is the process by which the person with stroke (and their family or carers if they wish)
and members of the stroke team identify individual goals which are meaningful, challenging and
have personal value.
(RCP Stroke Clinical guidelines, 2016)
Supported Self management
A person-centred approach in which the individual is empowered and has ownership over the
management of their life and condition. (Gaun Yersel Self-Management Strategy, 2008)
Rehabilitation team
Expertise from an interdisciplinary team who collectively tailor rehabilitation input towards the
person's goals is required. This should be in partnership with the person who has had a stroke and
includes explicit involvement of family and carers.
Clinical Leadership
Robust clinical and service leadership provided by a range of professionals working across the stroke
pathway is required, ensuring equitable representation and resourcing of stroke rehabilitation.
Equitable access
Access to rehabilitation services should be equally available to those in urban and remote and rural
areas and across socio-demographic areas, using technology to deliver when appropriate
Appropriate care setting
In-patient rehabilitation is required for people with complex physical, cognitive, psychological and /
or social needs, who could not be supported in a community setting. Rehabilitation of stroke
patients in hospital should occur in a setting that meets the definition of a stroke unit;
• a single multi-disciplinary team of stroke specialists with easy access to all relevant
supporting services and information, advice and support for people with stroke and their
family/carers.
 who predominantly care for people with stroke.
Early supported discharge and stroke rehabilitation services should be offered in a community
setting whenever that best meets the needs and wishes of the patient.
Stroke rehabilitation services should be organised to treat a sufficient number of patients to ensure
that the specialist skills of the workforce are maintained. At the same time, the closer a
rehabilitation service is to the person's home the more that family/carers can be engaged and the
more targeted the rehabilitation can be.

Evaluation

Data on service delivery, patient outcomes and experiences should be collected systematically (Norrving et al., 2018). Outcome measures used should be standardised, valid and reliable (Kwakkel et al., 2017) as well as focused on what matters to patients (Duncan Millar et al., 2021). (Action Plan for Stroke in Europe 2018-2030)

Pathways and effectiveness of progressive stroke rehabilitation services will be reviewed via the Scottish Stroke Improvement Programme (SSIP) utilising data from the Scottish Stroke Care Audit (SSCA) and at least one annual review.

Stroke Rehabilitation services should reflect the range of rehabilitation needs for people who have had a stroke and be available in the right place and at the right time along the entire stroke pathway. Inpatient (acute and rehabilitation), community stroke rehabilitation and ESD services should be closely linked with social care and the voluntary sector as part of an integrated stroke rehabilitation service.

The duration of stroke rehabilitation services should be led by the needs of the person who has had a stroke and not time limited.

A clear life-long pathway for people to be able to re-engage with stroke rehabilitation services and re-access specialist support should be available to patients and families. (Norrving et al al 2018)

In-patient stroke rehabilitation

Strong evidence shows that a higher frequency and intensity of therapy than what is provided routinely, especially in the first six months post-stroke, can improve recovery rates and outcome (Brady et al. (2016), Kwakkel et al. (2004), Lohse et al. (2014), Schneider et al. (2016), Veerbeek et al. (2014)). This positive relationship between the amount of rehabilitation and the amount of recovery continues, even when patients are several years post stroke (Lohse et al., 2014) Provision of greater amounts of stroke therapy is associated with; higher therapy and nursing staffing levels; a weekend therapy service; and specialist stroke rehabilitation teams. (Gittins M et al 2020). Factors which impede the amount of therapy provision include time spent in information exchange and administration. Patient focussed reorganisation of working practices including shared documentation and individual patient therapy timetabling is recommended to enable therapy provision in line with clinical guideline recommendations. (Clarke et al 2018)

Stroke rehabilitation units should have a multi-disciplinary team including specialists in medicine; nursing; physiotherapy; occupational therapy; speech and language therapy; dietetics; clinical neuropsychology/clinical psychology; social work; orthoptics; and with easy access to pharmacy, orthotics, specialist seating, assistive technology and information, advice and support for people with stroke and their family/carers. (RCP 2.4.1); Stroke Unit Trialists' Collaboration, 2020; NICE, 2016): AHP and nursing services should be able to offer specialised input at an appropriate intensity over a seven day week in inpatient and community services. Clinical psychology and clinical neuropsychology should be part of the core team and service provision throughout the patient journey from acute to longer term.

Acute therapy assessment should be provided by stroke specialists by day three of admission following stroke (Scottish Stroke Improvement Plan) and a personalised rehabilitation plan agreed with the person and their family/carers.

Rehabilitation and recovery should be embedded within all aspects of Stroke Unit care, by all team members, on a 24/7 basis. Interdisciplinary teams should engage people in as much therapeutic

Commented [JH(G5]: ? Need to put in a couple of sentences to reflect that research also shows that attending to psychological need also improves recovery rate and outcomes.

Commented [DM6R5]: Not sure needed specifically here – we are not

Referring here to specific input from specific staff groups

activity (including specialist therapy interventions and self practice) as required at a frequency and intensity that enables them to reach their rehabilitation goals. This should include a provision of no less than 45minutes of each required therapy per day, seven days a week if tolerated.

An enriched Stroke Unit environment should facilitate patient engagement in a range of physical, cognitive and social activities out with formal therapy time. This can be supported by staff, carers and volunteers. This whole system approach to Stroke Unit rehabilitation should be promoted to improve recovery and rehabilitation outcomes as well as patient experience. (Jones et al 2020; Clarke et al 2021; White et al 2015)

Evidence based stroke rehabilitation services should be available across the pathway seven days per week at an appropriate intensity with appropriate workforce skill mix.

Early Supported Discharge services (ESD)

Hospital in-patients with stroke who have mild to moderate disability should be offered access to a stroke specific multidisciplinary early supported discharge service which begins within one working day of hospital discharge and at an intensity and frequency that would be provided if they remained in hospital. Strong links are required between the acute service and the ESD team, with both hospital staff and ESD team members identifying patients. (RCP 2.7.1A-E; Langhorne et al, 2017; Fisher et al 2011).

Community stroke rehabilitation

People who require stroke specific community rehabilitation should have this provided by specialist stroke teams up to seven days per week as required. (Scottish Stroke Improvement Plan).

All those who have had a stroke or TIA should be followed up by a community stroke nurse or other healthcare professional to provide specialist advice and support.

Longer term support and supported self management

Self management support and long term care and support should be an integral element of stroke rehabilitation pathways and should be provided in partnership with health, social care and voluntary sector. (Norrving et al 2018)

All those with residual difficulties following a stroke on discharge from hospital should be provided with a documented plan for community rehabilitation and self-management support.

All patients should have a review carried out by a member of the stroke team using a single shared review document within six months of their discharge from stroke service care.

Stroke rehabilitation pathways

Documented stroke rehabilitation service pathways should be available for evidence based interventions. Many aspects of stroke rehabilitation require a tiered approach (Fig) whereby aspects of care are the responsibility of the whole multidisciplinary team with specialists within the team

Commented [DM7]: If we are putting a time scale on this review we need to stipulate whether this is from the stroke, the admission, hospital discharge or discharge from any community rehab services?

focusing on more complex presentations. E.g. for those with emotional, psychological or cognitive impairments.

Key elements of a progressive stroke rehabilitation service are noted below however this list is not exhaustive and a person centred approach should allow for all interventions which meet individual needs and preferences e.g. leisure activities, parenting, financial management.

Activities of Daily Living

Activities of daily living (ADL), also known as occupations include personal activities, e.g. washing and dressing; domestic activities, e.g. cooking and housework, and extended activities, e.g. work, driving and leisure. People experiencing difficulty with ADLs should be referred to an occupational therapist for assessment and the implementation of a personalised intervention programme. Evidence supports continued ADL training from occupational therapy and interventions can include direct training in an activity, training in adapted methods of performing an activity and the training in the use of adaptive equipment and assistive technology and environmental adaptation to maintain independence. . (Legg 2017)

Arm function

Impaired arm function after a stroke affects independence, mental health and quality of life. It can be persistent, but rehabilitation interventions that comprise intensive, graded practice of tasks and activities that focus on an individual's goals have been shown to be effective (Pollock et al., 2014a; Bosomworth et al., 2020). Progressive arm rehabilitation, usually provided by occupational therapists and physiotherapists, comprises comprehensive assessment, person-centred goal setting and the provision of a structured, goal-orientated programme of intensive practice. This may include assistive technologies (e.g. functional electrical stimulation, mirror-box therapy and virtual reality (Pollock et al., 2014)) as appropriate. In addition to undertaking scheduled arm rehabilitation, people who have had a stroke should be encouraged by all members of the healthcare team to involve their affected arm in activities of daily living as much as possible in order to increase the intensity of meaningful practice and to improve outcomes.

Bowel and Bladder rehabilitation

Bladder and bowel dysfunction (including urinary incontinence, faecal incontinence, constipation and nocturia) are common and persistent following stroke but amenable to rehabilitation intervention. Progressive rehabilitation will feature structured assessment by a nurse to identify the type of bladder/bowel dysfunction; agreement of individual goals and a programme of mainly behavioural interventions targeted to the type of dysfunction, to support active recovery of bladder/bowel function and use of the toilet. Regular review of the rehabilitation programme and avoidance of containment approaches (including indwelling catheters) are key to recovery of independent bladder/bowel functioning and toilet use. (RCP 2016; Australian Stroke clinical Guidelines)

Balance, walking and mobility

Problems with balance, walking and mobility are likely to increase the risk of falls, deconditioning, becoming housebound and social isolation. People who have had a stroke should have their mobilisation needs assessed as soon as possible following stroke onset. Once medically stable, they should be assisted to mobilise (with appropriate equipment if needed) usually within 48 hours of the stroke and where possible overseen by a physiotherapist. Walking training should be task specific and include a cardiovascular component. Treadmill training with or without body weight support can improve walking for those who are able to walk independently (Mehrholz et al., 2017) and should be available. For those who are not able to walk independently after stroke, electromechanical-assisted gait training devices (i.e. automated electromechanical gait machines) together with physiotherapy can improve the ability to walk independently (Mehrholz et al., 2020) and this technology should be made available. Early access to orthotic assessment for the provision of an Ankle Foot Orthosis (AFO) for those with lack of control around the knee, foot and ankle should be available with reassessment when necessary in order to facilitate walking and prevent falls. Functional Electrical Stimulation (FES) should be available to facilitate gait and prevent falls in those with persistent mild lower limb weakness.

Carer needs

Families and carers should be included in rehabilitation planning and goal setting, if agreed by the person who has had the stroke. Carers should be included in assessments to identify needs and provided with information about stroke and the caring role. Carers should be provided with advice, access to emotional support to adjust to their caring role and maintain their wellbeing, and peer support to reduce the impact of loneliness and social isolation, particularly for those with communication difficulties, if required.

Communication

Post-stroke communication disorders occur frequently. Aphasia and dysarthria each affect around a third of people following a stroke. People who are identified as having a communication disorder after a stroke should be assessed by a speech and language therapist and provided with an individualised rehabilitation programme using evidence-based interventions (Brady et al 2016) to reduce the impairment and/or support functional improvement and long-term adaptation. Such interventions may include group work, computer-based therapy, assistive technology and conversation partner training.

Community support

Community support and life after stroke services are often delivered in partnership with the voluntary sector (incl. Chest Heart and Stroke Scotland and The Stroke Association) and should be made available to all those affected by stroke. This includes information provision, community based support and advice.

Cognition

Up to sixty percent of patients experience significant cognitive impairment and is often considered the greatest barrier to social recovery and re-integration following stroke with overall poorer rehabilitation outcomes. Services should have a documented pathway for the identification and assessment of cognitive problems and the impact on participation. Cognitive rehabilitation should be integrated into the broader rehabilitation programme and goals should include cognitive rehabilitation interventions with the aim of restoring, compensating or adapting for reduced cognitive ability.

Driving

A documented pathway should be available to advise on national and local services for further assessment and advice with regard to resuming driving or alternative mobility options. Stroke service should ensure that driver status and intention to return to driving should be ascertained and advice / information is made available.

Fatigue

Fatigue is commonly reported following stroke and can impact on longer term recovery and well being. A range of physical and mental factors may contribute to fatigue and a documented pathway for the identification and assessment of fatigue and its impact on activity and participation should be available. Rehabilitation programmes should include strategies to anticipate and manage fatigue as well as education for patients and families/carers.

Pain management

Pain following stroke can be due to several causes including neuropathic pain, musculoskeletal pain and shoulder pain and subluxation. Each element requires specialised assessment and a range of evidence based interventions which should be available in documented pathway.

Physical activity, exercise and fitness training

In a progressive stroke service, physical activity, exercise and fitness training should be provided throughout the stroke pathway through partnerships between health and exercise professionals, the third sector and council services. Exercise and fitness training should begin in hospital (Billinger et al., 2014) and continue in the community (Norrving et al., 2018). It should be provided by therapists or exercise professionals who have evidence of stroke specific knowledge and skills to adapt and tailor exercise programmes for people after stroke.

In addition to scheduled exercise, physical activity should be encouraged. Many people who have had a stroke experience barriers to becoming more active (Nicholson et al., 2013) and sedentary behaviour tends to persist after stroke (Tieges et al., 2015; Fini et al., 2017). Members of the healthcare team should actively promote physical activity as soon as possible after stroke and raise awareness of the WHO guidelines on physical activity and sedentary behaviour (2020). These include aerobic activity, muscle strengthening and balance and also recommend limiting the amount of time spent sedentary, replacing this with physical activity where possible. Evidence-based counselling strategies are effective to encourage stroke survivors to engage and maintain physical activity after stroke (Morris et al., 2014) and these should be provided as required along the entire stroke pathway.

Posture and movement – spasticity services

Stroke services will implement a systematic approach to identify all those who need specialist spasticity assessment and treatment. Stroke services should implement a documented programme for prevention and management, including self management, of post stroke spasticity. All those who need it will have access to a specialist spasticity service (Botulinum toxin injections, EEG or ultrasound guided approach, appropriate clinical expertise to deliver, and coordinated multidisciplinary community follow up including occupational therapy, orthotics and physiotherapy).

Positioning and seating

Following stroke, many people will find it challenging to control their position when in bed and when sitting in a chair. Effective positioning and seating is essential for reducing the risk of aspiration, falls, skin breakdown, and contracture development in addition to providing maximum comfort and supporting participation in ADL. All staff from statutory and voluntary sector organisations and carers involved along the rehabilitation pathway should be aware of correct positioning. People with stroke, their carers, and all services should have access to clinicians with training in postural management. Appropriate beds, specialist chairs and positioning equipment should be available from inpatient and community rehabilitation services when required.

Psychological Care (cognitive and emotional)

In the aftermath of stroke, patients and families experience a wide range of psychological difficulties, cognitive and emotional, which impact profoundly on function and rehabilitation. Stroke services should implement a documented programme for promoting awareness, screening and treatment of psychological consequences of stroke, under the lead of a specialist clinical/neuropsychologist as detailed in the National Model of Psychological care for stroke (NMPCS: Scottish Stroke Psychology Forum 2020). Psychological care should be available to all patients in line with local delivery plans

Relationships and sexuality

Sexuality includes physical and psychosocial aspects of intimacy. Approximately 50% of individuals experience sexual dysfunction following stroke.(Stratton 2020) however it is not commonly included as part of a rehabilitation programme.(Winstein et al 2016). Services to address these aspects of life after stroke is variable and professional education is lacking. Education with regards to sexuality following stroke should be provided to the stroke rehabilitation team and specialised support should be made available to those who require it.

Swallowing

Post-stroke swallowing difficulties (dysphagia) are common and can persist long-term. Management of such difficulties should be led by a dysphagia specialist, such as a trained speech and language therapist (SLT), and should include evidence-based rehabilitation and restorative strategies which aim to improve oropharyngeal function. Management of swallowing difficulties will additionally include compensatory strategies, swallowing manoeuvres, sensory modification and texture modification of food and fluids as appropriate. All interventions should take into consideration the factors which may limit ability to participate, such as physical and cognitive impairment, as well as encompass shared decision-making and a shared responsibility for management of risk. There should be access to instrumental assessments such as videofluoroscopy and flexible endoscopic evaluation of swallowing (FEES) to determine the specific rehabilitation programme/management approach. There should also be pathways for people with long-term dysphagia to re-access services for review.

Technology and telerehabilitation

Access to a shared electronic record keeping systems is necessary to ensure teams can spend more time treating patients. Stroke rehabilitation services should integrate technology into service delivery and treatment programmes e.g. use of video conference facilities for assessment, specific

Commented [j8]: Addition from Rehab SG

interventions, meetings and follow up; and use of robotics, IT and computer software for rehabilitation interventions as appropriate.

Vision

Comprehensive assessment and rehabilitation services should be provided to all those with visual problems due to their stroke including:- Comprehensive visual screening, completed before discharge; Direct referral to appropriate professionals for assessment of suspected visual problems; Follow up to determine the level of spontaneous recovery of visual problems; Provision of treatment and rehabilitation, tailored to the specific visual problems by the most suitable profession in that locality (this may vary across NHS and Social Care areas); Provision of information and clear explanation of visual problems, and their possible impact, at each possible opportunity; Ensuring individuals have knowledge of, and access to, relevant low vision services initiating direct referral if required. (Pollock et al. 2019; Rowe F. 2013)

Vocational rehabilitation

Stroke rehabilitation services should identify work status and signpost and /or refer on for specialised intervention as appropriate. A documented pathway should identify local access to a specialised vocational rehabilitation service.

Appendix 1.

Acknowledgement of contributions made to this report

Priorities team

Kylie Barclay

- Susan Wallace
- John Wilson

PfG team

Katrina Brennan, Martin Dennis, Therese Lebedis, Neil Muir, Fiona Wright, Susan Wallace, Kylie Barclay

Pre- Hospital Group

Martin Dennis, Craig Henderson, Stephen Makin, Karen Garrott, Alison Brooks, Gareth Clegg

TIA Group

Mark Barber, Sandi Haines, Gethin Williams, Neil Hunter, Helen Slavin, Gareth Blayney, John Reid, Ronnie Burns, Luke Yates

Hyperacute stroke

Fiona Wright, Matt Lambert, Mary Joan, Tracey Baird

Stroke Unit

Elizabeth Barrie, Anthony Byrne, Linda Campbell, Christine Carter, Vera Cvoro, Peter Langhorne, Mary Joan MacLeod Christine McAlpine, Keri-Ann Van-Nuil, Richard O'Brien (plus input from Martin Dennis, Therese Lebedis, Fiona Wright)

Rehabilitation and longterm support

Chair

Thérèse Lebedis - Consultant AHP/Occupational Therapist in stroke

Members

- Anne Armstrong Specialist Occupational Therapist, NHS Lanarkshire
- Katrina Brennan Stroke Improvement programme lead & Stroke MCN manager NHS Lanarkshire
- Dr Fiona Brodie [redacted]
- Professor Jo Booth Professor of Rehabilitation Nursing, Glasgow Caledonian University.
- Gillian Crighton [redacted]
- Gillian Capriotti AHP Stroke Consultant/Speech and Language therapist, NHS Greater Glasgow and Clyde
- Andrea Cail Stroke Association, Scotland

- Dr Emma Coutts Speech and Language Therapist, NHS Grampian
- Dr Charlie Chung Rehabilitation Manager and Stroke Specialist Occupational Therapist, NHS Fife
- Dr Alastair Cozens -[redacted]
- Karen Garrott Stroke Association, Scotland
- Dr Christine Hazelton Optometrist & Stroke Association Non- clinical lecturer, NMAHP research Unit, Glasgow Caledonian University
- Lesley Kane Chest Heart and Stroke Scotland
- Dr Lisa Kidd Reader in Supported Self-Management (Nursing), University of Glasgow
- Dr Ashish Macaden Consultant in Rehabilitation Medicine and Stroke , NHS Highland
- Neil Muir Clinical coordinator, Scottish Stroke National Audit Programme
- Dr Alex Pollock, Senior Research Fellow, NMAHP Research Unit, Glasgow Caledonian University
- Dr Joanne Robertson Consultant Clinical Psychologist, NHS Greater Glasgow and Clyde
- Dr Lesley Scobbie Stroke Association Clinical Lecturer, Glasgow Caledonian University & Stroke clinical academic AHP, NHS Lanarkshire
- Mark Smith Consultant AHP/Physiotherapist in stroke, NHS Lothian
- Prof. Frederike van Wijck Professor of Neurological Rehabilitation, Glasgow Caledonian University
- Dr Luke Williams Consultant Clinical Psychologist, NHS Ayrshire & Arran

Patient voices

Input from CHSS and Stroke Association

Allan Cowie/ Joanne Graham /

Andrea ail / Karen Garrott

Members of

NACS

MCN subgroup

SSCA subgroup

Thrombectomy Advisory Group and subgroups

References for the Hyperacute section

References

- 1. <u>https://www.basp.org/wp-content/uploads/2019/07/BASP-Stroke-Medicine-Workforce-</u> <u>Requirements-Report-FINAL.pdf</u>
- 2. https://bsnr.org.uk/_userfiles/pages/files/bsnrtrainingresponsetomtevidencefinal23116.pdf
- 3. https://informme.org.au/en/Guidelines/Clinical-Guidelines-for-Stroke-Management

- 4. https://journals.sagepub.com/doi/pdf/10.1177/2396987321989865
- Demaerschalk BM, Boyd EL, Barrett KM, et al. Comparison of stroke outcomes of hub and spoke hospital treated patients in Mayo Clinic telestroke program. J Stroke Cerebrovasc Dis. 2018;27(11):2940-2942.
- Sharma R, Zachrison KS, Viswanathan A, et al. Trends in telestroke care delivery: a 15-year experience of an academic hub and its network of spokes. Circ Cardiovasc Qual Outcomes. 2020;13(3): 005903. doi:10.1161/CIRCOUTCOMES.119.005903
- Kim, J; Easton, D; Zhao, H; Coote, S; Sookram, G; Smith, K; Stephenson, M; Bernard, S; Parsons, M; Yan, B; Desmond, P; Mitchell, P; Campbell, B; Donnan, G; Davis, S; Cadilhac, D. Economic evaluation of the Melbourne Mobile Stroke Unit. International Journal of Stroke 2020 Jun 14. Online Ahead of print
- Hassan AE, Ringheanu VM, Rabah RR, et al. Early experience utilizing artificial intelligence shows significant reduction in transfer times and length of stay in a hub and spoke model. Interv. Neuroradiol., 2020, doi: 10.1177/1591019920953055.
- Murray NM, Unberath M, Hager GD, et al. Artificial intelligence to diagnose ischemic stroke and identify large vessel occlusions: A systematic review. Jf NeuroInterv Surg. 2020, doi: 10.1136/neurintsurg-2019-015135.
- 10. ESO Guidelines https://journals.sagepub.com/doi/pdf/10.1177/2396987321989865
- Thomalla G, Boutitie F, Ma H, et al. Intravenous alteplase for stroke with unknown time of onset guided by advanced imaging: systematic review and meta-analysis of individual patient data. Lancet 2020; 396:1574–1584.
- 12. McDermott M ,Skolarus LE ,Burke JF A systematic review and meta-analysis of interventions to increase stroke thrombolysis.BMC Neurol. 2019; 19: 86
- McMeekin P, White P, James MA, Price CI, Flynn D, Ford GA. Estimating the number of UK stroke patients eligible for endovascular thrombectomy. Eur Stroke J. 2017 Dec;2(4):319-326. doi: 10.1177/2396987317733343. Epub 2017 Oct 4. PMID: 29900409; PMCID: PMC5992738.
- 14. BASP/BSNR/UKNG Draft Thrombectomy consensus guideline
- Kim BM, Baek JH, Heo JH, Kim DJ, Nam HS, Kim YD. Effect of Cumulative Case Volume on Procedural and Clinical Outcomes in Endovascular Thrombectomy. Stroke. 2019 May;50(5):1178-1183.
- Zhang L, Ogungbemi A, Trippier S, Clarke B, Khan U, Hall C, Ji Q, Clifton A, Cluckie G. Huband-spoke model for thrombectomy service in UK NHS practice. Clin Med (Lond). 2021 Jan;21(1):e26-e31. doi: 10.7861/clinmed.2020-0579. PMID: 33479080; PMCID: PMC7850178.
- 17. <u>https://www.nice.org.uk/guidance/ng128/chapter/Recommendations#thrombectomy-for-people-with-acute-ischaemic-stroke</u>
- https://www.rcr.ac.uk/system/files/publication/field_publication_files/bfcr198-provisioninterventional-radiology-services-second-ed.pdf
- 19. https://bsnr.org.uk/_userfiles/pages/files/bsnrtrainingresponsetomtevidencefinal23116.pdf
- 20. DRAFT BASP /BSNR Thrombectomy guideline document
- Feigin VL, Krishnamurthi RV, Parmar P, et al. Update on the global burden of ischemic and hemorrhagic stroke in 1990-2013: the GBD 2013 study. Neuroepidemiology 2015;45:161–76. 10.1159/000441085
- 22. <u>https://www.strokebestpractices.ca/recommendations/management-of-intracerebralhemorrhage/emergency-management-of-intracerebral-hemorrhage</u>
- 23. Hemphill JC, Greenberg SM, Anderson CS, et al. Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the

American heart Association/American stroke association. Stroke 2015;46:2032–60. 10.1161/STR.000000000000069

- Parry-Jones AR, Sammut-Powell C, Paroutoglou K, et al. An intracerebral hemorrhage care bundle is associated with lower case fatality. Ann Neurol 2019;86:495–503. 10.1002/ana.25546
- Parry-Jones AR, Moullaali TJ, Ziai WC. Treatment of intracerebral hemorrhage: From specific interventions to bundles of care. Int J Stroke. 2020 Dec;15(9):945-953. doi: 10.1177/1747493020964663. Epub 2020 Oct 15. PMID: 33059547; PMCID: PMC7739136.

Appendix documents Transfer checklist Thrombectomy suitability document Readiness for repatriation checklist

Appendices (copied from Stroke Unit)

Appendix - Table 1. Terminology used for different types of stroke unit.

Stroke unit model	'Typical' timings		'Typical' route	Objectives	Comments
	Admission	Discharge	of admission		
Hyperacute	<6 hrs	Usually 1– 2 days	Direct from Emergency department	Provides specialist medical and nursing care during the hyperacute period when revascularisation (spontaneous or interventional) might occur. Monitoring and interventionfocus on physiological variables and early complications	No supporting evidence from RCTs. Supported by observational studies (Morris 2019). Should be integrated with rehabilitation phase service.
Acute	<24 hrs	Usually several days	From hyperacute unit or medical admissions unit	Provides stroke unit care in the first few days after stroke; including assessment, investigation and intervention (but usually beyond the time window for revascularisation). Monitoring and intervention focus on physiological variables and early complications. Provides appropriate early rehabilitation activities in patients with acute medical problems.	Evidence of effectiveness from two RCTs. Support from observational studies (Cadilhac 2017). Should be integrated with rehabilitation phase service.
Rehabilitation	Days– weeks	Weeks	From acute or integrated unit	Provides stroke unit care, with an emphasis on rehabilitation, but not involved in acute medical care. Usually begins several days after stroke onset and continues rehabilitation for several weeks to months as required.	Evidence of effectiveness from four RCTs. Often provided 'off-site' to support larger hospitals.
Comprehensive (combined)	<24 hrs	Days- weeks	From hyperacute unit or medical admissions unit	Combines both acute and rehabilitation phases in one unit. Overlap of characteristics with "acute" above.	Supporting evidence of effectiveness from 16 RCTs (Stroke Unit Trialists' Collaboration, 2020).

		Useful model for	
		smaller hospitals.	
		1	

Appendix - Table 2. Recommended staffing levels for stroke units

Staff	Hyperacute Stroke Unit	Acute Stroke Unit
Nurso	2.0	1 25
Whole-time equivalent (WTE) per	(80.20	(65:35
bed	registered: unregistered)	registered: unregistered)
Physiotherapist (WTE per 5 beds)	0.73	0.84
Occupational Therapist	0.68	0.81
(WTE per 5 beds)		
Speech and language therapist	0.34	0.40
(WTE per 5 beds)		
Clinical neuropsychologist/	0.20	0.20
Clinical psychologist		
(WTE per 5 beds)		
Dietitian (WTE per 5 beds)	0.15	0.15
Consultant stroke physician	24/7	Consultant led ward
	availability;	round 5 days/week
	minimum 6 thrombolysis	
	trained physicians on rota	

The evidence regarding the optimum size of a hyperacute stroke unit is similarly confined to observational studies, reflecting a level of institutional experience and competence in the provision of specialist hyperacute treatments such as intravenous thrombolysis (Bray et al, 2013) that corresponds with a volume of at least 500 acute stroke admissions per year.

Appendix – Table 3. Recommendations with details of implementation and supporting references

Recommendations – NHS Board level

Recommendation	How to achieve this
Stroke services should provide all people	Stroke services should provide all people with stroke
with stroke with specialist multi-disciplinary	with specialist multi-disciplinary care the whole
care for the whole patient pathway	patient pathway including; diagnosis, hyperacute
including; diagnosis, hyperacute and acute	and acute treatments, normalisation of homeostasis,
treatments, normalisation of homeostasis,	early rehabilitation, prevention of complications,
early rehabilitation, prevention of	secondary prevention, ongoing rehabilitation, and
complications, secondary prevention.	palliative care as required. (RCP 2.3.1C: RCP Sections
ongoing rehabilitation, and palliative care as	3.5-3.7. 3.10).
required.	
Treatment pathways for stroke patients in	Treatment pathways for stroke patients in hospital
hospital should include:	should include (RCP 2.4.1K: NICE, 2016: Stroke Unit
- a defined hyperacute stroke	Trialists' Collaboration 2020)
unit/admission area with assessment by a	- a defined hyperacute stroke unit/designated
stroke specialist:	admission area with assessment (local or remote) by
– geographically-defined stroke unit(s)	a stroke specialist:
where patients are managed by a co-	- geographically-defined stroke unit(s) which
ordinated multi-disciplinary team that fulfils	includes:
the criteria of a stroke unit:	– nation management by a co-ordinated multi-
- close links, protocols and communication	disciplinary team that meets at least once a week for
systems for the transfer of care with other	the exchange of information and care planning
in-natient stroke services, early supported	about in-nationts with stroke.
discharge teams and community services	- information, advice and support for people with
discharge teams and community services.	stroke and their family/carers:
	– management protocols for common problems
	has a upon the best available evidence:
	- training for healthcare professionals in the
	specialty of stroke (cross refer?)
	- close links, protocols and communication systems
	for the transfer of care with other in-nation systems
	services, early supported discharge teams and
	community services
Where small bosnital size / rurality prevents	Where small bosnital size and/or rurality prevents
the establishment of a hyperacute stroke	the establishment of a hyperacute stroke unit
unit arrangements should be in place to	arrangements should be in place to ensure
and, an angements should be in place to	aquivalent specialist assessment and monitoring (in
remote consultation with stroke specialists	a defined admission area) through remote
remote consultation with stroke specialists.	a defined admission area) through remote
	consultation (such as telemedicine) with stroke
Pohabilitation of stroke patients in bespital	Pohabilitation of stroke patients in herpital should
chould accur in a setting that mosts the	occur in a cotting that mosts the definition of a
definition of a stroke rebabilitation units a	stroke rehabilitation unit: a single multi-disciplinary
single multi-disciplinary team of stroke	team including specialists in the following (PCD
single multi-uisciplinary team of stroke	2.4.11: Stroke Unit Trialists' Collaboration 2020:
specialists with easy access to all relevant	
and support for people with stroke and their	mice, 2010).
family/carors	- meucine,
lanniy/carers.	- hursing;
	– physiotherapy;

Commented [K9]: I note there aren't any recommendations made here relevant to primary care e.g. primary prevention, identification of stroke / TIA, longer term management. I also feel that person-centred care, goal setting and supported self-management are missing from these tables.

	 occupational therapy; speech and language therapy; dietetics; clinical neuropsychology/clinical psychology; social work; orthoptics; with easy access to pharmacy, orthotics, specialist seating, assistive technology and information, advice
	and support for people with stroke and their family/carers.
Where small hospital size/ rurality prevents the establishment of a separate stroke rehabilitation unit, arrangements should be in place to ensure equivalent specialist care through the acute stroke unit and/or remote consultation with stroke specialists.	Where small hospital size/ rurality prevents the establishment of a separate stroke rehabilitation unit, arrangements should be in place to ensure equivalent specialist care through the acute stroke unit and/or remote consultation (such as telemedicine) with stroke specialists (PfG Group Consensus).
Stroke services should participate in national and local audit, multi-centre research and quality improvement programmes.	Stroke services should participate in national and local audit, multi-centre research and quality improvement programmes (RCP 2.3.1K; Working Party consensus).

Recommendations – Hospital level

General recommendations

People with stroke should be treated on a specialist stroke unit throughout their hospital stay.	People with stroke should be treated on a specialist stroke unit throughout their hospital stay unless their stroke is not the predominant clinical problem (RCP 2.4.1A; Stroke Unit Trialists' Collaboration, 2020).
A hyperacute/acute stroke service should provide specialist medical, nursing, and rehabilitation staffing levels matching the RCP Guideline.	A hyperacute/acute stroke service should provide staffing levels matching the recommendations in Appendix Table 2 (RCP 2.4.1B; Table 2.1. (Bray et al, 2014; Ramsay et al, 2015; Working Party consensus). Examples of good practice (eg. Educational Templates) are available.
Stroke services should have an education programme for all staff providing acute stroke care and should provide training for healthcare professionals in the specialty of stroke.	Stroke services should have an education programme for all staff providing acute stroke care (including ambulance services and the emergency department as appropriate) and should provide training for healthcare professionals in the specialty of stroke (Follows from the evidence concerning specialist stroke units (RCP - Section 2.4).
Stroke services should participate in national and local audit, multi-centre research and quality improvement programmes.	Stroke services should participate in national and local audit, multi-centre research and quality improvement programmes (RCP 2.3.1K; Working Party consensus).

Details of the Patient Journey

Hyperacute phase (approximately stroke onset to 24 hours)

People with suspected acute stroke should be admitted directly to a hyperacute stroke unit (or equivalent admission area) and be assessed for emergency stroke treatments by a specialist clinician (physician/nurse) without delay.	People with suspected acute stroke (including people already in hospital) should be admitted directly to a hyperacute stroke unit (or equivalent designated admission area) and be assessed for emergency stroke treatments by a specialist clinician (physician/nurse) without delay (RCP 2.3.1B; RCP Sections 3.4-3.7; Morris 2019).
A hyperacute stroke unit (or equivalent admission area) should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week.	A hyperacute stroke unit (or equivalent admission area) should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week. (RCP 2.4.1D; Working Party consensus).
A hyperacute stroke unit (or equivalent hyperacute area) should have immediate access to specialist medical, nursing, rehabilitation, and diagnostic	A hyperacute stroke unit should have immediate access to the following (RCP 2.4.1C; Follows from the evidence and recommendations concerning emergency treatments and monitoring):
staff trained in the hyperacute management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.	 specialist medical staff trained in the hyperacute and acute management of people with stroke, including the diagnostic and administrative procedures needed for the safe and timely delivery of emergency stroke treatments;
	 specialist nursing staff trained in the hyperacute and acute management of people with stroke, covering neurological, general medical and rehabilitation aspects;
	 stroke specialist rehabilitation staff;
	 diagnostic, imaging and cardiology services (cross-refer to hyperacute and prevention section?);
	 tertiary services for endovascular therapy, neurosurgery and vascular surgery.
Where telemedicine is used for the rapid assessment of people with suspected stroke, the system should include a high-quality video link to enable the remote stroke physician to assess the patient according to Clinical Guidelines.	Where telemedicine is used for the rapid assessment of people with suspected stroke by a specialist physician, the system should include a high-quality video link to enable the remote physician to observe the clinical examination, discuss with the assessing clinician, talk to the patient and/or carers directly and review radiological investigations (RCP 2.4.1G; Meyer et al, 2008; RCP Working Party consensus).
Staff providing care via telemedicine should be appropriately trained in the hyperacute assessment of suspected acute stroke, the delivery of thrombolysis and the use of this approach and technology. The quality of care using telemedicine should be regularly audited.	Staff providing care via telemedicine (at both ends of the system) should be appropriately trained in the hyperacute assessment of people with suspected acute stroke, in the delivery of thrombolysis and the use of this approach and technology. The quality of care and decision-making using telemedicine should be regularly audited (RCP 2.4.1H; Meyer et al, 2008; RCP Working Party consensus).
Hyperacute and acute stroke services should have protocols for the monitoring, referral and urgent transfer	Hyperacute and acute stroke services should have protocols for the monitoring, referral and transfer of patients to regional neurosurgical centres for

of patients to regional neurosurgical centres.	decompressive hemicraniectomy, surgical management of intracranial haemorrhage and the management of symptomatic hydrocephalus including external ventricular drain insertion (RCP 2.3.1F; Follows from the evidence concerning emergency stroke treatments).
Patients with acute stroke should have their clinical status monitored closely and managed according to Clinical Guidelines.	Patients with acute stroke should have their clinical status monitored closely and managed according to Clinical Guidelines; including level of consciousness; blood glucose; blood pressure; oxygen saturation; hydration and nutrition; temperature; cardiac rhythm and rate (3.10.1D; Working Party consensus, Middleton et al, 2011).
Patients with acute stroke should have their swallowing screened, and patients with dysphagia managed, according to Clinical Guidelines.	Patients with acute stroke should have their swallowing screened, using a validated screening tool, by a trained healthcare professional within four hours of arrival at hospital and before being given any oral food, fluid or medication (RCP 3.10.1E; NICE, 2016; Kertscher 2014; Martino et al, 2014; Bray et al, 2016).
	Until a safe swallowing method is established, patients with dysphagia after acute stroke should:
	– be immediately considered for alternative fluids;
	 have a comprehensive specialist assessment of their swallowing;
	 be considered for nasogastric tube feeding within 24 hours;
	 be referred to a dietitian for specialist nutritional assessment, advice and monitoring;
	 receive adequate hydration, nutrition and medication by alternative means. (RCP 3.10.1F, RCP 3.10.1G; NICE, 2006a, 2008b; Geegenage et al, 2012, Working Party consensus).
Healthcare professionals responsible for the assessment and management of patients with acute stroke should be trained in how to position and mobilise patients in a way that is safe and consistent with Clinical Guidelines.	Healthcare professionals responsible for the initial assessment of patients with acute stroke should be trained in how to position patients appropriately, taking into account the degree of their physical impairment after stroke (RCP 3.11.1B; Working Party consensus).
	Patients within the first 24 hours of onset can be safely managed in the lying-flat head position or the sitting-up position according to their preference (Anderson 2017).
	Patients with difficulty moving after stroke should be assessed as soon as possible within the first 24 hours of onset by an appropriately trained healthcare professional to determine the most appropriate and safe methods of transfer and mobilisation (RCP 3.12.1A; Working Party consensus).

Patients with acute stroke should be managed according to Clinical Guidelines to minimise the risk of complications.	Mobilisation within 24 hours of onset should only be for patients who require little or no assistance to mobilise (RCP 3.12.1B; AVERT Trial Collaboration group 2015; Bernhardt et al, 2016). Patients with difficulty moving early after stroke who are medically stable should be offered frequent, short daily mobilisations (sitting out of bed, standing or walking) by appropriately trained staff with access to appropriate equipment, typically beginning between 24 and 48 hours of stroke onset. Particular care should be taken when mobilising patients who are elderly (>80 years) or have intracerebral haemorrhage (Bernhardt 2020). When lying or sitting, patients with acute stroke should be positioned to minimise the risk of aspiration and other respiratory complications, shoulder pain and subluxation, contractures and skin pressure ulceration (RCP 3.11.1C; Working Party consensus)
	Patients with immobility after acute stroke should be offered intermittent pneumatic compression within 3 days of admission to hospital for the prevention of deep vein thrombosis. Treatment should be continuous for 30 days or until the patient is mobile or discharged, whichever is sooner (RCP 3.13.1A; CLOTS Trials
	Collaboration, 2014).

NB. Telemedicine is used in some centres to support decision-making in hyperacute stroke because of significant practical or geographical obstacles. However, unless telemedicine is used as part of an otherwise well-developed acute stroke service, there is concern that outcomes may suffer (Heffner et al, 2015). Observational evidence suggests that telemedicine is associated with more protocol violations and longer treatment times (Meyer et al, 2008, Dutta et al, 2015) compared with face-to-face assessment but video assessment is associated with better process outcomes than telephone assessment (Handschu et al 2008, Demaerschalk 2011).

Acute stroke patients should be	An acute stroke unit should provide the following (RCP
managed in an acute stroke unit that	2.4.1E; Follows from the evidence and recommendations
provides the following:	concerning emergency treatments and monitoring
 specialist medical and nursing staff 	(Sections 3.4-3.7, 3.10):
trained in the acute stroke	- specialist medical staff trained in the acute management
management;	of people with stroke;
- stroke specialist rehabilitation staff;	- specialist nursing staff trained in the acute management
 access to diagnostic, imaging and 	of people with stroke, covering neurological, general
cardiology services;	medical and rehabilitation aspects;
 access to tertiary services for 	 stroke specialist rehabilitation staff;
neurosurgery and vascular surgery;	 access to diagnostic, imaging and cardiology services
- continuous access to a consultant	(cross-refer to prevention section?);
with expertise in stroke medicine;	 access to tertiary services for neurosurgery and vascular
Staffing should be provided as per	surgery.
Clinical Guidelines.	

Acute phase (approximately first 1-2 weeks)

	An acute stroke unit should have continuous access to a
	concultant with expertise in stroke medicine, with
	consultant with expertise in stroke medicine, with
	consultant review 5 days per week.
Staff working in acute stroke units	Staff working in acute stroke units should have completed
should have completed the necessary	the necessary training as outlined in the National
training as outlined in the National	Educational template and should follow standardised
Educational template and should	management protocols for the assessment & management
follow standardised management	of acute stroke according to Clinical guidelines. This should
protocols for the assessment &	include management protocols for urinary and faecal
management of acute stroke	incontinence and constipation in people with stroke (RCP
according to Clinical guidelines	2.5.1A: Working Party consensus)
decording to ennical guidennes.	People with stroke should not have an indwelling (urethral)
	estheter incorted unless indicated to relieve urinary
	catheter inserted unless indicated to relieve urinary
	retention or when fluid balance is critical (RCP 2.5.1B;
	Working Party consensus).
	People with stroke who have continued loss of bladder
	and/or bowel control 2 weeks after onset should be
	reassessed to identify the cause of incontinence, and be
	involved in deriving a treatment plan (with their
	family/carers if appropriate). The treatment plan (Thomas
	et al. 2008: Working Party consensus) should include:
	- treatment of any identified cause of incontinence:
	- training for the person with stroke and/or their
	family/carers in the management of incontinence:
	referral for specialist treatments and behavioural
	adaptations if the person is able to participate;
	– adequate arrangements for the continued supply of
	continence aids and services.
	D People with stroke with continued loss of urinary
	continence should be offered behavioural interventions
	and adaptations (NICE, 2013c, 2015a) such as:
	 timed toileting;
	 prompted voiding;
	– review of caffeine intake:
	– bladder retraining:
	– pelvic floor exercises:
	_ external equinment
	nrier to considering pharmacoutical and long term
	sathatar antions
	Calification options.
	reopie with stroke with constipation should be
	offered (KCP 2.5.1E; NICE, 2007b; Coggrave et al, 2006;
	Working Party consensus):
	 advice on diet, fluid intake and exercise;
	 – a regulated routine of toileting;
	- a prescribed drug review to minimise use of constipating
	drugs;
	– oral laxatives;
	 – a structured bowel management programme which
	includes nurse-led bowel care interventions;
	– education and information for the person with stroke
	and their family/carers;

	- rectal laxatives if severe problems persist.
People with communication problems	People with communication problems after stroke should
after stroke should be assessed by a	be assessed by a speech and language therapist to
speech and language therapist and	diagnose the problem and to explain the nature and
ongoing management planned	implications to the person, their family/carers and the
according to Clinical Guidelines.	multidisciplinary team. (RCP 4.4.1.1A; Brady et al, 2016;
	Working Party consensus).
Services providing acute and ongoing	Services providing acute and long-term care for people
care for people with stroke should	with stroke should provide high quality end-of-life care for
provide high quality end-of-life care	those who need it.
for those who need it, including timely	Staff caring for people dying of stroke should be trained in
access to specialist palliative care if	the principles and practice of end-of-life care, including the
required.	recognition of people who are approaching the end of life.
	(RCP 2.15.2; NICE, 2015c; Working Party consensus).

Rehabilitation phase

Rehabilitation should be considered to	Rehabilitation should be considered to be a process that
be a process that begins as soon as a	begins as soon as a stroke is diagnosed and continues as
stroke is diagnosed and continues as	long as required. (the PfG group considered that this
long as required.	principle was important to ensure high-quality holistic
	care).
Rehabilitation of stroke patients in	A stroke rehabilitation unit should have a multi-
hospital should occur in a setting that	disciplinary team including specialists in the following
meets the definition of a stroke	(RCP 2.4.1J; Stroke Unit Trialists' Collaboration, 2020;
rehabilitation unit staffed by a single	NICE 2013b, NICE, 2016):
multi-disciplinary team of stroke	– medicine;
specialists (with easy access to all	– nursing;
relevant supporting services and	– physiotherapy;
information, advice and support for	 occupational therapy;
people with stroke and their	 speech and language therapy;
family/carers) who predominantly	- dietetics;
care for people with stroke.	 – clinical neuropsychology/clinical psychology;
	– social work;
	– orthoptics;
	 with easy access to pharmacy, orthotics, specialist
	seating, assistive technology and information, advice and
	support for people with stroke and their family/carers.
	A stroke rehabilitation unit should predominantly care
	for people with stroke (RCP 2.4.1I; Stroke Unit Trialists'
	Collaboration, 2020; NICE, 2016).
Where small hospital size/ rurality	Where small hospital size and/or rurality prevents the
prevents the establishment of a	establishment of a rehabilitation stroke unit,
separate stroke rehabilitation unit,	arrangements should be in place to ensure equivalent
arrangements should be in place to	specialist assessment and rehabilitation through generic
ensure equivalent specialist care	rehabilitation services supported by stroke specialists
through the acute stroke unit and/or	(PfG Group Consensus).
remote consultation with stroke	
specialists.	
	Staff caring for stroke patients should be trained in
	the principles and practice of end of-life care,
	including the recognition of people who are approaching the end of life and the current Clinical Guidelines of best practice (NICE, 2015c; Working Party consensus).
---------------------------------------	--
People with stroke and their	People with stroke and their family/carers should be
family/carers should be involved in	involved in decisions about the transfer of their care out
decisions about the transfer of their	of hospital, and the care that will be provided (RCP
care out of hospital	2.7.1F: Working Party consensus)
Transfer of care should be organised	Transfer of care should be organised and run in
and run in accordance with Clinical	accordance with clinical guidelines (NICE, 2013b, NICE
Guidelines.	2016; Working Party consensus).
	Hospital in-patients with stroke who have mild to moderate disability should be offered access to an early supported discharge service, organised and run in accordance with the clinical guidelines (RCP 2.7.1A-E; Langhorne et al, 2017; NICE 2013b, NICE 2016; Working Party consensus).

References

RCP 2016. Rudd AG, Bowen A, Young G, James MA. National clinical guideline for stroke : 5th edition 2016. In: Clinical Medicine. 2017.

Stroke Unit Trialists' Collaboration, 2020. Langhorne P, Ramachandra S. Organised inpatient (stroke unit) care for stroke: network meta-analysis. Cochrane Database of Systematic Reviews 2020, Issue 4. Art. No.: CD000197. DOI: 10.1002/14651858.CD000197.pub4.

Cadilhac, DA, Kilkenny, MF, Andrew, NE et al. Hospitals admitting at least 100 patients with stroke a year should have a stroke unit: a case study from Australia. BMC Health Serv Res 2017; 17:212. https://doi.org/10.1186/s12913–017–2150–2

Cadilhac D, Andrew N, Lannin N, et al. Quality of acute care and long-term quality of life and survival: the Australian Stroke Clinical Registry. Stroke 2017; 48(4):1026–1032.

SSNAP 2017. Royal College of Physicians. Sentinel Stroke National Audit Programme (SSNAP) Clinical Audit, Public Report. London: Royal College of Physicians, 2016.

Busingye D, Kilkenny MF, Purvis T, et al. Is length of time in a stroke unit associated with better outcomes for patients with stroke in Australia? An observational study. BMJ Open 2018; 8:e022536. doi: 10.1136/bmjopen-2018-022536

National Institute for Health and Care Excellence, 2016. Quality Standard 2: Stroke in adults [Online].Available: https://www.nice.org.uk/guidance/QS2.

National Institute for Health and Care Excellence (2019) Stroke and transient ischaemic attack in over 16s: diagnosis and initial management (NICE guideline 128). Available at: http://www.nice.org.uk/guidance/ng128 Published: 1 May 2019

Norrving B, Barrick J, Davalos A, et al; on behalf of the Action Plan for Stroke in Europe Working Group. Action Plan for Stroke in Europe 2018–2030. ESJ 2018; Vol. 3(4) 309–336.

Bray BD, Ayis S, Campbell J, Cloud GC, et al, 2014. Associations between stroke mortality and weekend working by stroke specialist physicians and registered nurses: prospective multicentre cohort study. PLoS Med, 11, e1001705.

Ramsay AI, Morris S, Hoffman A, Hunter RM, et al, 2015. Effects of Centralizing Acute Stroke Services on Stroke Care Provision in Two Large Metropolitan Areas in England. Stroke, 46, 2244-51.

Morris S, Ramsay AIG, Boaden RJ, et al. Impact and sustainability of centralising acute stroke services in English metropolitan areas: retrospective analysis of hospital episode statistics and stroke national audit data. BMJ 2019; 364: 11.

Meyer BC, Raman R, Hemmen T, Obler R, et al, 2008. Efficacy of site-independent telemedicine in the STRokE DOC trial: a randomised, blinded, prospective study 13. Lancet Neurology, 7, 787-795.

Middleton S, McElduff P, Ward J, Grimshaw JM, et al, 2011. Implementation of evidence-based treatment protocols to manage fever, hyperglycaemia, and swallowing dysfunction in acute stroke (QASC): a cluster randomised controlled trial. Lancet, 378, 1699-706.

Kertscher B, Speyer R, Palmieri M & Plant C, 2014. Bedside screening to detect oropharyngeal dysphagia in patients with neurological disorders: an updated systematic review. Dysphagia, 29, 204-12.

Martino R, Maki E & Diamant N, 2014. Identification of dysphagia using the Toronto Bedside Swallowing Screening Test (TOR-BSST©): are 10 teaspoons of water necessary? International Journal of SpeechLanguage Pathology, 16, 193-8

Bray BD, Smith CJ, Cloud GC, Enderby P, et al, 2016. The association between delays in screening for and assessing dysphagia after acute stroke, and the risk of stroke-associated pneumonia. Journal of Neurology, Neurosurgery & Psychiatry, [Epub ahead of print].

National Institute for Health and Care Excellence, 2006a. Clinical Guideline 32: Nutrition support in adults: oral nutrition support, enteral tube feeding and parenteral nutrition [Online]. Available: http://guidance.nice.org.uk/CG32.

National Institute for Health and Care Excellence, 2008b. Public Health Guidance 10: Stop smoking services [Online]. Available: http://guidance.nice.org.uk/PH10.

Geeganage C, Beavan J, Ellender S & Bath Philip MW, 2012. Interventions for dysphagia and nutritional support in acute and subacute stroke. Cochrane Database of Systematic Reviews, 10, CD000323.

Anderson CS, Arima H, Lavados P, Billot L, Hackett ML, Olavarría VV, Muñoz Venturelli P, Brunser A, Peng B, Cui L, Song L, Rogers K, Middleton S, Lim JY, Forshaw D, Lightbody CE, Woodward M, Pontes-Neto O, De Silva HA, Lin RT, Lee TH, Pandian JD, Mead GE, Robinson T, Watkins C; HeadPoST Investigators and Coordinators. Cluster-Randomized, Crossover Trial of Head Positioning in Acute Stroke. N Engl J Med. 2017 Jun 22;376(25):2437-2447. doi: 10.1056/NEJMoa1615715. PMID: 28636854.

AVERT Trial Collaboration group, 2015. Efficacy and safety of very early mobilisation within 24 hours of stroke onset (AVERT): a randomised controlled trial. Lancet, 386, 46-55.Bernhardt et al, 2016

Bernhardt J, Borschmann K, Collier JM, Thrift AG, Langhorne P, Middleton S, Lindley RI, Dewey HM, Bath PM, Said CM, Churilov L, Ellery FL, Bladin C, Reid CM, Frayne JH, Srikanth VK, Read SJ, Donnan

GA. Fatal and non-fatal events within 14 days after early, intensive mobilization post stroke. NEUROLOGY/2019/035063

Bernhardt J, Churilov L, Ellery F, Collier J, Chamberlain J, Langhorne P, Lindley RI, Moodie M, Dewey H, Thrift AG, Donnan G; AVERT Collaboration Group. Prespecified dose-response analysis for A Very Early Rehabilitation Trial (AVERT). Neurology. 2016 Jun 7;86(23):2138-45.

CLOTS Trials Collaboration, 2014. Effect of intermittent pneumatic compression on disability, living circumstances, quality of life, and hospital costs after stroke: secondary analyses from CLOTS 3, a randomised trial. Lancet Neurology, 13, 1186-92.

Brady MC, Kelly H, Godwin J, Enderby P, et al, 2016. Speech and language therapy for aphasia following stroke. Cochrane Database of Systematic Reviews, 6, CD000425.

Thomas LH, Cross S, Barrett J, French B, et al, 2008. Treatment of urinary incontinence after stroke in adults. Cochrane Database of Systematic Reviews, CD004462

National Institute for Health and Care Excellence, 2013c. Clinical Guideline 171: Urinary incontinence: the management of urinary incontinence in women [Online]. Available: http://guidance.nice.org.uk/CG171.

National Institute for Health and Care Excellence, 2015a. Clinical Guideline 97: Lower urinary tract symptoms in men: management [Online]. Available: https://www.nice.org.uk/guidance/cg97.

National Institute for Health and Care Excellence, 2007b. Clinical Guideline 49: Faecal incontinence: the management of faecal incontinence in adults [Online]. Available: https://www.nice.org.uk/CG49.

National Institute for Health and Care Excellence, 2013b. Clinical Guideline 162: Stroke rehabilitation in adults [Online]. London. Available: http://www.nice.org.uk/guidance/CG162

Coggrave M, Wiesel PH, Norton C. Management of faecal incontinence and constipation in adults with central neurological diseases. Cochrane Database Syst Rev. 2006 Apr 19;(2):CD002115. doi: 10.1002/14651858.CD002115.pub3. Update in: Cochrane Database Syst Rev. 2013;12:CD002115. PMID: 16625555.

National Institute for Health and Care Excellence, 2015c. NICE Guidelines 31: Care of Dying Adults in the Last Days of Life [Online]. Available: <u>https://www.nice.org.uk/guidance/ng31</u>. Langhorne P, Baylan S, Early Supported Discharge Trialists. Early supported discharge services for people with acute stroke. Cochrane Database of Systematic Reviews 2017, Issue 7. Art. No.: CD000443. DOI: 10.1002/14651858.CD000443.pub4.

Langhorne P, Audebert HJ, Cadilhac DA, Kim J, Lindsay P. Stroke systems of care in high-income countries: what is optimal? Lancet. 2020 Oct 31;396(10260):1433-1442. doi: 10.1016/S0140-6736(20)31363-5. PMID: 33129394.

Heffner DL, Thirumala PD, Pokharna P, Chang YF, Wechsler L. Outcomes of Spoke-Retained Telestroke Patients Versus Hub-Treated Patients After Intravenous Thrombolysis. Stroke. 2015;46:3161–316.

Meyer BC, Raman R, Hemmen T, Obler R, et al, 2008. Efficacy of site-independent telemedicine in the STRokE DOC trial: a randomised, blinded, prospective study 13. Lancet Neurology, 7, 787-795.

Dutta D, Kendall J, Holmes C, Murphy P, et al, 2015. Evaluation of a telephone advice system for remote intravenous thrombolysis in ischemic stroke: data from a United Kingdom network. Stroke, 46, 867-9.

Handschu R, Scibor M, Willaczek B, et al. Telemedicine in acute stroke: remote video-examination compared to simple telephone consultation. Journal of Neurology. 2008 Nov;255(11):1792-1797. DOI: 10.1007/s00415-008-0066-9.

Demaerschalk, B.M. Telemedicine or Telephone Consultation in Patients with Acute Stroke. Curr Neurol Neurosci Rep 11, 42–51 (2011). https://doi.org/10.1007/s11910-010-0147-x

Rehabilitation is a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in interaction with their environment". Rehabilitation helps people "to be as independent as possible in everyday activities and enables participation in education, work, recreation and meaningful life roles such as taking care of family. It does so by addressing underlying conditions and improving the way an individual functions in everyday life. WHO - <u>https://www.who.int/news-room/fact-sheets/detail/rehabilitation</u>

The United Nations Convention on the rights of persons with disabilities recognises rehabilitation as a human right<u>https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html</u>



Holistic Model of Stroke Rehabilitation (Williams, Hamilton & Evans, 2021)

Contents

1.	. Introduction				
	1.1.	.1 Realistic Medicine and shared decision making	5		
	1.1.	.2 Information Technology (IT)	5		
	1.1.	.3 Research	6		
2.	Gov	vernance	6		
3.	Prir	nary Prevention	7		
	3.1	Recommendations	7		
4.	Rec	cognition and Referral	8		
	4.1	Improving individual awareness and recognition of stroke	8		
	4.2	Improving referral pathways	8		
	4.3	Recommendations	10		
5.	TIA	Services	11		
	5.1	Specialist assessment	11		
	5.2	In vestigations	12		
	5.3	Treatment and care	12		
	5.4	Recommendations	14		
6.	Trai	nsfer to Hospital	14		
	6.1	Improving pre-hospital assessment	15		
	6.2	Pre Alert	15		
	6.3	Recommendations	16		
7.	Ass	sessment and diagnostics	16		
	7.1	Interface between stroke services and emergency departments	16		
	7.2	Assessment of eligibility for hyperacute treatment	17		
	7.3	Access to brain and vascular imaging and cardiac investigations	18		
	7.3.	.1 Brain imaging	18		
	7.3.2 Vascular imaging				
7.3.3 Cardiac investigations					
~	7.4	Recommendations	20		
8.	Hyp	beracute Stroke Treatment.	21		
	8.1		<u>2</u> 2		
	8.2	Thrombectomy.	<u>2</u> 2		
	8.2.	2 Departments	<u>22</u>		
	0.Z. 0.2	2 International Neuroradialogy	23 22		
	0.2.	Management of latragerabrel Hagmarrhage (ICH)	2ວ ວ⊿		
	0.3 0 1		24 24		
0	0.4		24 26		
9.	9. Acute stroke care				
	9.1		-0 27		
	0.2 0.2	End of Life Care	-' 20		
	9.4	Recommendations	29		
	·				

0. Rehabilitation and long term support		
10.1 Str	oke Rehabilitation	30
10.1.1	Key principles of stroke rehabilitation	31
10.1.2	Stroke Rehabilitation Service Provision	33
10.1.3	The Multi-Disciplinary Team	34
10.1.4	Rehabilitation settings	35
10.1.5	Key interventions delivered by a progressive stroke rehabilitation service	36
10.2 Sel	f-Management and Long-term support	40
10.3 Red	commendations	41
11. Workford	ce	43
11.1.1	Education and training	44
12. Glossary	/	45

1. Introduction

Stroke develops as a result of problems with the blood vessels supplying oxygen rich blood to the brain.

There were 3,754 deaths in Scotland in 2019 where cerebrovascular disease, including stroke, was the underlying cause. While there has been a decrease in deaths due to stroke over the last decade, it is important to note that it remains a leading cause of death and the leading cause of disability in Scotland¹. This highlights that there is still a significant amount of work to do to improve prevention and outcomes from stroke in Scotland. Services must be developed to ensure that people across Scotland have equitable access to treatment and care.

Stroke therefore remains a national clinical priority for Scottish Government and we made a number of commitments in the 2019/20 and 2020/21 Programmes for Government, including commitments to develop a national thrombectomy service and to 'scope out and define what a progressive stroke service looks like'.

This document defines a progressive stroke pathway in the Scottish context and sets out our vision of stroke services in Scotland. It has been produced in collaboration with those outlined in **Annex A**. We are grateful to the many health care professionals who shared their expertise with us, and to the National Stroke Voices who shared their lived experience of stroke to support the development of this document. To support the delivery of the vision set out, an implementation plan will follow.

The infographic below depicts an overview of the 'Progressive stroke pathway' defined in this document. This includes recognition, transfer to hospital, hyperacute and acute care through to rehabilitation and supported self-management. We have also recognised the importance of primary stroke prevention within this document.

Stroke symptoms appear: key aspects -

1. Recognition by individual, prompting health seeking behaviour.

2. Appropriate awareness and onward referral by Healthcare professionals.

Acute Stroke Suspected: Transfer to hospital: key aspects

 Improved pre-hospital assessments, enabled by better training and access to stroke specialists via technology, improved diagnostic tools.
Pre-alert including CHI number enabling quicker action upon arrival at hospital

TIA or Minor stroke suspected: Key aspects:

Early specialist assessment
Early access to investigations
Early initiation of treatment
Onward referral where necessary
5. Follow up

Assessment/diagnostics:

To determine diagnosis and assess eligibility for hyperacute stroke treatments. Key aspects: 1. Effective interface/collaboration with emergency department (as initial receivers). 2. Early access to investigations 3. Assessment for hyperacute treatment eligibility should take place immediately and by a stroke specialist.

Eligible for Thrombolysis:

Reduction in Door to Needle times across Scotland
Role of stroke nurse/interface with ED
Care in a stroke unit for post thrombolysis monitoring

Eligible for Thrombectomy:

1. Timely transfer to Comprehensive Stroke Centre
2. Care delivered within a stroke unit enabling increased
monitoring post intervention.
3. Specialist staff with recognised training experience

Intracerebral Haemorrhage

Key aspects 1. Care provided within Stroke Unit if no surgical intervention required. 2. Engagement with local or regional neurosurgical teams where necessary.

Acute Care

Key aspects: 1. Delivery of stroke care bundle 2. Provision of care within stroke unit 3. End of life care where appropriate

Rehabilitation : Key aspects

Started early in person's journey
Person centred and holistic
Appropriate frequency and intensity
Provided by a multidisciplinary team
Delivered in appropriate setting
Follow up
Supported self managment

There are a number of underpinning aspects of delivering a progressive stroke pathway. These include the principles of Realistic Medicine which should be incorporated throughout, the importance of good information technology (IT) and digital systems to facilitate seamless delivery of care, and an effective research environment.

1.1.1 Realistic Medicine and shared decision making

Delivery of a Realistic Medicine approach means ensuring that people who experience stroke are supported to take part in shared decision making about their treatment and care, to ensure that what matters to them is at the heart of the delivery of care throughout the whole pathway.

A process for shared decision making should be incorporated into all aspects of the progressive stroke pathway. Specific shared decision making tools, including those which support sharing of individualised information about patients' diagnosis, prognosis and treatments and goal setting.

It will also be important to ensure involvement of specific healthcare staff such as speech and language therapy for patients with communication difficulties, and clinical psychology for those with cognitive problems, where required to enable communication and shared decision making.

1.1.2 Information technology (IT)

The delivery of a progressive stroke pathway should be facilitated by IT systems which facilitate networking, teleconsultations, the use of artificial intelligence (AI) in decision making, more reliable delivery of care with real-time monitoring and the ability to support the movement of patients across different NHS Boards.

Therefore, stroke services should have access to IT systems which

- Support shared electronic health record keeping to reduce duplication and allow sharing across a network of care along the whole patient pathway. This should, if appropriately designed, help increase the proportion of healthcare professionals' time spent with patients
- Plan, prompt and record important aspects of care digitally to optimise delivery whilst making best use of clinicians' time.
- Support secure communication (voice, video, text, shared documents and images) between clinicians working across networks to ensure patients' access to timely treatment. This is important for ensuring timely access to hyperacute treatments, but also to enable decision support from a specialist in remote and rural settings.
- Alert a responsible clinician or team to referrals or abnormal investigations to maximise safety and minimise delays.
- Capture data in real-time for audit/quality improvement and monitoring as a by-product of clinical care.

- Support healthcare professionals in using "Tailored Talks'. This is a tool which facilitates the provision of tailored digital information and/or signposting for patients, their relatives and carers.
- Establish electronic documentation for remote consultation outcomes (e.g. Clinical Portal) when cases are referred and discussed. An audit trail of referrals, decisions and outcomes will help inform practice development and processes.

1.1.3 Research

Clinical research has a key function in delivering progressive stroke services. It not only helps produce the knowledge on which to base more effective stroke services going forward but also helps to ensure that healthcare staff are aware of the most up-to-date evidence and the latest developments in diagnostics and treatment. To facilitate continued clinical research activity we should:

- Maintain the research infrastructures (e.g. University departments, NHS Research & Development, the Scottish Stroke Research Network (SRN) and Cochrane Stroke Review Group which have helped make Scotland one of the leading countries for stroke research worldwide.
- Stroke patients should have the opportunity to participate in research in all parts of their pathway wherever they are being cared for.

2. Governance

The delivery of a progressive stroke pathway in Scotland will be overseen by the National Advisory Committee on Stroke, and monitored through the Scottish Stroke Care Audit and Scottish Stroke Improvement Programme.

While Scottish Government sets the overall policy direction and vision, NHS Boards have a statutory responsibility for the delivery of health care within their area. It is therefore important that NHS Boards seek to deliver the vision outlined within this document, giving an equivalent level of prioritisation to stroke services as outlined by Scottish Government.

To achieve this requires that

- NHS Boards should have a clear management structure for stroke services relating to the whole patient pathway covering inpatients, outpatients and community services.
- Managed Clinical Networks (MCNs) should serve to coordinate professionals, services and organisations to ensure equitable, high quality clinical services.
- MCNs should operate with clear clinical and operational leadership to connect services via clear service pathways.
- Stroke services should coordinate across clinical, professional and service pathways, and be tailored to individual needs based on a range of personal, environmental and social factors.

- Stroke services should capture data which reflects its performance in realtime, which supports quality improvement activities and monitoring by the organisation.
- The NHS Board senior management team should take responsibility for ensuring that stroke services meet all important quality indicators within the Scottish Stroke Care Audit.
- NHS Boards should work collaboratively with other NHS Boards in the delivery of services, where necessary. This is essential in the delivery of thrombectomy which requires a national approach and for thrombolysis, vascular surgery and sometimes TIA and rehabilitation services which often require a regional approach.
- NHS Boards should work as part of integrated joint boards, alongside social care delivery partners and the third sector to deliver effective rehabilitation and supported self-management.

3. **Primary Prevention**

This refers to the interventions aimed at reducing the risk of a stroke in people who have not yet had a stroke. This is distinct from secondary prevention which aims to reduce the risk of a recurrent stroke. A progressive stroke pathway begins with making the most of opportunities for the primary prevention.

The focus of a progressive stroke pathway should be to focus on primary preventative efforts on the identification and treatment of atrial fibrillation (AF) and raised blood pressure which are of specific importance to reduce the incidence of stroke. Secondary prevention such as detection of AF or high blood pressure after stroke is also important and more fully addressed within <u>Section 7.3: Access to imaging and other investigations.</u>

Actions on other risk factors for cardiovascular disease (including stroke) and other conditions (including cancer and dementia) such as obesity, smoking and alcohol consumption are covered in other Scottish Government policy commitments and action plans and therefore have been agreed as out of scope of this document.

Improving the primary identification and management of AF and blood pressure will involve a focus on improving data collection in primary care in order to better measure improvement, supporting community models of detection and improving access to technology to support self-management.

3.1 Recommendations

- 1. Local quality improvement within primary care and community settings should encourage improved detection, diagnosis and management of AF and high blood pressure.
- 2. Support the development of pathways of care for AF which ensure prompt assessment and where appropriate treatments including anticoagulation,

radiofrequency ablation and left atrial appendage occlusion to reduce the risk of future stroke.

3. Support the use of proven technology to support detection, tele-monitoring and the provision of tailored support for people with risk factors for stroke such as high blood pressure or AF.

4. Recognition and Referral

Raising and maintaining awareness of the symptoms of stroke and transient ischaemic attack (TIA) in the population, its recognition and the need to immediately seek help are key to optimising treatment and outcomes.

4.1 Improving individual awareness and recognition of stroke

The FAST campaign is a UK wide awareness campaign designed to help detect and enhance responsiveness to the needs of a person having a stroke. The acronym stands for

- Facial drooping,
- Arm weakness,
- Speech difficulties and
- Time to call emergency services.

Awareness campaigns should be shaped by evidence about what methods (e.g. TV/radio advertising, social media) most effectively reach target populations. It is especially important to consider how best to reach people who may face inequalities in access to information, or awareness of stroke. This includes

- People for whom English is not a first language
- People living in areas of deprivation
- Younger people who may not be aware of their risk of stroke

4.2 Improving referral pathways

Early assessment and triage for people with stroke or TIA is important because the time windows for delivering the most effective interventions (such as thrombolysis, thrombectomy & commencement of secondary prevention) are measured in hours. The earlier treatment is started the more effective it is.

Most services in Scotland have a system in place to allow urgent patient referral for rapid specialist assessment although practices vary, which can result in avoidable delays.

The National Stroke Voices highlighted the importance of raising awareness about recognition of stroke and TIA within primary care. Targeted education on FAST and clear referral guidelines could support primary care to recognise symptoms and

signs of stroke, including in circumstances where presentation may not be typical (for example where the FAST test might be negative).

4.2.1 Referral to TIA services

In instances where the symptoms of stroke have resolved rapidly and an acute stroke is not suspected, then a patient should be referred into TIA services. Key aspects of these services are outlined in more detail in <u>Section 5: TIA Services</u>. The most common sources of referral to TIA services will be from primary care, emergency departments, ophthalmology/optometry services, medical wards and Scottish Ambulance Service. Clear pathways should therefore be in place for all referrers.

In some locations TIA telephone hotlines are in place which allow paramedics, primary care and emergency department professionals to talk directly to a stroke physician at the time of the patient first accessing healthcare. These mean that patients can receive very early specialist intervention and treatment whilst waiting to have the diagnosis and treatment refined.

All patients referred to TIA services should be told that they must not drive for one month - as per Driver and Vehicle Licensing Agency (DVLA) recommendations - and should be advised regarding current regulations around resuming driving. This should be supported by a robust and rapid electronic referral system e.g. SCI gateway, TRAK workbench which should prompt driving advice and secondary prevention prescription. These referrals should be monitored, or have notification systems, to ensure prompt appointing to specialist review.

4.2.2 Suspected acute stroke – taking prompt action

In instances where symptoms of stroke persist and an acute stroke is suspected, the patient should be transferred by ambulance to the nearest 'stroke ready' hospital – that is a hospital with facilities to scan and offer hyperacute treatment with thrombolysis, and provide assessment of eligibility for thrombectomy.

There are 25 such hospitals across Scotland, 22 of these are Primary Stroke Centres (PSCs). The remaining three are Comprehensive Stroke Centres (CSCs), which in addition to the facilities described above, can also deliver thrombectomy and neurosurgical interventions.

All stroke centres will have stroke units unless they serve a very small population (such as occurs in remote and rural areas where the essential features of a stroke unit are delivered within a single ward area). This is <u>described in more detail in</u> <u>Section 9.2</u>.

In a progressive stroke pathway, it will be important to ensure ambulance response times are as short as possible, through appropriate assessment and prioritisation of emergency calls².

NHS 24 or 999 call handlers use algorithms to assess the urgency of calls and the likelihood that the person has had a stroke. Improved algorithms based on analyses of linked data about triage and resulting actual diagnoses could help reduce delays to effective treatments. Such an approach would be maximised by targeted training for call handlers in awareness and identification of stroke.

Ambulance crews also require continued training in the most up-to date tools to improve diagnosis of TIAs, strokes and assessment of the patients' need for hyperacute treatments and early secondary prevention.

Once the ambulance crew has made an assessment it is necessary to consider robust and transparent algorithms for the prioritisation of SAS resources, including air transfers, which take account of availability, of the benefits and risks to the patient, the time urgency of the interventions and the cost effectiveness to ensure that the optimum improvement in outcomes from the available resources can be achieved. These also should be informed and developed through analysis of linked data from SAS and the Scottish Stroke Care Audit of hospital stroke services.

4.3 Recommendations

- 1. A progressive stroke pathway should include a focus on the delivery of an effective campaign to raise awareness of stroke and TIA, their impact on people who experience them, and tools for timely recognition.
- Support the use of FAST and work to embed other pre-hospital stroke tools particularly those which enable the identification of Large Vessel Occlusion (LVO) - in a standardised way across NHS 24, primary care and SAS.
- 3. Improved algorithms and training for NHS 24 or SAS call handlers and crews should be deployed to support the assessment of the urgency of calls and the likelihood that the patient has had a stroke, and enable effective prioritisation of SAS resources, including air transfers.
- 4. Ensure appropriate referral of people with all stroke events, including those with acute ongoing symptoms, acute but resolved symptoms and other stroke like events.
- 5. All patients referred to TIA services should be told not to drive for one month (as per DVLA recommendations) at the point of referral, and advised on current regulations for resuming driving.
- 6. Referral systems should prompt driving advice and secondary prevention prescription.

5. TIA Services

Many people who develop mild or transient symptoms which might represent a TIA or mild stroke do not require immediate admission to hospital but do need specialist assessment by a clinician experienced in stroke care, early access to investigations and same day initiation of treatment to reduce the risk of a disabling stroke.

TIA services, aim to offer these functions flexibly, and also seek to provide access to longer term support to reduce long-term risks and optimise the person's physical, psychological and social outcomes.

These services may be configured in many different ways, including, but not limited to, specialist TIA outpatients' clinics. A proportion of patients are seen in an Emergency Department. This model of care, with either real-time access to stroke specialists and relevant investigations or backup from a TIA clinic can provide excellent care which minimises the risk of further stroke.

The performance of TIA clinics is currently monitored by the Scottish Stroke Care Audit which measures the proportion of patients seen in the TIA clinics who are seen within 4 days of referral. Whilst the majority of services meet the standard of 80% this is not the case everywhere, so there remain opportunities for improvement.

Patients with suspected TIAs can be managed very effectively via alternative services such as within an Emergency Department, ambulatory care units, in stroke units, or through rapid inpatient ward reviews which are available on a daily or even 24/7 basis, as long as they are supported by stroke specialists and have early access to investigations. At present, the Scottish Stroke Care Audit does not fully capture or monitor routinely this activity which takes place outside of TIA clinics as it has proven challenging to capture data in these more varied settings. To ensure that we can understand and compare all models of care for people with TIA, it is important to address this.

As the risk of recurrent stroke is higher in the first day or two following a TIA, the faster a person can be seen the better. Therefore, the Scottish Stroke Improvement Programme will work with services across Scotland to minimise delays.

At present, the Scottish Stroke Care Audit measures the referral time to TIA services, but there is an opportunity to look in more detail at the care for people who have experienced a TIA. Therefore, development of a TIA bundle including times to important investigations and treatments should be included within the audit.

5.1 Specialist assessment

Specialist assessment for people with suspected TIA is important. This helps to expedite additional imaging where this is necessary and ensure that a diagnosis and treatment plan is refined and tailored to the individual's needs.

Where in-person specialist assessment cannot always be rapidly available, TIA services should consider how targeted access to local or remote stroke specialists (for patients meeting agreed criteria) can minimise delay to time-sensitive interventions.

Due to the Covid-19 pandemic many NHS boards had started to incorporate virtual assessments using telephone and Near Me into their assessments. This more flexible approach has led to reduced waiting times for specialist input in some areas. It is however, important to ensure that in instances where virtual assessments are performed, patients should have the same access to rapid investigations and immediate secondary prevention as those who are seen face-to-face.

5.2 Investigations

People with suspected TIA or minor ischaemic stroke; require timely access to investigations to confirm a diagnosis and guide treatment.

High risk TIAs and patients with uncertain presentations may be assessed as inpatients, and so rapid access to necessary radiology and cardiac investigations should be available in both outpatient and inpatient settings. There should be a robust system in place to ensure that the results of radiology and cardiac investigation results are available rapidly and are flagged to the responsible clinicians.

Full details of access to investigations for people with suspected TIA or stroke is outlined in <u>Section 7.3</u>: Access to imaging and other investigations.

5.3 Treatment and care

Where necessary, people seen in TIA services should be able to rapidly access appropriate support from a Multi-Disciplinary Team including speech and language therapy, occupational therapy, clinical psychology, orthotics, ophthalmology and orthoptics.

About half of the patients seen in TIA clinics turn out not to have had a TIA or stroke. Alternative pathways should be available for these people if they require input from another specialist service. There should be a system for rapid feedback to referrers when a person would not benefit from attendance at a TIA service, and clear communication of an alternative pathway or approach.

For people who are identified as having had a TIA, treatment involves access to secondary prevention medication and advice. All NHS Boards should therefore have accessible pathways and secondary prevention guidelines for TIA patient management, which should be kept up-to-date and responsive to change in the evidence base. These should ensure that;

- For TIA (with full recovery) antiplatelet agents and a statin should be commenced immediately (as per local guidance, including any necessary investigations) pending specialist review, unless specialist review is immediate.
- Guidelines should recommend which secondary prevention medication to prescribe but should also have a plan for situations where medication should not be stopped (e.g. for some cases anticoagulants after TIA).
- Secondary preventative medications should be immediately available e.g. from ward stock, hospital pharmacy or written prescription to take straight to a 24/7 chemist.

People who have experienced a TIA or minor stroke may also require advice or onward referral to support them in their longer term self-management. The following services should be available from the TIA service:

- Referral to addiction support teams
- Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
- Referral to exercise service
- Referral to Dietetics
- Vocational advice and support

Communication between health professionals following TIA assessment is important. There should be a rapid electronic communication system back to the referrer following assessment in a TIA service. If using a traditional dictated letter system, then the letter should go rapidly electronically and within 48 hours of the specialist assessment.

It is important that referrers are made aware of individual treatment targets e.g. for blood pressure and lipids.

- Remote blood pressure monitoring should be available in certain circumstances e.g. FLORENCE programme or 24 hour ambulatory monitoring
- Selected patients may benefit from more aggressive lipid management aiming for lower LDL targets. Where appropriate pathways should be in place for this e.g. a pharmacist led stroke lipid clinic, primary care follow up system.
- Furthermore any request to referrer to make urgent prescribing changes or other key changes to management should be transmitted immediately.

Following discharge from TIA services, patients who have experienced TIA or minor stroke should be followed up lifelong in primary care long-term conditions monitoring. This will require ongoing education targeted at primary care professionals to support them with;

- current best practice for longer-term care of TIA or stroke survivors,
- managing stroke in people with other, co-existing conditions
- Current guidance and pathways for referring a person back to stroke services.

Follow up appointments for people who have experienced TIA should be available when needed, potentially through the TIA clinic or a stroke liaison nurse team.

5.4 Recommendations

- 1. People with suspected TIA should have specialist assessment by a clinician experienced in stroke care, early access to investigations and same day initiation of treatment to reduce the risk of further stroke.
- 2. Where in-person specialist review cannot always be rapidly available, TIA services should consider how to enable targeted access to local or remote stroke specialists (for patients meeting agreed criteria).
- 3. People with suspected TIA or minor stroke should have early access to investigations.
- 4. There should be appropriate pathways in place for onward referral of people who have had neither stroke nor TIA but require input from another specialist service.
- 5. All NHS Boards should have accessible pathways and secondary prevention guidelines for suspected TIA patient management.
- 6. TIA services should support the following, where required;
 - Referral to addiction support teams
 - Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
 - Referral to exercise service
 - Referral to Dietetics
 - Referral to psychology support
 - Vocational advice and support

6. Transfer to Hospital

The majority of patients with symptoms of acute stroke will be transferred to hospital by the Scottish Ambulance Service (SAS). In general, SAS transport patients with suspected hyperacute stroke to the nearest hospital which can provide thrombolysis (Primary Stroke Centre).

Transfer to hospital is a vital part of a progressive stroke pathway. There are important opportunities to;

• Improve pre-hospital diagnostic accuracy including assessment of eligibility for hyperacute treatments, and in the future enabling possible by-pass of their local Primary Stroke Centre (sometimes referred to as a spoke hospital in the thrombectomy pathway) to a Comprehensive Stroke Centre (sometimes referred to as a thrombectomy hub).

• Provide receiving clinicians with information to enable quick decision making upon arrival at hospital.

6.1 Improving pre-hospital assessment

Paramedics across Scotland use the FAST test to identify possible strokes. It is important to continue training and to support ambulance crews in the use of prehospital clinical assessment tools and to explore the use of more detailed tools or technologies which might improve diagnostic accuracy and triage for stroke, TIA and the identification of people potentially suitable for thrombolysis and thrombectomy.

Improving pre-hospital assessment of people who would benefit from hyperacute treatment will reduce time to treatment by ensuring that they can be transferred immediately to the nearest Primary Stroke Centre, and are quickly placed on the pathway for the most appropriate treatment.

Further to the use of pre-hospital clinical assessment tools, it is also important that ambulance crews have the capacity to seek advice from stroke specialists to support with triage and diagnosis while the patient is en-route.

Delivery of advice from stroke specialists can be provided via telestroke services. For example, there have been small pilot projects indicating that providing ambulance crews with access to a specialist via a Professional to Professional audio and/or video call can enhance the pre hospital diagnostic accuracy and decision making with respect to TIA and stroke.

However, these systems are not widely in place yet. Ambulances crews currently rely on the Airwaves systems which does not facilitate data transfer or links with specialists who maybe offsite.

6.2 Pre Alert

Ensuring that appropriate information is available to the receiving clinicians based in the hospital enables more rapid decision making and quicker access to imaging and treatment for patients upon arrival at hospital.

Pre-alert refers to the sharing of information about a patient with the hospital during transfer by an ambulance crew. Through our review process, hospital clinicians highlighted the vital importance of the pre-alert including patient identifiers such as the CHI number, name and date of birth. This is vital for facilitating rapid decision making on arrival, which has a resulting impact on time to treatment.

Despite this, the reviews identified that this information is included in only a minority of locations. Furthermore, there is variation in appropriate pre-alerting of patients with stroke. For example, a number of patients without stroke may be pre-alerted, while some with hyperacute stroke are not.

At present, there is a lack of timely data available from NHS boards and sites, concerning the number of patients with suspected hyperacute stroke that are prealerted by SAS. This in turn means that there is no robust measure to ensure the correct patients are being taken to the most suitable hospital, and then placed on the most appropriate pathway. It is therefore important to have access to better information about pre-alerting across Scotland, to address variation and to improve pre-alerting in general.

6.3 Recommendations

- 1. To improve pre-hospital assessment ambulance crews should be trained and supported in the use of pre-hospital clinical assessment tools.
- 2. The use of more detailed tools or technologies, which might improve diagnostic accuracy and triage for stroke, TIA and the identification of people potentially suitable for thrombolysis and thrombectomy, should be explored.
- 3. Telestroke systems should be available for use in ambulances and air transport to enable professional to professional calls to support paramedics in decision making with regard to hyperacute stroke.
- 4. A single communication platform should facilitate voice, data and video communication between paramedics, ambulance control, stroke physicians in PSCs and CSCs, stroke nurses and interventional radiologists.
- 5. Communication of patient identifiers during pre-alert should be enabled to support timely decision making and improve time to treatment upon arrival at hospital.
- 6. A mechanism should be developed to provide routine feedback of confirmed diagnosis and treatment pathway to SAS in order to support staff development and improve performance and patient pathways.

7. Assessment and diagnostics

Early assessment and diagnosis is vital to ensuring that people can receive prompt and appropriate treatment, thus improving their chances of positive outcomes.

7.1 Interface between stroke services and emergency departments

Seamless joint working between stroke services and emergency departments is paramount for optimal patient care and outcomes in the acute stage of the stroke pathway.

To minimise delays to assessment and treatment for people with stroke, emergency department services should include:

- Systems supporting pre-registered imaging requests from the stroke team clinicians.
- Staff competent in acute stroke management and familiar with thrombolysis and thrombectomy eligibility criteria and pre-transfer procedures, checklists and processes.
- Video links for optimal virtual communication between the and stroke teams, where required.
- Senior stroke decision maker and senior leadership involvement at the front door to minimise door to needle times for thrombolysis e.g. straight to CT protocols.
- Systems and resources agreed with SAS to minimise door in, door Out times for patients eligible for thrombectomy
- Goal of minimising inappropriate or futile transfers to the CSC for thrombectomy.
- "Straight to MRI protocols" for some strokes where this is the most appropriate imaging modality.
- Agreed stroke mimic pathways where non stroke patients are cared for out with the stroke service when possible enabling efficient use of stroke beds and workforce.

Performance and protocols should be robustly audited and cases reviewed.

7.2 Assessment of eligibility for hyperacute treatment

People with suspected acute stroke should be assessed immediately to determine the best approach to treatment. This is particularly important for identifying people who would benefit from specific hyperacute stroke treatments such as thrombolysis and/or thrombectomy.

Assessment for emergency hyperacute stroke treatments should be undertaken by a stroke specialist clinician (physician/nurse) without delay. In locations where that specialist clinician is not available on site then telestroke services should provide access to specialist assessment and decision making.

Telestroke involves the use of mobile technologies to provide audio and/or video calls between patients and local and remote healthcare professionals. It has a major role in improving access to hyperacute specialist care, decision making and the safe delivery of hyperacute treatments.

Electronic documentation for remote consultation outcomes (e.g. Clinical Portal) should be established. An audit trail of referrals, decisions and outcomes will help inform practice development and processes.

Telestroke can be used to support filtering and triage of referrals from remote sites into designated stroke units, and reduce delays in time critical decisions including

those on the delivery of appropriate treatments and identification of patients not suitable for specific interventions or transfer to another site.

Eligibility for thrombolysis should be guided by available clinical support tools. Further information on thrombolysis is included in <u>Section 8.1: Intravenous</u> <u>Thrombolysis</u>.

Eligibility for thrombectomy should be guided by available clinical support tools. Patients who are identified as eligible for thrombectomy should be transferred to the relevant CSC for further assessment to confirm eligibility and to receive this intervention. They should then be admitted to a stroke unit to receive appropriate post intervention monitoring and care. Further detail on the core components of the delivery of thrombectomy are outlined in <u>Section 8.2: Thrombectomy</u>

The majority of patients with acute stroke will not be eligible for thrombolysis or thrombectomy. The key focus for these patients is ensuring access to the stroke bundle, including care within a designated stroke unit. Full information on this is included in <u>Section 9: Acute Stroke Care</u>.

7.3 Access to brain and vascular imaging and cardiac investigations

The role of diagnostic imaging and other investigations in stroke management is integral to achieving the best outcomes for patients by supporting time critical decision making.

7.3.1 Brain imaging

For people with acute stroke Computed Tomography (CT) of the brain is a useful tool in detecting recent bleeding in and around the brain and can sometimes detect ischaemic changes. CT Angiography (CTA) and CT Perfusion (CTP) are important in identifying large vessel occlusion, collateral circulation and salvageable tissue for reperfusion interventions. Magnetic Resonance Imaging (MRI) is particularly useful in detecting early or minor ischaemic changes, previous bleeding and can also be used to assess the blood vessels and salvageable brain tissue³.

Decision support systems based on AI can provide clinicians and radiologists with very early access to the results of imaging, on laptops or even mobile phones. These platforms support them in the immediate interpretation of the images to confirm the diagnosis and identify a large vessel occlusion and thus speed up the appropriate decision making to refer a patient for hyperacute treatment or not^{4 5}.

However, it is important to recognise that AI is not a standalone decision making technology and therefore, the process of using AI for decision support should be closely supported by radiology professionals. Formal reporting of images within 24 hours is important as a governance and learning tool.

The additional logistical link in delivering thrombectomy (patients are transferred to a CSC for this treatment) requires a clear plan between the PSC (spoke) and CSC (hub) regarding investigations to avoid duplication and minimise time to treatment. It

also requires effective acquisition, transfer and interpretation of images between the PSC and CSCs.

There is also a need to ensure adequate imaging resources in PSCs and CSCs to cope with increasing numbers of patients needing assessments to determine eligibility for thrombolysis or thrombectomy. Improved access to advanced imaging will maximise the number of patients who present on waking, or present late, to receive thrombolysis and/or thrombectomy⁶.

7.3.2 Vascular imaging

Imaging of the arteries and veins supplying the brain is not only important to determine suitability for thrombectomy but also guides the use of medication, interventional neuro radiology and surgery and to reduce risks of stroke recurrence.

All PSCs and CSCs should have a pathway for carotid vascular imaging (using Carotid Doppler and/or CTA or MRA), enabling early identification of vascular pathology and rapid access to the vascular Multi-Disciplinary Team (MDT) to inform secondary prevention strategies where indicated.

- Carotid Ultrasound +/- CTA or MRA should be used for carotid imaging when required.
- Where carotid stenosis is detected there should be rapid access to a vascular MDT. Carotid intervention should be performed within the standard time as recommended and monitored by the Scottish Stroke Care Audit. A carotid coordinator role may help this process.

7.3.3 Cardiac investigations

Post-stroke cardiac investigations are important for identifying an underlying cardiac cause of stroke, such as AF or Patent Foramen Ovale (PFO). When judged to be required by the stroke specialist there should be early access to prolonged cardiac monitoring to detect paroxysmal (intermittent) AF. Prolonged cardiac monitoring should be carried out and reported within two weeks.

Cardiac rhythm monitoring systems should, where technically possible, have realtime reporting of paroxysmal AF with immediate notification of the service to allow verification of the diagnosis and, if appropriate, immediate anticoagulation. Where patients need anticoagulation, there should be a pathway in place for early anticoagulation with counselling and monitoring systems.

For patient work up for PFO, there should be 'soon' access to contrast transthoracic echocardiography or transcranial doppler and transcessophageal echocardiography with a pathway in place ensuring that PFO closure is carried out within six months of the index stroke.

Monitoring of Boards' ability to perform cardiac investigations for people with stroke within these time frames will be via the Stroke Action Plan and Scottish Stroke Improvement Programme team.

7.4 Recommendations

- 1. People with suspected acute stroke should be assessed for hyperacute stroke treatments by a specialist clinician (physician/nurse) without delay.
- 2. Where telemedicine is used for the rapid assessment of people with suspected stroke, the system should include the option of a high-quality video link.
- 3. Staff providing care via telemedicine should be appropriately trained in hyperacute stroke assessment, the delivery of thrombolysis and the use of this approach and technology.
- 4. All stroke services should have access to CT, CTA, and CTP on a 24/7 basis whether the patient is an inpatient or outpatient.
- 5. Departments offering CT, CTA, CTP and MRI should have systems in place which ensure that patients with stroke or TIA are prioritised appropriately in order to enable rapid access to these time sensitive investigations.
- 6. When the stroke specialist feels that brain imaging is required in patients attending the TIA service, there should be same day access to this. MRI will usually be the preferred imaging modality in TIA/minor stroke patients who do require a brain scan so there should be increased availability to this in particular.
- 7. Where all of the above investigations are not delivered within one location, stroke services should have a clear plan for a) assessing the gain in outcome if a transfer takes place, and b) enabling a transfer for investigations where the outcome would be improved.
- 8. Where AI is used to support interpretation of imaging and enable timely decisions around transfer for thrombectomy, formal reporting of all radiology investigations should take place the following working day after the investigation is conducted.
- 9. Each stroke service should have a pathway in place enabling same day access to MRI in instances where this would be the most appropriate imaging modality.
- 10. There should be nationally agreed imaging protocols to be followed by PSCs and CSCs for non-contrast CT, CT Angiography (CTA) and CT perfusion (CTP) to avoid duplication.

- 11. All stroke centres should have a clear pathway ensuring that carotid imaging and intervention is performed within the standard time as recommended and monitored by the Scottish Stroke Care Audit. A carotid co-ordinator role is recommended to support delivery of this pathway.
- 12. People who have experienced stroke should have access to cardiac investigations including:
 - Prolonged cardiac monitoring to identify paroxysmal AF (within two weeks)
 - Access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal echocardiography with a pathway in place ensuring that PFO closure is carried out within six months of the index stroke.
- 13. IT systems should be in place which highlight that the results of tests are available to the referring clinician. This enables prompt action to be taken on the results of the investigation.

8. Hyperacute Stroke Treatment

For some people, treatment of stroke within the first few hours can include reperfusion treatments such as thrombolysis and thrombectomy. These are aimed at unblocking an artery causing an ischaemic stroke. Both have the potential to greatly reduce the brain damage caused, and thus improve functional outcomes and probably survival.

Early blood pressure lowering, in some cases of intracerebral haemorrhage (ICH) may be beneficial and continues to be researched.

The earlier these hyperacute treatments are given, the more chance the person will have of an improved outcome. Therefore, stroke services need to be configured to minimise any delays and maximise the proportion of patients suitable for these treatments.

Patients receiving these treatments require more intensive observation and monitoring to minimise risks and identify complications early when they can be most effectively treated. Therefore, post intervention, they should be cared for in a stroke unit enabling close non-invasive monitoring of physiological parameters to detect the early complications of treatment and of their stroke.

Assessment to determine eligibility for these treatments is outlined in <u>Section 7.2</u>: <u>Assessment of eligibility for hyperacute treatments</u>. This section will therefore focus on the logistics of delivering these treatments as quickly as possible once a patient has been identified as eligible.

8.1 Intravenous thrombolysis

Outcomes from ischaemic stroke treated with thrombolysis are time critical and can be improved by minimising the delay from stroke onset to thrombolysis treatment. There are a number of performance measures within the Scottish Stroke Care Audit relating to the delivery of thrombolysis, and performance measures for thrombectomy are in development.

Thrombolysis is carried out at 22 PSCs and 3 CSCs in Scotland. There is marked variation in the proportions of patients receiving thrombolysis and also variation in door to needle time between hospitals.

In most hospitals offering thrombolysis the door to needle times are much shorter during normal working hours than at other times. However, in services where a stroke nurse is involved in "pulling" the patient through the pathway, or where specialist stroke doctors are available in person out of hours, door to needle times tend to be shorter overall, and the difference between in and out of hours is minimised. This reinforces the importance of adequate stroke specific staffing, including the important role played by stroke nurses⁷.

8.2 Thrombectomy

The most severe 10-20% of acute ischaemic strokes are due to a large vessel occlusion (LVO). Restoring blood flow with early thrombectomy, which is sometimes referred to as clot retrieval, significantly reduces dependency^{8,9}. In some cases, thrombolysis is given prior to the thrombectomy procedure.

Approximately 800 cases per annum in Scotland, 10% of all stroke presentations, could be treated by a 24/7, Scotland wide, thrombectomy service¹⁰.

Geographical modelling recommends three CSCs (sometimes called Thrombectomy hubs) serving 22 PSCs (sometimes referred to as spoke hospitals) where patients are first taken to their nearest PSC to be diagnosed, scanned, receive thrombolysis if appropriate, and then be transferred to a CSC for thrombectomy. This is known as the 'drip and ship model'¹¹.

There is a planned incremental development of services across the three CSCs (Queen Elizabeth University Hospital, Glasgow, Royal Infirmary of Edinburgh and Ninewells Hospital, Dundee) aiming for 24/7 availability across Scotland by 2023.

It will be important, as the service develops, that monitoring of referrals to the service is followed closely and accounted for in future service planning. This is because the number of people eligible for thrombectomy may increase as a result of in imaging, technology and research.

8.2.1 Transfer from PSC to CSC for thrombectomy

The transfer of patients between hospitals is an aspect of the thrombectomy pathway which can introduce delays to this time critical treatment. Therefore, it is important that safe, efficient and timely transfers take place.

An important aspect of transfer is ensuring agreed and robust communication processes and modalities for discussing cases between PSC, CSCs and the interventional neuro radiologists (INRs) /interventional radiologists (IRs) who will be carrying out the procedure. It is therefore vital that adequate infrastructure is in place for effective and reliable communications between all relevant teams and health boards.

Utilisation of electronic devices (using 4G/5G), capable of real time information sharing between the thrombectomy nurse escort (based at the PSC hospital), the PSC and CSC stroke physicians and INR/IR which integrate with patients' electronic health records would improve workflows and patient safety. Back-up systems (such as airwave radio systems) should be in place for when primary modes of communication fail or become unreliable due to connectivity or unplanned downtime.

The use of a mobile communication platform is currently being explored by the Thrombectomy Advisory Group (TAG)¹.

8.2.2 Repatriation

People who receive thrombectomy initially require intensive monitoring and support after the intervention in a stroke unit in the CSC until they are deemed to require less intensive care and are suitable for transfer to a stroke unit in the PSC. This is known as repatriation. Repatriation enables patients to receive as much of their care near their own home as possible. Prompt repatriation is vital to maintain flow and for CSCs to continue to take incoming referrals from PSCs.

It is therefore important that there are shared protocols between CSCs, PSCs and the SAS for the delivery of agreed, safe and efficient repatriation. Decisions around repatriation after thrombectomy should be guided by the readiness for repatriation checklist, developed by TAG.

8.2.3 Interventional neuroradiology

Imaginative and flexible workforce solutions will be essential in a globally competitive employment market due to a shortage of specialist trained INRs. Incentivising rotas and job plans may be a partial solution if Scotland is to be an attractive workplace for specialist trained staff. Features of a sustainable interventional neuroradiology/radiology service for thrombectomy will include^{12,13,14}:

 A volume of work at CSCs that satisfies the agreed numbers for maintaining competency and training¹⁵. Training may involve remote mentoring and simulation technology based teaching.

¹ The Thrombectomy Advisory Group is a national group tasked with overseeing the delivery of a national thrombectomy service in Scotland.

- Credentialing, supported by interventional neuroradiologists (INRs), may be necessary to train sufficient operators to populate 24/7 rotas across Scotland and enable cover of non- stroke INR work e.g. aneurysm coiling.
- Workforce planning futureproofed for the anticipated increase in workload once a service has commenced and the inevitable effect of extending time windows for intervention as advancements in therapies emerge.
- Cognisance that 60% of potential cases will present out of hours, work patterns, job plans and rotas will need to reflect this in order to provide equity of access and avoid the "weekend effect".
- Adoption of cutting-edge technological innovation including advancements in AI and neurointerventional robotic solutions.
- Opportunities to participate in research and teaching.

8.3 Management of intracerebral haemorrhage (ICH)

Strokes due to intracerebral haemorrhage (ICH) represented 12% of stroke admissions in Scotland in 2019. Mortality rates and disability remain disproportionately high within this group worldwide¹⁶.

A progressive stroke service must aim to improve the outcomes for this group of patients. Hyperacute stroke services for ICH should include¹⁷ ¹⁸ ¹⁹ ²⁰

- Expert supportive care on a stroke unit. Aiming for consistent and optimal care and close observation for signs of deterioration²¹.
- Care that reflects emerging best evidence for reducing secondary brain injury.
- Consideration of the adoption of care bundles to help consistency and reduce variation by standardising processes of care. Incorporate evidence based interventions if and when available.
- Early communication with local or regional neurosurgical teams in cases of ICH at risk of developing hydrocephalus or other complications amenable to neurosurgical intervention²¹.
- Rapid anticoagulant reversal protocols responsive to emerging evidence as up to 20% of ICH cases occur in patients taking anticoagulant medication²².
- If required, the delivery of appropriate end of life care, consistent with the approach outlined in <u>Section 9.3: End of Life Care</u> and the avoidance of harm and unintended limitations of care by ensuring timely senior level decision making regarding advanced care planning.

8.4 Recommendations

1. All patients eligible for thrombolysis must receive the intervention with the minimum delay. Therefore, there must be a sustained drive to improve door to needle times across Scotland.

- 2. Telestroke networks should be developed to support hospitals achieving optimal thrombolysis treatment numbers and door to needle times.
- 3. There should be time efficient pathways and agreed processes for thrombectomy in place at all PSCs and CSCs to optimise patient outcomes and limit patient exclusions in those with ischaemic stroke due to LVO.
- 4. The provision of mobile communication platforms and adequate mobile technology will enable stroke physicians and INR/IRs to interpret hyperacute imaging when at home or outside the hospital.
- 5. There should be nationally agreed pathway documentation, in digital and paper format, to facilitate movement of patients between NHS Boards and regions and to reduce duplication of imaging and investigations.
- 6. For patients referred for thrombectomy the door in, door out time in PSCs should be minimised.
- 7. Patients eligible for thrombectomy should be transferred to the CSC via the quickest and safest transport means available as determined by SAS.
- 8. Staff carrying out thrombectomies unsupervised should have completed recognised training and should perform sufficient number of interventional procedures per annum to maintain their competencies.
- 9. The door to puncture time at thrombectomy hubs should be as short as is safely possible.
- 10. There should be agreed and sustainable rotas for anaesthetic staff, INRs/IRs, stroke physicians and theatre staff supporting the thrombectomy service.
- 11. There should be agreed, safe and efficient repatriation protocols in place between the CSCs and PSCs to ensure optimal patient flow.
- 12. There should be continuous review of the thrombectomy service model, processes of care and referral criteria as the evidence base grows. Regular multi-professional governance meetings should take place across Scotland with the intent of optimising learning for all involved in the process and embracing a culture of quality improvement.
- 13. Stroke services should have protocols for the monitoring, referral and urgent transfer of patients to regional neurosurgical centres.

14. A focus should be placed on improving outcomes for people with intracranial haemorrhage. This may be achieved by the adoption of care bundles to help consistency and reduce variation by standardising processes of care.

9. Acute stroke care

9.1 Provision of 'the bundle' of care.

The majority of people who experience a stroke will not be eligible to receive hyperacute treatments such as thrombolysis or thrombectomy. The emphasis of care for the majority of stroke patients, is therefore to deliver the stroke bundle.

There are four components to the bundle. These are;

- Swallow screen (100% within 4 hours of arrival, and before any food, fluids or oral medication is administered)²³, we believe this reduces the risk of pneumonia, dehydration, malnutrition and death.
- Brain imaging (90% within 12 hours accepting that hyperacute patients require a scan as soon as possible after arrival), since confirmation of the stroke diagnosis and distinguishing strokes due to ischaemic and bleeding has wide reaching effects on management from the earliest stages.
- aspirin for those with ischaemic stroke (95% on day or admission or following day) – which is a very simple and almost universally applicable treatment which improves patients outcomes and
- Admission to stroke unit (90% on day of admission or following day) which reliably provides a wide range of targeted interventions. – which reduces the risks of complications, improves the patients' experience and is known to improve functional outcomes and reduce mortality.

In general, brain imaging and aspirin standards are met across Scotland. However, there remains significant challenges in swallow screen and access to stroke units, and as a consequence the overall adherence to the stroke bundle performance remains low.

Where patients are at risk of post stroke complications (e.g. infection, venous thromboembolism, dehydration, malnutrition, pressure sores), and depending on the established aims of treatment, patients should receive evidence based interventions such as parenteral fluids, early tube feeding, intermittent pneumatic compression and antibiotics.

At present, delivery of these important aspects of stroke care (e.g. feeding, fluids, positioning, use of intermittent pneumatic compression, rehabilitation assessments and treatments) is assessed through sprint audits within the Scottish Stroke Care Audit or local audits. These have demonstrated variable delivery. Such audits had to rely on review of paper or electronic health records which are burdensome, time

consuming and therefore failures in delivery are inevitably only identified in retrospect.

TRAKcare, the electronic health record used across Scotland does not support the sort of data capture, extraction and analysis to provide real-time data on delivery of important aspects of stroke unit care. An improved approach is required where failures of delivery are identified in real time, when they can be rectified to avoid patient harm. However, IT systems which are available to do this for certain aspects of care (delivery of the National Early Warning System (NEWS) of observations to avoid in hospital deterioration and cardiac arrest) are not currently used to provide improvements in delivering specialty specific aspects of care, such as those in a stroke unit.

9.2 Access to stroke unit care

Stroke unit care is the central feature of a modern stroke service²⁴. As it can benefit most stroke patients, even those who do also undergo hyperacute treatments, it is important that the important role of stroke unit care within hospitals is recognized and supported²⁵.

Through engagement with the National Stroke Voices, we heard that receiving care in a Stroke Unit was important to people.

"My treatment was much better and much more focused when I was placed in the Stroke Unit" – National Stroke Voices participant.

Every stroke patient should receive the core service characteristics of stroke unit care²⁶ from initial assessment to discharge from hospital²⁷. Key features of a stroke unit in a progressive stroke pathway should include:

- a geographically-defined unit;
- a co-ordinated multi-disciplinary team that meets at least once a week for the exchange of information about in-patients with stroke;
- information, advice and support for people with stroke and their family/carers;
- management protocols for common problems, based upon the best available evidence;
- close links and protocols for the transfer of care with other in-patient stroke services, early supported discharge teams and community services;
- Training for healthcare professionals in the specialty of stroke.
- the provision of holistic assessment of need for every patient which incorporates the views of patients and their families, which informs decisions about care
- all interactions and interventions are carried out under a person-centred approach

Although the core features are well described, services have sought to deliver stroke unit care in a variety of different ways²⁸. The size and configuration of stroke units depends on factors such as rurality and the other services and resources available within the local area.

Of the 22 PSCs, the seven smallest general hospitals in Scotland define stroke unit admission as entering the appropriate acute medical ward. While this means that the hospitals do not meet the first criteria of a geographically defined unit, they should meet all other criteria outlined above. In some instances, this may mean that remote stroke specialist support is required to provide early specialist assessments and a coordinated, regular multi-disciplinary team (MDT) meeting. This is an appropriate response to maintaining local services, and reduced time to thrombolysis, for people with stroke in these areas.

The Scottish Stroke Care Audit 'bundle' reflects access to stroke unit care and shows that this is currently variable between health boards and sites. From our organisational audits we know that there are marked variations in the size of stroke units, their staffing levels (medical, nursing, allied health professionals, clinical and neuropsychologists and social work staff) and the training of those staff.

While every stroke patient should have access to stroke unit care as defined above, in some instances, patients may require more intensive care. This is the case for those who undergo thrombectomy. In such instances, those people should receive care within a stroke unit which can also provide:

- Specialist staffing and technology that provide close clinical and continuous physiological monitoring for all and especially those at higher risk of early deterioration or complications
- Seamless working with intensive care units and high dependency units where required.
- Continuous access to a consultant with expertise in stroke medicine, with consultant review seven days per week.
- Immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the hyperacute management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

These features are often available within a hyperacute stroke unit (HASU) where patients often stay for just the first couple of days, or a hyperacute bay within a stroke unit.

All stroke services should have protocols for the monitoring, referral and urgent transfer of patients where there is a risk of patients requiring neurosurgical intervention to regional neurosurgical centres.

Systems of joint working should be developed to establish broadly agreed referral criteria for carefully selected cases, e.g. those patients who might benefit from decompressive hemicraniectomy for malignant middle cerebral artery (MCA) syndrome.

As outlined in the introduction of this paper, supporting shared decision making helps to ensure treatments are delivered which are most likely to deliver the outcome valued by the patient and/or family. This remains important in the acute and hyperacute phases and is likely to be optimised by early involvement of senior clinicians with access to systems to share tailored information with patients and their family.

9.3 End of Life Care

About one in 20 people with acute stroke will be receiving end-of-life care within 72 hours of onset, and one in seven people with acute stroke will die in hospital²⁹.

Therefore, providing high quality end-of-life care should be a core activity for the multi-disciplinary stroke team. The key aim is to appropriately and holistically manage distress associated with the end of life experience for the person and the family/carers, in line with guideline advice³⁰.

Patients with severe stroke resulting in a high risk of death or poor functional outcome, should be involved at an early stage in shared decision making about the aims of treatments including cardiopulmonary resuscitation, critical care, hemicraniectomy, and treatments to reduce the risk of serious complications. Where the patient lacks capacity then next of kin or advocate should be involved.

Advanced care planning should take place for those people who may survive the acute stroke with limited life expectancy, to facilitate timely referral to specialist palliative care services, where required³¹.

9.4 Recommendations

- 1. Patients with acute stroke should have their clinical status monitored closely and managed according to clinical guidelines.
- 2. Stroke services should deliver the stroke bundle, meeting the Scottish Stroke Care Audit Standards for
 - swallow screen
 - brain imaging
 - provision of aspirin for those with ischaemic stroke
 - admission to stroke unit
- 3. Healthcare professionals responsible for the assessment and management of patients with acute stroke should be trained in how to position and mobilise patients in a way that is safe and consistent with clinical guidelines.
- 4. Acute stroke patients should be managed in a stroke unit that meets the core requirements outlined in Section 9.2.
- 5. A stroke unit should have continuous access to a consultant with expertise in stroke medicine, with consultant review 5 days per week,

- Staff working in stroke units should have completed the necessary training as outlined in the national educational template and should follow standardised management protocols for the assessment & management of acute stroke according to clinical guidelines.
- 7. Staff working in stroke units should have access to IT systems which optimise the reliability of assessments and treatment delivery
- 8. People with rehabilitation needs should be assessed by a therapist and ongoing management planned according to clinical guidelines and in line with the progressive vision of rehabilitation outlined in Section 10.
- 9. Services providing acute and ongoing care for people with stroke should provide high quality end-of-life care for those who need it, including advanced care planning and timely access to specialist palliative care if required.
- 10. All stroke services should have protocols for the monitoring, referral and urgent transfer of patients where there is a risk of patients requiring neurosurgical intervention to regional neurosurgical centres.
- 11. In addition, for patients who require closer monitoring
 - A so called hyperacute stroke unit or area which is providing close monitoring of patients post thrombectomy should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week.
 - These units should in addition have immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

10. Rehabilitation and long term support

10.1 Stroke Rehabilitation

People who have had a stroke should have access to high quality, evidence based, person-centred stroke rehabilitation which reflects their needs and preferences.

Stroke rehabilitation aims to optimise function, reduce disability and promote independence and will work alongside people and their families to achieve meaningful outcomes³². It helps people to be as independent as possible in everyday activities and enables participation in education, work, recreation and meaningful life roles. The United Nations has set out the right of people with

disabilities to have access to rehabilitation to achieve participation and inclusion in all aspects of life ³³.

The World Health Organisation Rehabilitation in Health Framework highlights a tiered approach to rehabilitation which should be community based and focussed on the needs of the population.



Figure 1: Rehabilitation in Health Framework³⁴

A multi-disciplinary approach to working is essential to deliver this with the individual and their family or carers at the centre and the opportunity to see the right professional at the right time to support their needs.

Stroke rehabilitation should be based on a holistic biopsychosocial approach which seeks to understand the interactions of a diverse range of factors in a person's presentation (i.e. biological, psychological and social factors). This is essential for defining the aims of rehabilitation and to ensure that interventions are appropriate for, and meet the needs and preferences of the individual. This shared understanding promotes interdisciplinary working between health and social care professionals to support effective and efficient stroke rehabilitation services³⁵.

The foundations of a progressive stroke rehabilitation service are underpinned by a holistic rehabilitation model and appropriate service infrastructure, leadership and expertise. This is shown as an infographic in **Annex A**.

The core elements of rehabilitation include person centred care, personal goals and supported self-management. Personalised and evidence based therapeutic interventions delivered by stroke specialists should be offered to support recovery, adaptation to new functional status, self-management, and longer term health and wellbeing.

10.1.1 Key principles of stroke rehabilitation

Person-centred - Person-centred care is about treating people as individuals and working with them to develop the knowledge skills and confidence to manage and
make decisions about their own health and social care needs. Rehabilitation should be personalised, coordinated and enabling, and above all ensure that people are treated with dignity, compassion and respect.

Person-centred rehabilitation considers the person's needs, preferences, wishes, values, lifestyle, environment, family and social circumstances. The rehabilitation team works in partnership with them to understand their priorities and to develop solutions.

To demonstrate a person-centred approach, evaluation should include;

- The systematic approach to activities that are deemed central to personcentred care, e.g. regular holistic assessment of need; goal setting; supported self-management, family involvement, and
- Patient experience of these activities and the way in which they are treated and communicated with by the professionals working with them

Personal goals - Goal setting is the process by which the person with stroke (and their family or carers if they wish) and members of the stroke team identify individual goals which are meaningful, challenging and have personal value³⁶.

Supported Self-management - A person-centred approach in which the individual is empowered and has ownership over the management of their life and condition.

Co-ordinated via clinical networks - Areas in which managed clinical networks operate with clear clinical and operational leadership are more able to connect services via clear service pathways. Stroke rehabilitation services should coordinate across clinical and service pathways & be tailored to individual needs based on a range of personal, environmental and social factors.

Rehabilitation team - Expertise from an interdisciplinary team who collectively tailor rehabilitation input towards the person's goals is required. This should be in partnership with the person who has had a stroke and includes explicit involvement of family and carers.

Clinical Leadership - Robust clinical and programme leadership provided by senior Allied Health Professionals, Doctors and Nursing staff ensuring equitable representation and resourcing of hospital and community rehabilitation pathways.

Equitable access - Access to rehabilitation services should be equally available to those in urban and remote and rural areas and across socio-demographic areas, using technology to deliver when appropriate.

Appropriate care setting - In-patient rehabilitation is required for people with complex physical, cognitive, psychological and/or social needs, who could not be

supported in a community setting. Rehabilitation of stroke patients in hospital should occur in an integrated stroke unit or a specialist rehabilitation area. Early supported discharge (ESD) and community stroke rehabilitation services should be offered in a community setting whenever that best meets the needs and wishes of the patient.

Evaluation - Data on service delivery, patient outcomes and experiences should be collected systematically³⁷. Outcome measures used should be standardised, valid and reliable³⁸ as well as focused on what matters to patients³⁹.

Pathways and effectiveness of progressive stroke rehabilitation services will be reviewed via the Scottish Stroke Improvement Programme utilising data from the Scottish Stroke Care Audit and at least one annual review.

10.1.2 Stroke Rehabilitation Service Provision

Stroke rehabilitation services should be provided as part of an integrated network which includes inpatient rehabilitation services, ESD and community stroke or neuro rehabilitation teams who work closely to ensure services are delivered in the most appropriate setting for each person's needs and ensures equity of service provision.

Rehabilitation for people with stroke in all settings should be person-centred, optimise outcomes and enable appropriate long-term support and self-management.

Important aspects are to ensure;

- that people receive a holistic assessment to determine their rehabilitation needs as quickly as possible,
- that the delivery of rehabilitation takes place in the most appropriate setting for that person's needs.

To achieve this, stroke rehabilitation plans should be agreed and initiated in the acute phase and be available, according to need, along the entire stroke pathway.

In practice, this means that stroke rehabilitation services should reflect the range of rehabilitation needs for people who have had a stroke and be available in the right place and at the right time along the pathway from acute and rehabilitation inpatient settings to the community.

The duration of stroke rehabilitation services should be led by the needs of the person who has had a stroke and not be time limited. A clear life-long pathway for people to be able to re-engage with stroke rehabilitation services and re-access specialist support should be available to patients and families⁴⁰.

It is important that families and carers are included in rehabilitation planning and goal setting, if agreed, by the person who has had the stroke. If agreed, then carers should be

• included in assessments to identify needs

- provided with tailored information about stroke and the caring role.
- provided with advice, access to emotional support to adjust to their caring role and maintain their wellbeing.
- signposted to peer support to reduce the impact of loneliness and social isolation if required.

Delivery of the holistic biopsychosocial approach to stroke rehabilitation relies in part on having the right infrastructures in place, which includes sufficient access to rehabilitation professionals and close links with social care and the voluntary sector as part of an integrated stroke rehabilitation network.

Evidence supports increased frequency and intensity of therapy especially in the first six months post-stroke which can improve recovery rate and outcome. Provision of greater amounts of stroke therapy is associated with; higher therapy and nursing staffing levels; a weekend therapy service; and specialist stroke rehabilitation teams⁴¹.

Stroke rehabilitation services should therefore be available as required across the pathway seven days per week at an appropriate intensity with appropriate workforce skill mix.

Factors which impede the amount of therapy provision include time spent in information exchange and administration. Patient focussed reorganisation of working practices including shared documentation, and individual patient therapy timetabling is recommended to enable therapy provision in line with clinical guideline recommendations⁴².

10.1.3 The Multi-Disciplinary Team

Stroke rehabilitation services must include regular access to a coordinated multidisciplinary team who work in an integrated manner and work collaboratively towards common goals.

The inpatient stroke rehabilitation team should include stroke specialists in medicine, nursing, occupational therapy, physiotherapy, speech and language therapy, dietetics, and must also ensure timely access other specialist clinical services as required, such as orthotics, pharmacy, orthoptics, and social work.

The psychological, emotional, cognitive effects of stroke should be understood and supported by the whole team. Specialist input from clinical psychology and neuropsychology should be part of the core team and service provision throughout the patient journey from acute to longer term.

ESD and community stroke rehabilitation teams should include occupational therapy, physiotherapy, speech and language therapy, nursing and neuro/psychology with easy access to other professionals as required.

Rehabilitation and recovery should be embedded within all aspects of Stroke rehabilitation by all team members on a 24/7 basis. Teams should work in an interdisciplinary manner to engage people in as much therapeutic activity (including specialist therapy interventions and self-practice) as required at a frequency and intensity that enables them to reach their rehabilitation goals.

The stroke rehabilitation environment should facilitate patient engagement in a range of physical, cognitive and social activities out with formal therapy time. This can be supported by staff, carers and volunteers. This whole system approach to stroke rehabilitation should be promoted to improve recovery and rehabilitation outcomes⁴³.

10.1.4 Rehabilitation settings

Inpatient stroke rehabilitation is required for those who have complex physical, cognitive and psychological needs which are unable to be managed in a community setting.

Community stroke rehabilitation can be offered by a range of services including ESD and community stroke/neuro rehabilitation teams, with varying intensity depending on the individual's needs. Regardless of which health board the patient receives acute stroke care, it is important that rehabilitation is provided in their local area. This should be facilitated by effective communication and clear referral pathways between health boards.

ESD facilitates early transfer of care to a community setting and is co-ordinated and supported by a multi-disciplinary team of allied health professionals, stroke nurses and stroke specialists as required. Specialist rehabilitation is then provided in the person's home environment.

All hospital in-patients with stroke who have mild to moderate disability should have the opportunity for early supported discharge⁴⁴ which enables rehabilitation to commence within one working day of hospital discharge and at an intensity and frequency that would be provided if they remained in hospital. To enable this, strong links are required between the inpatient and community rehabilitation teams⁴⁵⁴⁶.

People who require community stroke rehabilitation should have this provided by specialist stroke or neuro teams for up to seven days per week as required.

To ensure equitable access to ongoing support and self-management resources, all those who have had a stroke or TIA should be provided with high quality, tailored information at the point of discharge from outpatient clinic, emergency department or hospital and be followed up in a timely manner by a community stroke nurse or other stroke specialist healthcare professional to provide further specialist advice and support.

Everyone with residual difficulties following a stroke on discharge from hospital should be provided with a documented plan for community rehabilitation and self-management support.

In addition, everyone who has experienced a stroke should receive a review by a stroke specialist health care professional within six months of their event.

10.1.5 Key interventions delivered by a progressive stroke rehabilitation service

Many aspects of stroke rehabilitation require a tiered approach whereby aspects of care are the responsibility of the whole MDT with specialists within the team focusing on more complex presentations. Each stroke rehabilitation network should have clearly defined pathways about how these services are provided.

Activities of Daily Living

Activities of daily living (ADL) include personal activities, e.g. washing and dressing; domestic activities, e.g. cooking and housework, and extended activities, e.g. work, driving and leisure. People experiencing difficulty with ADLs should be seen by an occupational therapist for assessment and the implementation of a personalised intervention programme. Evidence supports continued ADL training from occupational therapy and interventions can include direct training in an activity, training in adapted methods of performing an activity and the training in the use of adaptive equipment and assistive technology and environmental adaptation to maintain independence⁴⁷.

Arm function

Impaired arm function after a stroke affects independence, mental health and quality of life. Rehabilitation interventions that comprise intensive, graded practice of tasks and activities that focus on an individual's goals have been shown to be effective⁴⁸. Progressive arm rehabilitation, usually provided by occupational therapists and physiotherapists, comprises comprehensive assessment, person-centred goal setting and the provision of a structured, goal-orientated programme of intensive practice. This may include assistive technologies (e.g. functional electrical stimulation, mirror-box therapy and virtual reality⁴⁹) as appropriate. In addition to undertaking scheduled arm rehabilitation, people who have had a stroke should be encouraged by all members of the healthcare team to involve their affected arm in activities of daily living as much as possible in order to increase the intensity of meaningful practice and to improve outcomes.

Bowel and Bladder rehabilitation

Bladder and bowel dysfunction (including urinary incontinence, faecal incontinence, constipation and nocturia) are common and can be persistent following stroke but are amenable to rehabilitation intervention. Progressive rehabilitation will feature structured assessment by a nurse to identify the type of bladder/bowel dysfunction; agreement of individual goals and a programme of mainly behavioural interventions targeted to the type of dysfunction, to support active recovery of bladder/bowel function and use of the toilet. Regular review of the rehabilitation programme and

avoidance of containment approaches (including indwelling catheters) are key to recovery of independent bladder/bowel functioning and toilet use⁵⁰.

Balance, walking and mobility

Problems with balance, walking and mobility are likely to increase the risk of falls, deconditioning, becoming housebound and social isolation. People who have had a stroke should have their mobilisation needs assessed and once medically stable, they should be assisted to mobilise, overseen by a physiotherapist. Walking training should be task specific and include a cardiovascular component. Treadmill training with or without body weight support can improve walking and should be available for those who are able to walk independently⁵¹. For those who are not able to walk independently after stroke, electromechanical-assisted gait training devices (i.e. automated electromechanical gait machines) together with physiotherapy can improve the ability to walk independently⁵² and this technology should be made available. Early access to orthotic assessment for the provision of an ankle foot orthosis (AFO) should be available with reassessment when necessary in order to facilitate walking and prevent falls. Functional electrical stimulation (FES) should be available to facilitate gait and prevent falls in those with persistent mild lower limb weakness.

Communication

Post-stroke communication disorders occur frequently. Aphasia and dysarthria each affect around a third of people following a stroke. People who are identified as having a communication disorder after a stroke should be assessed by a speech and language therapist and provided with an individualised rehabilitation programme using evidence-based interventions⁵³ to reduce the impairment and/or support functional improvement and long-term adaptation. Such interventions may include group work, computer-based therapy, assistive technology and conversation partner training⁵⁴.

Cognition

Cognitive impairment is common following a stroke and can have a significant impact on social recovery and re-integration with overall poorer rehabilitation outcomes. Services should have a documented pathway for the identification and assessment of cognitive problems and the impact on participation. Cognitive rehabilitation should be integrated into the broader rehabilitation programme and goals should include cognitive rehabilitation interventions with the aim of restoring, compensating or adapting for reduced cognitive ability.

Driving

A documented pathway should be available to advise on national and local services for further assessment and advice with regard to resuming driving or alternative mobility options. Stroke service should ensure that driver status and intention to return to driving should be ascertained and advice / tailored information is made available.

Fatigue

Fatigue is commonly reported following stroke and can impact on longer term recovery and wellbeing. A range of physical and mental factors may contribute to fatigue and a documented pathway for the identification and assessment of fatigue and its impact on activity and participation should be available. Rehabilitation programmes should include strategies to anticipate and manage fatigue as well as education for patients and families/carers.

Pain management

Pain following stroke can be due to several causes including neuropathic pain, musculoskeletal pain and shoulder pain and subluxation. Each element requires specialised assessment and a range of evidence based interventions which should be available in documented pathway.

Physical activity, exercise and fitness training

Physical activity, exercise and fitness training should be provided through partnerships between health and exercise professionals, the third sector and council services. Exercise and fitness training should begin, as appropriate, in hospital and continue in the community⁵⁵. It should be provided by therapists or exercise professionals who have evidence of stroke specific knowledge and skills to adapt and tailor exercise programmes for people after stroke.

In addition to scheduled exercise, physical activity should be encouraged. Many people who have had a stroke experience barriers to becoming more active and sedentary behaviour tends to persist after stroke⁵⁶. Evidence-based counselling strategies are effective to encourage stroke survivors to engage and maintain physical activity after stroke⁵⁷⁵⁸ and these should be provided as required along the entire stroke pathway.

Posture and movement – spasticity services

Stroke services will implement a systematic approach to identify all those who need specialist spasticity assessment and treatment. Stroke services should implement a documented programme for prevention and management, including self-management, of post stroke spasticity. All those who need it will have access to a specialist spasticity service which may include Botulinum toxin injections, electroencephalogram (EEG) or ultrasound guided approach, appropriate clinical expertise to deliver, and coordinated multidisciplinary community follow up including occupational therapy, orthotics and physiotherapy.

Positioning and seating

Following stroke, many people will find it challenging to control their position when in bed and when sitting in a chair. Effective positioning and seating is essential for reducing the risk of aspiration, falls, skin breakdown, and contracture development in addition to providing maximum comfort and supporting participation in ADL. All staff from statutory and voluntary sector organisations and carers involved along the whole pathway should be aware of correct positioning. People with stroke, their carers, and all services should have access to clinicians with training in postural management. Appropriate beds, specialist chairs and positioning equipment should be available from inpatient and community rehabilitation services when required.

Psychological Care (cognitive and emotional)

In the aftermath of stroke, patients and families experience a wide range of psychological, cognitive and emotional difficulties which impact profoundly on function and rehabilitation. Stroke services should implement a documented programme for promoting awareness, screening and treatment of psychological consequences of stroke, led by a specialist clinical/neuropsychologist as detailed in the National Model of Psychological care for stroke⁵⁹. Psychological care should be available to all patients in line with local delivery plans.

Relationships and sexuality

Sexuality includes physical and psychosocial aspects of intimacy. Approximately 50% of individuals experience sexual dysfunction following stroke⁶⁰, however it is not commonly included as part of a rehabilitation programme⁶¹. Services to address these aspects of life after stroke are variable and professional education is lacking. Education with regards to sexuality following stroke should be provided to the stroke rehabilitation team and specialised support should be made available to those who require it.

Swallowing

Post-stroke swallowing difficulties (dysphagia) are common and can persist longterm. Management of such difficulties should be led by a dysphagia specialist, such as a trained speech and language therapist (SLT), and should include evidencebased rehabilitation and restorative strategies which aim to improve oropharyngeal function. Management of swallowing difficulties will additionally include compensatory strategies, swallowing manoeuvres, sensory modification and texture modification of food and fluids as appropriate. All interventions should take into consideration the factors which may limit ability to participate, such as physical and cognitive impairment, as well as encompass shared decision-making and a shared responsibility for management of risk. There should be access to instrumental assessments such as videofluoroscopy and flexible endoscopic evaluation of swallowing (FEES) to determine the specific rehabilitation programme/management approach. There should also be pathways for people with long-term dysphagia to reaccess services for review.

Technology and tele rehabilitation

Stroke rehabilitation services should include the use of robotics and software programmes which support rehabilitation interventions as appropriate.

Vision

Comprehensive assessment and rehabilitation services should be provided to all those with visual problems due to their stroke including:- Comprehensive visual screening completed before discharge; direct referral to appropriate professionals for assessment of suspected visual problems; follow up to determine the level of spontaneous recovery of visual problems; provision of treatment and rehabilitation, tailored to the specific visual problems by the most suitable profession in that locality (this may vary across NHS and Social Care areas); provision of tailored information and clear explanation of visual problems, and their possible impact, at each possible opportunity; ensuring individuals have knowledge of, and access to, relevant low vision services initiating direct referral if required⁶².

Vocational rehabilitation

Stroke rehabilitation services should identify work status and signpost and /or refer on for specialised intervention as appropriate. A documented pathway should identify local access to a specialised vocational rehabilitation service.

10.2 Self-Management and Long-term support

Self-management support and long term care & support should be an integral element of stroke rehabilitation pathway and should be provided in partnership with health, social care and voluntary sector.

It is a core component of person centred care and is a multidisciplinary approach which supports people to develop skills, knowledge, and confidence to manage the impact of stroke and to maintain an ability to engage in meaningful activities and life roles.

Not everyone who experiences a stroke or TIA will have ongoing rehabilitation needs identified at the time of their discharge. However, feedback from people with lived experience was that often, this meant that there was a missed opportunity to identify routes to access support.

Everyone who experiences a stroke or TIA should receive tailored information provision and be signposted to community based support and advice. It is important that people who have had a stroke or TIA are provided with the necessary skills, resources and support to continue self-management in the longer term along with management of other long-term conditions they may have.

There is considerable variation across the country in the longer term support for people who have had a stroke. This may comprise nurse or other healthcare

professional follow up, peer support groups and exercise classes. In some places these aspects of care are provided directly by NHS stroke services, in others they are commissioned from the charities including Chest Heart and Stroke Scotland (CHSS) and the Stroke Association.

Primary care services are the main source of medical care for stroke survivors in the longer-term after their stroke. It is common practice that routine annual reviews for people with stroke take place alongside reviews of other long-term conditions. In addition, people who have had a stroke identify health issues that arise and contact primary care services for assessment.

Primary and secondary care services should communicate effectively to enable the provision of patient-centred care, for example primary care may identify a further rehabilitation need and refer the person back to the community rehabilitation team.

People with lived experience of stroke highlighted that a key issue was the lack of a 'joined up' approach, and outlined how important it would be to have a person who could support them by signposting to advice and support services, and act as a point of return for when issues arose further down the line in their journey.

"One of the big aspects is going to be having someone who is responsible for ensuring that the service is joined up. I think that's what's missing" – National Stroke Voices participant.

It is therefore important that people who experience stroke are provided with clear and easily accessible contact information once discharged from community services, enabling the provision of continued advice, support and signposting. A clear life-long pathway for people to be able to re-engage with stroke services and re-access specialist support should be available to patients and families⁶³.

To ensure equitable access to ongoing support and self-management resources every person who has had a stroke should be contacted by a community stroke nurse or other appropriate stroke professional in a timely manner following their discharge from outpatient clinic, emergency department or hospital to provide review and an opportunity to access specialist advice and support⁶⁴.

10.3 Recommendations

- 1. Stroke rehabilitation services should be underpinned by a holistic rehabilitation model, appropriate service infrastructure, leadership and expertise.
- 2. Stroke rehabilitation in all settings should be person-centred; optimise outcomes with evidence based interventions, and enable appropriate long-term support and self-management.

- 3. Rehabilitation should be a process that begins as soon as a stroke is diagnosed and continues as long as required. The duration of stroke rehabilitation should be needs led and not time limited
- 4. An early holistic assessment of a person's rehabilitation needs should be provided by stroke specialist teams and a personalised, documented rehabilitation and self-management plan agreed with the person who has had a stroke and their family/carers.
- 5. Stroke rehabilitation services must include regular access to a coordinated multidisciplinary team who work in an interdisciplinary manner and collaborate towards common person centred goals.
- 6. The psychological, emotional, cognitive effects of stroke should be understood and supported by the whole team. Specialist input from clinical psychology and neuropsychology should be part of the core team and service provision throughout the patient journey from acute to longer term.
- 7. Evidence based stroke rehabilitation services should be available across the pathway seven days per week at an appropriate intensity, with appropriate workforce skill mix.
- 8. Inpatient stroke rehabilitation is required for those who have complex physical, cognitive and psychological needs which are unable to be managed in a community setting.
- 9. Community stroke rehabilitation can be offered by a range of services with a range of intensities including Early Supported Discharge and community stroke or neuro rehabilitation teams.
- 10. Stroke rehabilitation services should be provided as part of an integrated network which includes inpatient rehabilitation services, ESD and community stroke or neuro rehabilitation teams who work closely to ensure services are delivered in the most appropriate setting for each person's needs and ensure equity of service provision.
- 11. Clinical and programme leadership should be provided by senior Allied Health Professionals, Doctors and Nursing staff to ensure equitable representation and resourcing of hospital and community rehabilitation pathways.

- 12. Every person who has had a stroke should be followed up by a community stroke nurse or other appropriate healthcare professional, in a timely manner, following discharge from hospital, ideally in their own home.
- 13. A clear lifelong pathway for people to reengage with stroke rehabilitation services and re-access specialist support should be available to patients and families
- 14. In addition, a formal review should be carried out for everyone who has experienced a stroke, six months post event, to provide another opportunity to access specialist advice and support, regardless of the rehabilitation needs identified at the time of their discharge from hospital.
- 15. People who have had a stroke should be signposted to relevant resources and support to continue self-management in the longer term along with management of other long-term conditions they may have.
- 16. Evaluation of stroke rehabilitation services should include person centred approach including regular holistic assessment of need, goal setting, supported self-management and family/carer involvement as well as the patient experience of these activities and the treatment and communication they experience with the professionals working with them.

11. Workforce

The quality of stroke services provided is hugely dependent on the availability of knowledgeable, skilled and experienced healthcare professionals. This is influenced by access to high quality education and supported learning, and staff turnover.

Stroke services should provide specialist medical, nursing, allied health professional and rehabilitation staffing levels matching the Royal College of Physicians ⁶⁵ and British Association of Stroke Physicians Guidelines⁶⁶.

It is recognised that there is significant attrition of stroke trained staff from acute stroke rotas and services and retention of trained staff remains a challenge for future service provision. It is imperative that burnout risk is minimised in a speciality with unpredictable intensity and requiring complex decision making. To support this it will be necessary to;

- Ensure that working patterns and staffing levels, especially for healthcare staff contributing to out of hours care, are sustainable to attract and retain staff.
- Consider novel remuneration rates for unsociable hours which may save on external locum costs for rota gaps.
- Ensure that there are adequate levels of support staff and access to IT to optimise the efficiency of clinical staff and optimise patient facing time.

Through the review process for this document, staffing available to deliver equitable rehabilitation services was raised as a concern, in particular with reference to limited access to psychology & neuropsychology services across the country.

The rehabilitation workforce challenges mean that in practice, few stroke rehabilitation services are able to offer a seven day service with appropriate intensity. To be able to provide a progressive stroke rehabilitation service these workforce challenges should be addressed.

11.1.1 Education and training

Stroke services should have an education programme for all staff providing acute, hyperacute stroke care and rehabilitation.

There is currently a national education template which outlines the training required for staff involved in the care of stroke patients. It is important that all NHS boards enable staff involved in delivery stroke care to undertake the education outlined by this template. Dedicated trainers can support this.

- All professional groups potentially dealing with hyperacute patients should have been trained in core stroke competencies, STAT+, STARS Advanced Modules and Hyperacute stroke treatment decision making for clinicians.
- Stroke physicians and radiologists should have up to date training in advanced imaging for stroke.
- Training should be supported by rolling educational plans with blended learning, web based and simulation based training.
- Regular national educational sessions will support shared learning amongst professional groups
- Education development framework with clear career progression opportunities important for retaining staff.
- Mentoring for junior staff, opportunities to rotate into other parts of the stroke pathway or undertake secondments and gain wider knowledge and appreciation of their role within the entire system

To support health boards to deliver effective training and education, at a national level, there will be a continued

- Investment in developing and maintaining interactive online training which can be accessed at the convenience of the learner.
- Delivery of live training sessions which can be delivered remotely via MS Teams to a large live audience across many NHS Boards, and also be recorded for others to access later.
- Coordinated national training programmes tailored to each group of healthcare staff involved in stroke services.

NHS Boards should keep records of the staff working within stroke services, their training needs and training received. When new staff join a stroke service their training needs should be identified and a plan made to meet those needs promptly.

12. Glossary

Activities of daily living (ADL): personal activities, e.g. washing and dressing; domestic activities, e.g. cooking and housework, and extended activities, e.g. work, driving and leisure.

ACTATS (Acute CTA for Thrombectomy in Stroke): An online training package aimed at stroke clinicians and radiologists to help them interpret CT (see computerized

tomography) & CTA (see computed tomography angiography) in the context of thrombectomy.

Al: Artificial intelligence.

Aneurysm coiling: a procedure performed to block blood flow into an aneurysm (a weakened area in the wall of an artery).

AFO: Ankle Foot Orthoses are external biomechanical devices utilized on lower limbs to stabilize the joints, improve the gait and physical functioning of the affected lower limb.

Aphasia: a disorder of language which can affect speech, reading and writing. It's usually caused by damage to the left side of the brain.

AF: Atrial Fibrillation is an irregular and often very rapid heart rhythm (arrhythmia) that can lead to blood clots in the heart. AF increases the risk of stroke.

Assistive technology: products or systems that support and assist individuals with disabilities, restricted mobility or other impairments to perform functions that might otherwise be difficult or impossible.

Botulinum toxin injections: Botulinum toxin can help to relax overactive muscles for a short period of time. During this time a therapy programme can be implemented to stretch shortened muscles and stiff joints. This may help improve function e.g. walking or grip or could help care staff manage personal hygiene.

Carotid Ultrasound: Carotid ultrasound is an imaging test that uses high-frequency sound waves to create pictures of the inside of carotid arteries. It is used to identify patients who may benefit from carotid endarterectomy or angioplasty and stenting

Carotid endarterectomy: An operation to remove the narrowing in a carotid artery to reduce the risk of future stroke.

CVD: Cerebrovascular disease is a condition that develops as a result of problems with the blood vessels supplying the brain. One of the common consequences of CVD is stroke.

CHI number: Community Health Index number is a unique patient identifier used across Scotland. The first 6 digits include the patient's date of birth.

Cochrane Stroke Research Group: A Scottish based network of the Cochrane worldwide collaboration to identify and summarise the information from research, especially from randomised controlled trials, evaluating treatments and diagnostic tests.

CSC - Comprehensive Stroke Centre: a hospital which in addition to the facilities of the PSC can also provide thrombectomy and neurosurgery with associated critical care support.

CT: A computerized tomography (CT) scan combines a series of X-ray images taken from different angles around your body and uses computer processing to create cross-sectional images (slices) of the inside of the body.

CTA: Computed tomography angiography (CTA) uses an injection of contrast material into your blood vessels and CT scanning to help diagnose and evaluate blood vessel disease or related conditions.

CTP: Computed tomographic perfusion (CTP) imaging is an advanced modality that can aid in diagnosis, management, and prognosis of acute stroke patients by clarifying acute cerebral physiology.

Decompressive hemicraniectomy: a surgical treatment for cerebral oedema (when the brain swells, causing an increase in pressure). Has been performed for several different pathologies, including malignant middle cerebral artery syndrome, one of the most widely recognized large vessel strokes.

DTN: Door-to-Needle Time is the delay between arrival at a hospital and the administration of a bolus of thrombolysis medication

DIDO: Door In, Door Out time is the delay between a patient's arrival at a Primary Stroke Centre (PSC) and their departure from that hospital to go to a Comprehensive Stroke Centre (CSC) for consideration of thrombectomy

DVLA: the Driver and Vehicle Licensing Authority

Dysarthria: Slurred speech caused by disturbance of muscular control.

Dysphagia: Medical term for swallowing difficulties. Some people with dysphagia have problems swallowing certain foods or liquids, while others can't swallow at all.

ED: Emergency Department (previously referred to as Accident and Emergency Department)

Endovascular therapy: Minimally invasive procedures that are done inside the blood vessels.

ESD: Early supported discharge services comprise a stroke specific multidisciplinary team and sufficient care staff to allow hospital admitted stroke patients to be discharged home earlier than otherwise to continue their rehabilitation in the community

FAST: Face, Arm Speech Time – a simple clinical assessment to facilitate the rapid identification of a stroke used by the public and ambulance crews.

Flexible endoscopic evaluation of swallowing (FEES): FEES is a procedure designed to assess swallowing function through visualization of the pharyngeal and laryngeal (throat) structures.

FLORENCE: Flo or Florence is a simple telehealth system that uses text messages to support patients to manage their high blood pressure and related aspects of health.

FES: Functional Electrical Stimulation is a treatment that uses small electrical charges to produce muscle activity or a muscle contraction.

Hydrocephalus: a build-up of fluid around the brain, which increases pressure and can cause brain damage.

IJB: Integrated Joint Boards: Bodies that lead the planning of health and social care services. IJB's commissions the local authority and health board to deliver services in line with a strategic plan.

IPC: Intermittent pneumatic compression comprises sleeves wrapped around the legs which are inflated regularly to squeeze the legs, increase blood flow to reduce the risk of blood clots in the legs (deep vein thrombosis (DVT).

INR: Interventional Neuroradiologists: doctors who specialise in minimally invasive treatment of neurovascular disease including thrombectomy

IR: Interventional Radiologists: Doctors who performs image guided procedures, fully interprets the imaging required to guide and monitor response of those procedures, as well as provides the pre and post procedural care for those patients receiving procedures including thrombectomy.

LDL: Low density lipoprotein (LDL) cholesterol is often referred to as "bad cholesterol" because too much is unhealthy.

LVO: Large Vessel Occlusion a blockage in one of the major arteries of the brain which may be opened up with thrombectomy.

MCN: Managed Clinical Networks: linked groups of health professionals and organisations from primary, secondary and tertiary care, working in a co-ordinated manner, unconstrained by existing professional and Health Board boundaries, to ensure equitable provision of high quality clinically effective services throughout Scotland.

MRA: Magnetic resonance angiography (MRA) uses a powerful magnetic field, radio waves and a computer to evaluate blood vessels and help identify abnormalities.

MRI: Magnetic resonance imaging (MRI) is a type of scan that uses strong magnetic fields and radio waves to produce detailed images of the inside of the body.

MSK: musculoskeletal pain is pain which affects the muscles, ligaments, tendons, and bones.

MT: Mirror-box therapy: a rehabilitation therapy in which a mirror is placed between the arms or legs so that the image of a moving non-affected limb gives the illusion of normal movement in the affected limb.

Multi-disciplinary team - a group of professionals from one or more clinical disciplines who together make decisions regarding recommended treatment of individual

Near Me: A secure form of video consulting approved for use by the Scottish Government and NHS Scotland.

Neuropathic pain: Neuropathic pain is often described as a shooting or burning pain. It often is the result of nerve damage or a malfunctioning nervous system. The impact of nerve damage is a change in nerve function both at the site of the injury and areas around it.

Neurosurgery: Specialty concerned with the diagnosis and treatment of patients with injury to, or diseases/disorders of the brain, spinal cord and spinal column, and peripheral nerves within all parts of the body.

Nocturia: the medical term for excessive urination at night.

Orthotics: A medical specialty which makes and fits braces and splints (orthoses) for people who need added support for body parts that have been weakened by injury, disease, or disorders of the nerves, muscles, or bones.

Orthoptics: A medical specialty which diagnoses, treats and manages disorders of eye movement and binocular vision, which is the ability of the eyes to work together as a pair.

PFO: Patent Foramen Ovale is a hole in the heart that didn't close the way it should after birth. It occurs in about 20 of normal people but is known to increase the risk of stroke.

Post stroke spasticity: After a stroke, muscles may become stiff, tighten up and resist stretching. This is called spasticity. Spasticity relates to muscle tone. Tone is the natural tension, or contraction, in a muscle that resists stretching. Stroke may cause an abnormal increase in muscle tone, leading to spasticity.

PSC: Primary Stroke centre: a hospital which has staffing and facilities to acute assess acute stroke patients, carry out an early CT brain scan and deliver thrombolysis. They will also have a stroke unit, or equivalent facility for ongoing care of stroke patients

Realistic medicine: An approach to healthcare which emphasises the importance of involving patients and their families in decision about all aspects of their care. Formalised as an entity by the 2014/15 report from the Scottish Chief Medical Officer (CMO)

SAS: Scottish Ambulance Service

SCI Gateway: Scottish Care Information (SCI) Gateway is a national system that integrates primary and secondary care systems using highly secure Internet technology. SCI Gateway enables GPs to access SCI services on-line.

SRN: Stroke research network funded by the Scottish Government to facilitate clinical research into the causes, diagnosis and treatment of stroke.

SSCA: Scottish Stroke Care Audit which is coordinated by Public health Scotland and which supports the capture of data to measure the performance of stroke services against national standards

STAT+, STARS Advanced Modules: Professional training:

STAT+: Stroke and Transient Ischaemic Attack (TIA) Assessment Training (STAT) and STAT+. Training incorporates simulated scenarios to improve the emergency response to stroke and TIA. Most of this training is delivered on line.

STARS: Stroke Training and Awareness Resources. An e-learning resource providing a learning tool for health and social care staff to enable them to become more knowledgeable and skilful in the challenging area of stroke care.

Stroke: A stroke occurs when the blood supply to part of the brain is interrupted and brain cells are starved of oxygen. This usually occurs because a blood vessel becomes blocked by fatty deposits or a blood clot. Ischaemic strokes occur when a blood clot blocks the flow of blood and oxygen to the brain. A haemorrhagic stroke can happen when blood from an artery begins bleeding into the brain after a blood vessel bursts.

Subluxation: Shoulder subluxation happens when the upper arm bone, called the humerus, becomes partially dislocated from the shoulder socket. This condition starts when the muscles around the shoulder become weak or paralyzed after stroke.

Tailored talks: A web based IT system available across Scottish stroke services which enables healthcare professionals to share tailored digital information for patients and their family to support shared decision making.

Telestroke: A service which uses telephone, video conferencing and access to Picture Archiving and Communication System (PACS) to allow clinicians to remotely assess patients to enable the clinician to advise on management, including thrombolysis and thrombectomy

Thrombectomy: The physical removal of a thrombus (clot) which is blocking an artery causing a stroke.

Thrombolysis: Ischaemic strokes can sometimes be treated using a medicine which dissolves blood clots and restores blood flow to the brain. This use of "clot-busting" medicine is known as thrombolysis.

TIA: A transient ischaemic attack (TIA) or "mini stroke" is caused by a temporary disruption in the blood supply to part of the brain. The symptoms last only minutes or hours.

TRAKCare: An electronic health record management system which is available in all NHS Boards.

Treadmill training: used to aid walking rehabilitation with or without the use of body weight support

TTE: Transthoracic echocardiogram is the most common type of echocardiogram, which provides a moving image of the internal parts of the heart using ultrasound.

TOE: Transoesophageal Echocardiography is a type of echocardiogram where a small probe is passed down the throat into the gullet and stomach.

TCD: Transcranial Doppler is a painless test that uses sound waves to detect medical problems that affect blood flow in your brain.

Triage: The assignment of degrees of urgency to illnesses to decide the order of treatment of a large number of patients.

Vascular surgery: Vascular surgeons are trained in the diagnosis and management of conditions affecting the circulation, including disease of the arteries, veins and lymphatic vessels. Vascular surgeons perform carotid endarterectomies to reduce the risks of future stroke

VTE: Venous thromboembolism is where blood clots that can develop in the deep veins in the legs or pelvis (a deep vein thrombosis (DVT)) and can travel to the lungs to cause pulmonary embolism PE).

Videofluoroscopy: A videofluoroscopy assesses your swallowing ability. It takes place in the X-ray department and provides a moving image of your swallowing in real time.

ANNEX A

Holistic Model of Stroke Rehabilitation (Williams, Hamilton & Evans, 2021)



Acknowledgements

This document has been delivered through contributions of a number of individuals during the Covid-19 pandemic. We are grateful for their support and contributions and pay special thanks to;

Scottish Government/Programme for Government team

Katrina Brennan, Professor Martin Dennis Thérèse Lebedis Neil Muir, Dr Fiona Wright Susan Wallace Kylie Barclay

Pre-Hospital Expert Group

Professor Martin Dennis, Craig Henderson, Stephen Makin, Karen Garrott, Alison Brooks, Gareth Clegg

TIA Expert Group

Mark Barber, Sandi Haines, Gethin Williams, Neil Hunter, Helen Slavin, Gareth Blayney, John Reid, Dr Ronnie Burns, Luke Yates

Hyperacute stroke expert group

Dr Fiona Wright, Matt Lambert, Mary Joan, Tracey Baird

Stroke Unit Expert Group

Elizabeth Barrie, Anthony Byrne, Linda Campbell, Christine Carter, Vera Cvoro, Peter Langhorne, Mary Joan MacLeod Christine McAlpine, Keri-Ann Van-Nuil, Richard O'Brien (plus input from Martin Dennis, Therese Lebedis, Fiona Wright)

Rehabilitation and long-term support expert group

Thérèse Lebedis - Consultant AHP/Occupational Therapist in stroke Anne Armstrong - Specialist Occupational Therapist, NHS Lanarkshire Katrina Brennan - Stroke Improvement programme lead & Stroke MCN manager NHS Lanarkshire Dr Fiona Brodie -Professor Jo Booth – Professor of Rehabilitation Nursing, Glasgow Caledonian University. Gillian Crighton Stroke MCN Gillian Capriotti - AHP Stroke Consultant/Speech and Language therapist, NHS Greater Glasgow and Clvde Andrea Cail - Stroke Association, Scotland Dr Emma Coutts - Speech and Language Therapist, NHS Grampian Dr Charlie Chung - Rehabilitation Manager and Stroke Specialist Occupational Therapist. NHS Fife Dr Alastair Cozens -Karen Garrott - Stroke Association, Scotland Dr Christine Hazelton - Optometrist & Stroke Association Non- clinical lecturer, NMAHP research Unit, Glasgow Caledonian University Lesley Kane - Chest Heart and Stroke Scotland Dr Lisa Kidd - Reader in Supported Self-Management (Nursing), University of Glasdow Dr Ashish Macaden - Consultant in Rehabilitation Medicine and Stroke, NHS Highland Neil Muir - Clinical coordinator, Scottish Stroke National Audit Programme Dr Alex Pollock, Senior Research Fellow, NMAHP Research Unit, Glasgow Caledonian University Dr Joanne Robertson - Consultant Clinical Psychologist, NHS Greater Glasgow and Clvde Dr Lesley Scobbie - Stroke Association Clinical Lecturer, Glasgow Caledonian University & Stroke clinical academic AHP, NHS Lanarkshire Mark Smith - Consultant AHP/Physiotherapist in stroke. NHS Lothian Prof. Frederike van Wijck - Professor of Neurological Rehabilitation, Glasgow Caledonian University Dr Luke Williams - Consultant Clinical Psychologist, NHS Ayrshire & Arran Plus advice and guidance from the following groups National Stroke Voices National Advisory Committee on Stroke and subgroups Thrombectomy Advisory Group and subgroups

¹ Public Health Scotland, (2021), *Scottish Stroke statistics - Year ending 31 March 2020*, available at <u>https://publichealthscotland.scot/publications/scottish-stroke-statistics/scottish-stroke-statistics-year-ending-31-march-2020/</u>, accessed 1st November 2021.

² Royal College of Physicians, (2016), *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 1st November 2021.

³ Ajay Bhalla, Mehool Patel, Jonathan Birns, (2021), An update on hyper-acute management of ischaemic stroke, *Clinical Medicine*, 21 (3) pp 215-221

⁴ Hassan AE, Ringheanu VM, Rabah RR, et al, (2020). Early experience utilizing artificial intelligence shows significant reduction in transfer times and length of stay in a hub and spoke model, *Interventional Neuroradiology*, 26(5): pp 615-622.

⁵ Murray NM, Unberath M, Hager GD, et al (2020), Artificial intelligence to diagnose ischemic stroke and identify large vessel occlusions: A systematic review, *Journal of NeuroInterventional Surgery*, 2020, 12(2): pp 156-164.

⁶ Thomalla G, Boutitie F, Ma H, et al, (2020), Intravenous alteplase for stroke with unknown time of onset guided by advanced imaging: systematic review and meta-analysis of individual patient data, *Lancet*, Nov 14; 396(10262): pp 1574-1584.

⁷ McDermott M ,Skolarus LE ,Burke JF, (2019), A systematic review and meta-analysis of interventions to increase stroke thrombolysis, *BMC Neurology*, May 3;19(1): pp 86

⁸ Mortimer A, Lenthall R, Wiggam I, et al, (2021), To support safe provision of mechanical thrombectomy services for patients with acute ischaemic stroke: 2021 consensus guidance from BASP, BSNR, ICSWP, NACCS, and UKNG, *Clinical Radiology*, 76(2).

⁹ NICE, (2019), Stroke and transient ischaemic attack in over 16s: diagnosis and initial management NICE guideline: NG128, available at

https://www.nice.org.uk/guidance/ng128/chapter/Recommendations#thrombectomy-for-people-withacute-ischaemic-stroke, accessed 25th October 2021.

¹⁰McMeekin P, White P, James MA, et al, (2017), Estimating the number of UK stroke patients eligible for endovascular thrombectomy, *European Stroke Journal*, Dec;2(4): pp319-326.

¹¹ Zhang L, Ogungbemi A, Trippier S, et al, (2021), Hub-and-spoke model for thrombectomy service in UK NHS practice. *Clinical Medicine Journal*, Jan;21(1): pp e26-e31.

¹² British Society of Interventional Radiology and The Royal College of Radiologists, (2019), *Provision of Interventional Radiology: Second Edition*, London, The Royal College of Radiologists, available at https://www.rcr.ac.uk/system/files/publication/field_publication_files/bfcr198-provision-interventional-radiology-services-second-ed.pdf, accessed 25th October 2021.

¹³ <u>https://bsnr.org.uk/_userfiles/pages/files/bsnrtrainingresponsetomtevidencefinal23116.pdf</u>

¹⁴ Mortimer A, Lenthall R, Wiggam I, et al, (2021), To support safe provision of mechanical thrombectomy services for patients with acute ischaemic stroke: 2021 consensus guidance from BASP, BSNR, ICSWP, NACCS, and UKNG, *Clinical Radiology*, 76(2).

¹⁵ Kim BM, Baek JH, Heo JH, et al, (2019), Effect of Cumulative Case Volume on Procedural and Clinical Outcomes in Endovascular Thrombectomy, *Stroke*, May; 50(5): pp1178-1183.

¹⁶ Feigin VL, Krishnamurthi RV, Parmar P, et al, (2015), Update on the global burden of ischemic and hemorrhagic stroke in 1990-2013: the GBD 2013 study, *Neuroepidemiology*, 45: pp161–76.

¹⁷ Canadian Stroke Best Practices, (2020), Emergency Management of Intracerebral Hemorrhage: 7th Edition – 2020 UPDATE, available at <u>https://www.strokebestpractices.ca/recommendations/management-of-intracerebral-hemorrhage/emergency-management-of-intracerebral-hemorrhage, accessed 15th November 2021.</u>

¹⁸ Hemphill JC, Greenberg SM, Anderson CS, et al, (2015), Guidelines for the management of

spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American heart Association/American stroke association, *Stroke*, Volume 46, No7: pp2032–60

¹⁹ Parry-Jones AR, Sammut-Powell C, Paroutoglou K, et al, (2019), An intracerebral hemorrhage care bundle is associated with lower case fatality, *Annals of Neurology*, 86 (4): pp495–503

²⁰ Parry-Jones AR, Moullaali TJ, Ziai WC, (2020), Treatment of intracerebral hemorrhage: From specific interventions to bundles of care, *International Journal of Stroke*, 15(9): pp945-953.

²¹ Canadian Stroke Best Practices, (2020), Emergency Management of Intracerebral Hemorrhage: 7th Edition – 2020 UPDATE, available at <u>https://www.strokebestpractices.ca/recommendations/management-of-intracerebral-hemorrhage/emergency-management-of-intracerebral-hemorrhage</u>, accessed 15th November 2021.

²² Canadian Stroke Best Practices, (2020), Emergency Management of Intracerebral Hemorrhage: 7th Edition – 2020 UPDATE, available at <u>https://www.strokebestpractices.ca/recommendations/management-of-intracerebral-hemorrhage/emergency-management-of-intracerebral-hemorrhage, accessed 15th November 2021.</u>

²³ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

²⁴ (RCP 2016; Appendix Figure 1 - Purple box)

²⁵ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

²⁶ Langhorne P, Ramachandra S, (2020), Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke: network meta-analysis, *Cochrane Database of Systematic Reviews*, 4(4):CD000197

²⁷ Busingye D, Kilkenny MF, Purvis T, et al, (2018), Is length of time in a stroke unit associated with better outcomes for patients with stroke in Australia? An observational study, *BMJ Open*, 12;8(11):e022536

²⁸ (Appendix Table 1 and 2).

²⁹ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

³⁰ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

³¹ NHS Quality Improvement Scotland, (2010), Best Practice Statement: End of life care following acute stroke, available at <u>Best Practice Statement End of life care following acute stroke.pdf</u> (scot.nhs.uk), accessed 15th November 2021.

³² Wright J, Zeeman H, Biezaitis V, et al, (2016), Holistic Practice in Traumatic Brain Injury Rehabilitation: Perspectives of Health Practitioners, *PLOS ONE*, 11(6): e0156826.

³³ United Nations, Convention on the Rights of Persons with Disabilities and Optional Protocol, available at <u>https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html#Fulltext</u>, accessed 1st November 2021.

³⁴ World Health Organisation, (2019), Rehabilitation in health systems: guide for action, available at <u>https://www.who.int/publications/i/item/9789241515986</u>, accessed 15th November 2021.

³⁵ Wade DT & Halligan PW, (2017), The biopsychosocial model of illness: a model whose time has come, Clinical Rehabilitation, Vol. 31(8) 995–1004

³⁶ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

³⁷ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

³⁸ Kwakkel G, van Peppen R, Wagenaar RC, et al, (2004), Effects of augmented exercise therapy time after stroke a metaanalysis, *Stroke*, 35(11): pp2529–2539

³⁹ Duncan-Millar D, van Wijck F, Pollock A, Ali M, (2021), International consensus recommendations for outcome measurement in post-stroke arm rehabilitation trials, *European Journal of Physical and Rehabilitation Medicine*, 57(1): pp61-68.

⁴⁰ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁴¹ Gittins M, Vail A, Bowen A, et al on behalf of the SSNAP collaboration, (2020), Factors influencing the amount of therapy received during inpatient stroke care: an analysis of data from the UK Sentinel Stroke National Audit Programme, *Clinical Rehabilitation*, Volume: 34 issue: 7, page(s): 981-991

⁴² Clarke DJ, Burton LJ, Tyson SF et al, (2018), Why do stroke survivors not receive recommended amounts of active therapy? Findings from the ReAcT study, a mixed-methods case-study evaluation in eight stroke units, *Clinical Rehabilitation*, Vol. 32(8) pp1119 - 1132

⁴³ Clarke D, Gombert-Waldron K, Honey S, et al, (2021), Co-designing organisational improvements and interventions to increase inpatient activity in four stroke units in England : a mixed-methods process evaluation using normalisation process theory. *BMJ Open*, 11(1):e042723

⁴⁴ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁴⁵ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁴⁶ Langhorne P, Baylan S, (2017, Early supported discharge services for people with acute stroke, *Cochrane Database of Systematic Reviews*, Issue 7. Art. No: CD000443.

⁴⁷ Legg LA, Lewis SR, Schofield-Robinson OJ et al, (2017), Occupational Therapy for adults with problems in activities of daily living after stroke. *Cochrane Database of Systematic Reviews*, Issue 7, Article No: CD003316

⁴⁸ Bosomworth H, Rodgers H, Shaw L, (2020), Evaluation of the enhanced upper limb therapy programme within the Robot-Assisted Training for the Upper Limb after Stroke trial: descriptive analysis of intervention fidelity, goal selection and goal achievement, *Clinical Rehabilitation*, 35(1): pp119-134

⁴⁹ Pollock A, Baer G, Campbell P, et al, (2014), Physical rehabilitation approaches for the recovery of function and mobility following stroke, *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001920.

⁵⁰ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁵¹ Mehrholz J, Thomas S, Elsner B, (2017), Treadmill training and body weight support for walking after stroke. *Cochrane Database of Systematic Reviews*, Issue 8. Art. No.: CD002840

⁵² Mehrholz J, Thomas S, Elsner B, (2017), Treadmill training and body weight support for walking after stroke. *Cochrane Database of Systematic Reviews*, Issue 8. Art. No.: CD002840

⁵³ Brady MC, Kelly H, Godwin J, Enderby P, et al, 2016. Speech and language therapy for aphasia following stroke. *Cochrane Database of Systematic Reviews*, Issue 6, Art. No: CD000425.

⁵⁴ UK Government, Guidance: Assistive technology: definition and safe use, Updated 28 October 2021, available at <u>Assistive technology: definition and safe use - GOV.UK (www.gov.uk)</u>, accessed 15th November 2021.

⁵⁵ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁵⁶ Tieges, Z. et al, (2015), Sedentary behavior in the first year after stroke: a longitudinal cohort study with objective measures. *Archives of Physical Medicine and Rehabilitation*, 96(1), pp15-23

⁵⁷ Pollock A, Baer G, Campbell P et al, (2014), Physical rehabilitation approaches for the recovery of function and mobility following stroke, *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001920

⁵⁸ Fini NA, Holland AE, Keating J, et al, (2017), How physically active are people following stroke? systematic review and quantitative synthesis, *Physical Therapy*, 97: pp707–717

⁵⁹ National Model of Psychological Care in Stroke (Scotland) (NMPCS) in *Improving Psychological Care in Stroke Service: A National Model for Scotland, October 2020*, Scottish Stroke Psychology Forum.

⁶⁰ Stratton, H., Sansom, J., Brown-Major, A et al, (2020). Interventions for sexual dysfunction following stroke, *Cochrane Database of Systematic Reviews*, Issue 5. Art. No.: CD011189

⁶¹ Winstein, C.J., et al (2016). Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke, 47(6), e98-169

⁶² Pollock, A, Hazelton, C., Rowe, F et al, (2019), Interventions for visual field defects in people with stroke, *Cochrane Database of Systematic Reviews*, Issue 5, Art. No.: CD008388

⁶³ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁶⁴ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁶⁵ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁶⁶ British Association of Stroke Physicians, (2019), Meeting the Future Consultant Workforce Challenges: Stroke Medicine, available at <u>BASP-Stroke-Medicine-Workforce-Requirements-Report-</u> <u>FINAL.pdf</u>, accessed 23rd October 2021.

Contents

1.	Inti	Introduction				
	1.1	.1	Realistic Medicine and shared decision making	5		
	1.1	.2	Information technology (IT)	5		
	1.1	.3	Research	6		
2.	Go	vern	ance	6		
3.	Pri	mary	/ Prevention	7		
	3.1	Red	commendations	7		
4.	Recognition and Referral					
	4.1	Imp	proving individual awareness and recognition of stroke	8		
	4.2	Imp	proving referral pathways	8		
	4.2	2.1	Referral to TIA services	9		
	4.2	2.2	Suspected acute stroke – taking prompt action	9		
	4.3	Red	commendations	10		
5.	TIA	A Sei	rvices	11		
;	5.1	Spe	ecialist assessment	11		
;	5.2	Inve	estigations	12		
	5.3	Tre	atment and care	12		
	5.4	Red	commendations	14		
6.	Tra	ansfe	er to Hospital	14		
	6.1	Imp	proving pre-hospital assessment	15		
	6.2	Pre	-Alert	15		
	6.3	Red	commendations	16		
7.	As	Assessment and diagnostics16				
	7.1	Inte	erface between stroke services and emergency departments	16		
	7.2	Ass	sessment of eligibility for hyperacute treatment	17		
	7.3	Acc	ess to brain and vascular imaging and cardiac investigations	18		
	7.3	8.1	Brain imaging	18		
	7.3	3.2	Vascular imaging	19		
	7.3	3.3	Cardiac investigations	19		
	7.4	Red	commendations	20		
8.	Hy	pera	cute Stroke Treatment	21		
	8.1	Intr	avenous thrombolysis	21		
	8.2	Thr	ombectomy	22		
	8.2	2.1	Transfer from ASC to CSC for thrombectomy	22		
	8.2	2.2	Repatriation	23		
	8.2	2.3	Interventional neuroradiology	23		

8.3	Mana	agement of intracerebral haemorrhage (ICH)	24					
8.4	Reco	mmendations	24					
9. Ac	ute str	oke care	26					
9.1	Provi	sion of 'the bundle' of care	26					
9.2	Acce	ss to stroke unit care	27					
9.3	End	of Life Care	28					
9.4	Reco	mmendations	29					
10. F	Rehabi	litation and long-term support	30					
10.1	Str	oke Rehabilitation	30					
10.	.1.1	Key principles of stroke rehabilitation	33					
10.	.1.2	Stroke Rehabilitation Service Provision	34					
10.	.1.3	The Rehabilitation Team	35					
10.	.1.4	Rehabilitation settings	35					
10.	.1.5 Wice	Key interventions delivered by a progressive stroke rehabilitation	36					
10.2	9000 Suu	ported Solf Management and Longerterm support	40					
10.2	Do		40					
10.5	Vorkfo		۲4 ۸۸					
11. V		Education and training	++ 11					
12 0			44					
12. C		ly	40 51					
13. A	CKNOV	viedgements	51					

1. Introduction

Stroke develops as a result of problems with the blood vessels supplying blood to the brain.

There were 3,754 deaths in Scotland in 2019 where cerebrovascular disease, including stroke, was the underlying cause. While there has been a decrease in deaths due to stroke over the last decade, it is important to note that it remains a leading cause of death and the leading cause of disability in Scotland¹. This highlights that there is still work to do to improve prevention of, and outcomes from, stroke and to ensure that people across Scotland have equitable access to treatment and care.

Stroke remains a national clinical priority for Scottish Government. The <u>2019/20</u> and <u>2020/21</u> Programmes for Government made a number of commitments on stroke, including commitments to develop a national thrombectomy service and to 'scope out and define what a progressive stroke service looks like'.

This document defines a progressive stroke pathway in the Scottish context and sets out a vision of stroke services in Scotland. It has been produced by the National Advisory Committee for Stroke (NACS) in collaboration with the groups and individuals outlined in <u>section 13 (Acknowledgements)</u> We are grateful to the many health care professionals who shared their expertise with us, and to the National Stroke Voices who shared their lived experience of stroke to support the development of this document. A refreshed Stroke Improvement Plan will follow to support in the delivery of this vision.

The infographic below depicts an overview of the 'Progressive stroke pathway' defined in this document. This pathway includes prevention, recognition of stroke, transfer to hospital, hyperacute and acute care through to rehabilitation and supported self-management.



Eligible for Thrombectomy:

1. Timely transfer to Comprehensive Stroke Centre 2. Care delivered within a stroke unit enabling increased monitoring post intervention. 3. Specialist staff with recognised training experience

4. Repatriation protocols in place

Acute Care

- 1. Delivery of stroke care bundle
- 2. Provision of care within stroke unit
- 3. End of life care where appropriate

1. Care provided within Stroke Unit if no surgical intervention required.

2. Engagement with local or regional neurosurgical teams where necessary.

Rehabilitation:

1. Started early in person's journey 2. Person-centred and holistic 3. Appropriate frequency and intensity 4. Provided by an interdisciplinary team 5. Delivered in appropriate setting 5. Appropriate follow-up 6. Supported self-management

There are number of principles underpinning delivery of a progressive stroke pathway. These include the principles of Realistic Medicine, the importance of good information technology (IT) and digital systems to facilitate seamless delivery of care, and an effective research environment.

1.1.1 Realistic Medicine and shared decision making

Delivery of a Realistic Medicine approach means ensuring that people who experience stroke are supported to take part in shared decision making about their treatment and care, to ensure that what matters to them is at the heart of the delivery of care throughout the whole pathway.

This should be incorporated into all aspects of the progressive stroke pathway. Specific shared decision-making tools, including those which facilitate sharing of individualised information about patients' diagnosis, prognosis and treatments and goal setting, can support such an approach.

Involvement of specific healthcare staff such as speech and language therapy for patients with communication difficulties, and clinical psychology for those with cognitive problems, can further enable communication and shared decision making.

1.1.2 Information technology (IT)

The delivery of a progressive stroke pathway is facilitated by digital health systems which facilitate networking between clinicians, the use of artificial intelligence (AI) in decision making, the ability to support the movement of patients across different NHS Boards and enable digital models of care to provide people with stroke access to remote care and self-management tools based on their needs and preferences.

In a progressive stroke pathway, stroke services should have access to systems which:

- Support shared electronic health record keeping, reduce duplication and allow information sharing across a network of care along the whole pathway.
- Plan, prompt and record important aspects of care digitally to optimise delivery whilst making best use of clinicians' time.
- Support secure communication (voice, video, text, shared documents and images) between clinicians working across networks.
- Alert a responsible clinician or team to referrals or abnormal investigations to maximise safety and minimise delays.
- Capture data in real-time for audit/quality improvement and monitoring as a by-product of clinical care.
- Support healthcare professionals in using "Tailored Talks". This is a tool which facilitates the provision of tailored digital information and/or signposting for patients, their relatives and carers.
- Establish electronic documentation for remote consultation outcomes (e.g. Clinical Portal) when cases are referred and discussed. An audit trail of

referrals, decisions and outcomes will help inform practice development and processes.

1.1.3 Research

Clinical research has an important function in delivering progressive stroke services. It helps to produce the knowledge on which to base more effective stroke services and ensures that healthcare staff are aware of the most up-to-date evidence and the latest developments in diagnostics and treatment. To facilitate continued clinical research activity, it is important to:

- Maintain the research infrastructures (e.g., University departments, NHS Research & Development, the Scottish Stroke Research Network (SRN) and Cochrane Stroke Review Group) which have helped make Scotland one of the leading countries for stroke research worldwide.
- Ensure that stroke patients and their families or carers can shape and participate in research in all parts of their pathway, wherever they are being cared for.

2. Governance

This vision document will be supported by a refreshed Stroke Improvement Plan, the delivery of which will be overseen by the National Advisory Committee on Stroke, and monitored through the Scottish Stroke Care Audit and Scottish Stroke Improvement Programme.

While Scottish Government sets the overall policy direction and vision, NHS Boards have a statutory responsibility for the delivery of health care within their area. It is therefore important that NHS Boards seek to deliver the vision outlined within this document, giving an equivalent level of prioritisation to stroke services as outlined by Scottish Government.

To achieve this requires that:

- NHS Boards have a clear management structure for stroke services relating to the whole patient pathway covering inpatients, outpatients and community services.
- Each NHS board should identify a member of their Senior Management Team to be accountable for the delivery of stroke services.
- Managed Clinical Networks (MCNs) should serve to coordinate professionals, services and organisations to ensure equitable, high quality clinical services.
- MCNs should operate with clear clinical and operational leadership to connect services via service pathways.
- Stroke services should coordinate across clinical, professional and service pathways, and be tailored to individual needs based on a range of personal, environmental and social factors.
- Stroke services should capture data which reflects performance in real-time, to support quality improvement activities.

- The NHS Board senior management team should take responsibility for ensuring that stroke services meet all important quality indicators within the Scottish Stroke Care Audit.
- NHS Boards should, where necessary, work collaboratively with other NHS Boards in the delivery of services. This is essential in the delivery of thrombectomy, which requires a national approach, and for thrombolysis, vascular surgery and sometimes TIA and rehabilitation services, which often require a regional approach.
- NHS Boards should work as part of integrated joint boards, alongside social care delivery partners and the third sector to deliver effective rehabilitation and supported self-management.

3. **Primary Prevention**

This refers to interventions aimed at reducing the risk of a stroke in people who have not yet had a stroke. This is distinct from secondary prevention which aims to reduce the risk of a recurrent stroke.

A progressive stroke pathway should focus preventative efforts on the identification and treatment of atrial fibrillation (AF) and raised blood pressure which are of specific importance to reduce the incidence of stroke. Secondary prevention (detection of AF or high blood pressure after stroke) is also important and more fully addressed within <u>Section 7.3: Access to imaging and other investigations.</u>

Actions on other risk factors for cardiovascular disease, including stroke, such as obesity (<u>A Healthier Future: Scotland's Diet & Healthy Weight Delivery Plan 2018</u>), smoking (<u>Raising Scotland's Tobacco-Free Generation: Tobacco Control Action Plan 2018</u>) and alcohol consumption (<u>Alcohol Framework 2018</u>: <u>Preventing Harm</u>) are covered by other Scotlish Government policy commitments and therefore are out of scope for this document.

Improving the primary identification and management of AF and blood pressure will involve a focus on improving data collection in primary care to better measure improvement, supporting community models of detection, and improving access to technology to support self-management.

3.1 Recommendations

- 1. Encourage improved detection, diagnosis and management of AF and high blood pressure, through quality improvement within primary care and community settings.
- 2. Support the development of pathways of care for AF which ensure prompt assessment and, where appropriate, treatments including anticoagulation, ablation and left atrial appendage occlusion to reduce the risk of future stroke.
3. Enable the use of proven technology to support detection, tele-monitoring and the provision of tailored self-management support for people with risk factors for stroke such as high blood pressure or AF.

4. Recognition and Referral

Raising and maintaining awareness of the symptoms of stroke and transient ischaemic attack (TIA) in the population, its recognition, and the need to immediately seek help are key to optimising treatment and outcomes.

4.1 Improving individual awareness and recognition of stroke

The FAST campaign is a UK wide awareness campaign designed to help detect and enhance responsiveness to the needs of a person having a stroke. The acronym stands for:

- Facial drooping
- Arm weakness
- **S**peech difficulties
- Time to call emergency services

Awareness campaigns should be shaped by evidence about what methods (e.g. TV/radio advertising, social media) most effectively reach target populations. It is especially important to consider how best to reach people who may face inequalities in access to information, or awareness of stroke. This includes:

- People for whom English is not a first language
- People living in areas of deprivation
- Younger people who may not be aware of their risk of stroke

4.2 Improving referral pathways

Early assessment and triage for people with stroke or TIA is important because the time windows for delivering the most effective interventions, such as thrombolysis, thrombectomy & commencement of secondary prevention, are measured in hours. The earlier treatment is started the more effective it is.

Most services in Scotland have a system in place to allow urgent patient referral for rapid specialist assessment, though unwarranted variation should be identified and addressed.

The National Stroke Voices highlighted the importance of raising awareness about recognition of stroke and TIA within primary care, and identified emergency departments as a key area for improvement. Targeted education on FAST and clear referral guidelines could support health care professionals to recognise symptoms and signs of stroke, including in circumstances where presentation may not be typical (for example where the FAST test might be negative, or where the person experiencing stroke is young).

4.2.1 Referral to TIA services

In instances where the symptoms of stroke have resolved rapidly and an acute stroke is not suspected, then the person should be referred into TIA services. Key aspects of these services are outlined in detail in <u>Section 5: TIA Services</u>. The most common sources of referral to TIA services will be from primary care, emergency departments, ophthalmology/optometry services, medical wards and Scottish Ambulance Service. Clear pathways should be in place for all referrers.

In some locations TIA telephone hotlines are in place which allow paramedics, primary care clinicians and emergency department professionals to talk directly to a stroke physician at the time of the patient first accessing healthcare. This enables early specialist intervention and treatment whilst the patient is waiting to have the diagnosis and treatment refined.

All patients referred to TIA services should be told that they must not drive for one month - as per <u>Driver and Vehicle Licensing Agency (DVLA) recommendations</u> - and should be advised regarding current regulations around resuming driving. This should be supported by a robust and rapid electronic referral system e.g., SCI gateway or TRAK workbench, which should prompt driving advice and secondary prevention prescription. These referrals should be monitored, or have notification systems, to ensure prompt appointing to specialist review.

4.2.2 Suspected acute stroke – taking prompt action

In instances where symptoms of stroke persist and an acute stroke is suspected, the patient should be transferred by ambulance to the nearest 'stroke ready' hospital – that is a hospital with facilities to scan patients, offer hyperacute treatment with thrombolysis and provide assessment of eligibility for thrombectomy.

There are 25 such hospitals across Scotland, 22 of these are Acute Stroke Centres (ASCs). The remaining three are Comprehensive Stroke Centres (CSCs), which in addition to the facilities described above, can also deliver thrombectomy and neurosurgical interventions.

All stroke centres will have stroke units unless they serve a very small population (such as occurs in remote and rural areas where the essential features of a stroke unit are delivered within a single ward area). This is <u>described in more detail in</u> <u>Section 9.2</u>.

In a progressive stroke pathway, it will be important to ensure ambulance response times are as short as possible, through appropriate assessment and prioritisation of emergency calls².

NHS 24 or 999 call handlers use algorithms to assess the urgency of calls and the likelihood that the person has had a stroke. Improved algorithms based on analysis of linked data about triage and resulting actual diagnoses could help reduce delays to effective treatments. Such an approach would be maximised by targeted training for call handlers in awareness and identification of stroke.

Ambulance crews should be supported with continued training in the most up-to date tools to improve diagnosis and assessment of the patients' need for hyperacute treatments and early secondary prevention.

Once the ambulance crew has made an assessment it is necessary to consider robust and transparent algorithms for the prioritisation of SAS resources, including air transfers, which take account of availability, the benefits and risks to the patient, the time urgency of the interventions and the cost effectiveness to ensure that the optimum improvement in outcomes from the available resources can be achieved. These should be developed through analysis of linked data from SAS and the Scottish Stroke Care Audit.

4.3 Recommendations

- 1. Effective campaigns to raise awareness of stroke and TIA, their impact on people who experience them, and tools for timely recognition should consider how best to reach people who may face inequalities in access to information, or awareness of stroke.
- 2. Support the use of FAST and work to embed other pre-hospital stroke tools particularly those which support assessment for hyperacute treatment - in a standardised way across NHS 24, primary care and SAS.
- 3. Improved algorithms and training for NHS 24 or SAS call handlers and crews should be deployed to support the assessment of the urgency of calls and the likelihood that the patient has had a stroke, and enable effective prioritisation of SAS resources, including air transfers.
- 4. Ensure appropriate referral of people with all stroke events, including those with acute ongoing symptoms, acute but resolved symptoms and other stroke-like events.
- 5. Referral systems should prompt driving advice and secondary prevention prescription.
- 6. All patients referred to TIA services should be told not to drive for one month (as per DVLA recommendations) at the point of referral and advised on current regulations for resuming driving.

5. TIA Services

Many people who develop mild or transient symptoms which might represent a TIA or mild stroke do not require immediate admission to hospital but do need specialist assessment by a clinician experienced in stroke care, early access to investigations and same day initiation of treatment to reduce the risk of a disabling stroke.

TIA services aim to offer these functions flexibly and provide access to support to reduce long-term risks and optimise the person's physical, psychological and social outcomes.

These services may be delivered in a variety of settings including, but not limited to, specialist TIA outpatients' clinics. However, people with suspected TIA can also be supported effectively through the provision of services within ambulatory care units, stroke units, or through rapid inpatient ward reviews. A proportion of patients with TIA are seen in an Emergency Department. These models of care, so long as they are supported by stroke specialists and have early access to investigations, or backup from a TIA clinic, can provide excellent care which minimises the risk of further stroke.

The Scottish Stroke Care Audit does not fully capture or monitor routinely activity which takes place outside of TIA clinics as it has proven challenging to capture data in these more varied settings. This should be addressed to enable us to understand and compare all models of care for people with TIA.

The performance of TIA clinics is currently monitored by the Scottish Stroke Care Audit which measures the proportion of patients seen in the TIA clinics within 4 days of referral. Whilst the majority of services meet the standard of 80%, there remain opportunities for improvement and to address variation.

As the risk of recurrent stroke is higher in the first day or two following a TIA, the faster a person can be seen the better. Therefore, the Scottish Stroke Improvement Programme will work with services across Scotland to minimise delays.

At present, the Scottish Stroke Care Audit measures the referral time to TIA services, but there is an opportunity to look in more detail at the care for people who have experienced a TIA. Therefore, development of a TIA bundle including times to important investigations and treatments should be included within the audit.

5.1 Specialist assessment

Specialist assessment for people with suspected TIA helps to expedite additional imaging where this is necessary and ensure that a diagnosis and treatment plan is refined and tailored to the individual's needs. This should take place in a timely manner, as specified by relevant clinical guidelines.

Where in-person specialist assessment cannot always be rapidly available, TIA services should consider how targeted access to local or remote stroke specialists (for patients meeting agreed criteria) can minimise delay to time-sensitive interventions.

Due to the Covid-19 pandemic many NHS boards had started to incorporate virtual assessments using telephone and Near Me into their assessments. This more flexible approach has led to reduced waiting times for specialist input in some areas. It is important to ensure that where virtual assessments are performed, patients should have the same access to rapid investigations and immediate secondary prevention as those who are seen face-to-face.

5.2 Investigations

People with suspected TIA or minor ischaemic stroke require timely access to investigations to confirm a diagnosis and guide treatment.

High risk TIAs and patients with uncertain presentations may be assessed as inpatients, and so rapid access to necessary radiology and cardiac investigations should be available in both outpatient and inpatient settings. There should be a robust system in place to ensure that the results of radiology and cardiac investigation results are available rapidly and are flagged to the responsible clinicians.

Full details of access to investigations for people with suspected TIA or stroke is outlined in <u>Section 7.3: Access to imaging and other investigations.</u>

5.3 Treatment and care

Where necessary, people seen in TIA services should be able to rapidly access appropriate support from a Multi-Disciplinary Team including speech and language therapy, occupational therapy, clinical psychology, orthotics, ophthalmology and orthoptics.

Some patients seen in TIA services turn out not to have had a TIA or stroke. Alternative pathways should be available if input is required from another specialist service. There should also be a system for rapid feedback to referrers when a person would not benefit from attendance at a TIA service, and clear communication of an alternative pathway or approach.

For people who are identified as having had a TIA, treatment involves access to secondary prevention medication and advice. All NHS Boards should therefore have accessible pathways and secondary prevention guidelines for TIA patient management, which should be up-to-date and responsive to change in the evidence base. These should ensure that:

- For TIA (with full recovery) antiplatelet agents and a statin should be commenced immediately (as per local guidance, including any necessary investigations) pending specialist review, unless specialist review is immediate.
- Guidelines should recommend which secondary prevention medication to prescribe but should also have a plan for situations where medication should not be stopped (e.g., for some cases anticoagulants after TIA).
- Secondary preventative medications should be immediately available e.g., from ward stock, hospital pharmacy or written prescription to take straight to a 24/7 chemist.

People who have experienced a TIA or minor stroke may also require advice or onward referral to support them in their longer-term self-management. The following should be available from the TIA service:

- Referral to addiction support teams
- Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
- Recommendations to optimise physical activity and reduce sedentary behaviour, including referral to exercise services where appropriate
- Referral to Dietetics
- Vocational advice and support
- Recommendations to support emotional and psychological wellbeing including referral to psychological services where appropriate

Communication between health professionals following TIA assessment is important. There should be a rapid electronic communication system back to the referrer following assessment in a TIA service. If using a traditional dictated letter system, then the letter should be sent electronically and within 48 hours of the specialist assessment.

It is important that referrers are made aware of individual treatment targets:

- Remote blood pressure monitoring should be available where required e.g., FLORENCE programme or 24-hour ambulatory monitoring
- Selected patients may benefit from more aggressive lipid management aiming for lower LDL targets where appropriate, pathways should be in place for this e.g., a pharmacist led stroke lipid clinic, primary care follow up system.
- Furthermore, any request to referrer to make urgent prescribing changes or other key changes to management should be transmitted immediately.

Following discharge from TIA services, patients who have experienced TIA or minor stroke should receive lifelong follow-up in primary care and long-term conditions monitoring. This will require ongoing education to support primary care professionals with:

- Current best practice for longer-term care of TIA or stroke survivors
- Managing stroke in people with co-existing conditions

• Current guidance and pathways for referring a person back to stroke services

Follow up appointments for people who have experienced TIA should be available when needed, potentially through the TIA clinic or a stroke liaison nurse team.

5.4 Recommendations

- 1. People with suspected TIA should have specialist assessment by a clinician experienced in stroke care, early access to investigations and same day initiation of treatment to reduce the risk of further stroke.
- 2. Where in-person specialist review cannot always be rapidly available, TIA services should consider how to enable access to local or remote stroke specialists for patients meeting agreed criteria.
- 3. There should be appropriate pathways in place for onward referral of people who have had neither stroke nor TIA but require input from another specialist service.
- 4. All NHS Boards should have accessible pathways and secondary prevention guidelines for TIA patient management.
- 5. TIA services should support the following, where required:
 - Referral to addiction support teams
 - Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
 - Recommendations to optimise physical activity and reduce sedentary behaviour, including referral to exercise services where appropriate.
 - Referral to Dietetics
 - Recommendations to support emotional and psychological wellbeing including referral to psychological services where appropriate
 - Vocational advice and support
- 7. The Scottish Stroke Care Audit should develop a TIA bundle which takes account of the varied models of providing care for people with TIA.

6. Transfer to Hospital

Most patients with symptoms of acute stroke will be transferred to hospital by the Scottish Ambulance Service (SAS). In general, SAS transport patients with suspected hyperacute stroke to the nearest hospital which can provide thrombolysis (Acute Stroke Centre).

Transfer to hospital is a vital part of a progressive stroke pathway. There are important opportunities to:

- Improve pre-hospital diagnostic accuracy including assessment of eligibility for hyperacute treatments, enabling possible bypass of the local Acute Stroke Centre (sometimes referred to as a spoke hospital in the thrombectomy pathway) to a Comprehensive Stroke Centre (sometimes referred to as a thrombectomy hub).
- Provide receiving clinicians with information to enable quick decision making upon arrival at hospital.

6.1 Improving pre-hospital assessment

It is important to continue providing training and support to ambulance crews in the use of pre-hospital clinical assessment tools and to explore the use of more detailed tools or technologies which might improve diagnostic accuracy and triage for stroke, TIA and the identification of people potentially suitable for thrombolysis and thrombectomy.

Improving pre-hospital assessment of people who would benefit from hyperacute treatment will reduce time to treatment by ensuring that they can be quickly placed on the pathway for the most appropriate treatment.

It is also important that ambulance crews have the capacity to seek advice from stroke specialists to support with triage and diagnosis while a patient is being transferred. This can be provided via telestroke services. For example, there have been pilot projects indicating that providing ambulance crews with access to specialist support via a Professional to Professional audio and/or video call can enhance the pre hospital diagnostic accuracy and decision making with respect to TIA and stroke.

6.2 Pre-Alert

Ensuring that appropriate information is available to clinicians receiving the patient at the hospital enables quicker decision making and enables timely access to imaging and treatment upon arrival.

Pre-alert refers to the sharing of information about a patient with the hospital during transfer by an ambulance crew. Through our review process, hospital clinicians highlighted the vital importance of the pre-alert including patient identifiers such as the CHI number, name and date of birth. Despite this, the reviews identified that there is variation in appropriate pre-alerting of patients with stroke, and of the information included with the pre-alert.

At present, there is a lack of timely data available from NHS boards and sites, concerning the number of patients with suspected hyperacute stroke that are prealerted by SAS. This in turn means that there is no robust measure to ensure the correct patients are being taken to the most suitable hospital, and then placed on the most appropriate pathway. It is therefore important to have access to better information about pre-alerting across Scotland, to address variation and to improve pre-alerting in general.

6.3 Recommendations

- 1. To improve pre-hospital assessment ambulance crews should continue to be trained and supported in the use of pre-hospital clinical assessment tools.
- 2. The use of more detailed tools or technologies, which might improve diagnostic accuracy and triage for stroke, TIA and the identification of people potentially suitable for thrombolysis and thrombectomy, should be explored.
- 3. Telestroke systems should be available for use in ambulances and air transport to enable professional-to-professional calls to support ambulance crews in decision making regarding hyperacute stroke.
- 4. A single communication platform should facilitate voice, data and video communication between paramedics, ambulance control, stroke physicians in ASCs and CSCs, stroke nurses and interventional radiologists.
- 5. Communication of patient identifiers during pre-alert should be enabled to support timely decision making and improve time to treatment upon arrival at hospital.
- 6. A mechanism should be developed to provide routine feedback of confirmed diagnosis and treatment pathway to SAS to support staff development and improve performance and patient pathways.

7. Assessment and diagnostics

Early assessment and diagnosis are vital to ensuring that people can receive prompt and appropriate treatment, thus improving their chances of positive outcomes.

7.1 Interface between stroke services and emergency departments

Seamless joint working between stroke services and emergency departments is paramount for optimal patient care and outcomes in the acute stage of the stroke pathway.

To minimise delays to assessment and treatment for people with stroke, emergency department services should include:

• Systems supporting pre-registered imaging requests from the stroke team clinicians.

- Staff competent in acute stroke management and familiar with thrombolysis and thrombectomy eligibility criteria and pre-transfer procedures, checklists and processes.
- Video links for optimal virtual communication between the emergency department and stroke teams, where required.
- Senior stroke decision maker and senior leadership involvement at the front door to minimise door-to-needle times for thrombolysis e.g., straight to CT protocols.
- Systems and resources agreed with SAS to minimise door in, door out times for patients eligible for thrombectomy.
- Goal of minimising inappropriate or futile transfers to the CSC for thrombectomy.
- "Straight to MRI protocols" for some strokes where this is the most appropriate imaging modality.
- Agreed stroke mimic pathways where non stroke patients are cared for out with the stroke service, when possible, enabling efficient use of stroke beds and workforce.

Performance and protocols should be audited, and cases reviewed.

7.2 Assessment of eligibility for hyperacute treatment

People with suspected acute stroke should be assessed immediately to determine the best approach to treatment. This is particularly important for identifying people who would benefit from specific hyperacute stroke treatments such as thrombolysis and/or thrombectomy.

Assessment for emergency hyperacute stroke treatments should be undertaken by a stroke specialist clinician without delay. In locations where that specialist clinician is not available on site then telestroke services should provide access to specialist assessment and decision making.

Telestroke involves the use of mobile technologies to provide audio and/or video calls between patients and local and remote healthcare professionals. It has a major role in improving access to hyperacute specialist care, decision making and the safe delivery of hyperacute treatments.

Electronic documentation for remote consultation outcomes (e.g., Clinical Portal) should be established. An audit trail of referrals, decisions and outcomes will help inform practice development and processes.

Telestroke can be used to support filtering and triage of referrals from remote sites into designated stroke units and reduce delays in time critical decisions, including on the delivery of appropriate treatments and identification of patients not suitable for specific interventions or transfer to another site.

Eligibility for thrombolysis should be guided by available clinical support tools. Further information on thrombolysis is included in <u>Section 8.1: Intravenous</u> <u>Thrombolysis</u>. Eligibility for thrombectomy should be guided by available clinical support tools. Patients who are identified as eligible for thrombectomy should be transferred to the relevant CSC for further assessment to confirm eligibility and to receive this intervention. They should then be admitted to a stroke unit to receive appropriate post intervention monitoring and care. Further detail on the core components of the delivery of thrombectomy are outlined in <u>Section 8.2: Thrombectomy</u>

The majority of patients with acute stroke will not be eligible for thrombolysis or thrombectomy. The key focus for these patients is ensuring access to the stroke bundle, including care within a designated stroke unit. Full information on this is included in <u>Section 9: Acute Stroke Care</u>.

7.3 Access to brain and vascular imaging and cardiac investigations

The role of diagnostic imaging and other investigations in stroke management is integral to achieving the best outcomes by supporting time critical decision making.

7.3.1 Brain imaging

For people with acute stroke Computed Tomography (CT) of the brain is a useful tool in detecting recent bleeding in and around the brain and can sometimes detect ischaemic changes present as a result of thrombotic stroke. CT Angiography (CTA) and CT Perfusion (CTP) are important in identifying large vessel occlusion, collateral circulation and salvageable tissue for reperfusion interventions. Magnetic Resonance Imaging (MRI) is particularly useful in detecting early or minor ischaemic changes, previous bleeding and can also be used to assess the blood vessels and salvageable brain tissue³.

Decision support systems based on Artificial Intelligence (AI) can provide clinicians and radiologists with very early access to the results of imaging, on laptops or even mobile phones. These platforms support them in the immediate interpretation of the images to confirm the diagnosis and identify a large vessel occlusion and thus speed up the appropriate decision making to refer a patient for hyperacute treatment or not^{4,5}.

However, it is important to recognise that AI is not a standalone decision-making technology and therefore, the process of using AI for decision support should be closely supported by radiology professionals. Formal reporting of images within 24 hours is important as a governance and learning tool.

The additional logistical link in delivering thrombectomy (patients are transferred to a CSC for this treatment) requires a clear plan between the ASC (spoke) and CSC (hub) regarding investigations to avoid duplication and minimise time to treatment. It also requires effective acquisition, transfer and interpretation of images between the ASC and CSCs.

There is also a need to ensure adequate imaging resources in ASCs and CSCs to cope with increasing numbers of patients needing assessments to determine

eligibility for thrombolysis or thrombectomy. Improved access to advanced imaging will maximise the number of patients who present on waking, or present late, to receive thrombolysis and/or thrombectomy⁶.

7.3.2 Vascular imaging

Imaging of the arteries and veins supplying the brain is not only important to determine suitability for thrombectomy but also guides the use of medication, interventional neuro radiology and surgery to reduce risks of stroke recurrence.

All ASCs and CSCs should have a pathway for carotid vascular imaging (using Carotid Doppler and/or CTA or MRA), enabling early identification of vascular pathology and rapid access to the vascular Multi-Disciplinary Team (MDT) to inform secondary prevention strategies where indicated.

- Carotid Ultrasound +/- CTA or MRA should be used for carotid imaging when required
- Where carotid stenosis is detected, there should be rapid access to a vascular MDT
- Carotid intervention should be performed within the standard time as recommended and monitored by the Scottish Stroke Care Audit – a Carotid Co-ordinator role may help this process

7.3.3 Cardiac investigations

Post-stroke cardiac investigations are important for identifying an underlying cardiac cause of stroke, such as AF or Patent Foramen Ovale (PFO). When judged to be required by the stroke specialist there should be early access to prolonged cardiac monitoring to detect paroxysmal AF. Prolonged cardiac monitoring should be carried out and reported within two weeks.

Cardiac rhythm monitoring systems should, where technically possible, have realtime reporting of paroxysmal AF with immediate notification of the service to allow verification of the diagnosis and, if appropriate, immediate anticoagulation. Where patients need anticoagulation, there should be a pathway in place for early anticoagulation with counselling and monitoring systems.

For patient work up for PFO, there should be 'soon' access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal echocardiography with a pathway in place ensuring that PFO closure is carried out within six months of the index stroke.

Monitoring of Boards' ability to perform cardiac investigations for people with stroke within these time frames will be via the Stroke Action Plan and Scottish Stroke Improvement Programme team.

7.4 Recommendations

- 1. People with suspected acute stroke should be assessed for hyperacute stroke treatments by a specialist clinician without delay.
- 2. Where telemedicine is used for the rapid assessment of people with suspected stroke, the system should include the option of a high-quality video link.
- 3. Staff providing care via telemedicine should be appropriately trained in hyperacute stroke assessment, the delivery of thrombolysis and the use of this approach and technology.
- 4. All stroke services should have access to CT, CTA, and CTP on a 24/7 basis whether the patient is an inpatient or outpatient.
- 5. Departments offering CT, CTA, CTP and MRI should have systems in place which ensure that patients with stroke or TIA are prioritised appropriately in order to enable rapid access to these time-sensitive investigations.
- 6. When the stroke specialist feels that brain imaging is required in patients attending the TIA service, there should be same day access to this. MRI will usually be the preferred imaging modality in TIA/minor stroke patients who require a brain scan.
- 7. Where the above investigations are not delivered within one location, stroke services should have a clear plan for a) assessing the gain in outcome if a transfer takes place, and b) enabling a transfer for investigations where the outcome would be improved.
- 8. Where AI is used to support interpretation of imaging and enable timely decisions around transfer for thrombectomy, formal reporting of all radiology investigations should take place the following working day after the investigation is conducted.
- 9. Each stroke service should have a pathway in place enabling same day access to MRI in instances where this would be the most appropriate imaging modality.
- 10. There should be nationally agreed imaging protocols to be followed by ASCs and CSCs for non-contrast CT, CT Angiography (CTA) and CT perfusion (CTP) to avoid duplication.

- 11. All stroke centres should have a clear pathway ensuring that carotid imaging and intervention is performed within the standard time as recommended and monitored by the Scottish Stroke Care Audit. A Carotid Co-ordinator role is recommended to support delivery of this pathway.
- 12. People who have experienced stroke should have access to cardiac investigations including:
 - Prolonged cardiac monitoring to identify paroxysmal AF (within two weeks)
 - Access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal echocardiography with a pathway in place ensuring that PFO closure is carried out within six months of the index stroke.
- 13. IT systems should be in place which highlight that the results of tests are available to the referring clinician. This enables prompt action to be taken on the results of the investigation.

8. Hyperacute Stroke Treatment

For some people, treatment of stroke within the first few hours can include treatments such as thrombolysis and thrombectomy. These are aimed at unblocking the artery. Both have the potential to greatly reduce the brain damage caused, and thus improve functional outcomes and probably survival.

Early blood pressure lowering, in some cases of intracerebral haemorrhage (ICH) may be beneficial and continues to be researched.

The earlier these treatments are given, the more chance the person will have of an improved outcome. Therefore, stroke services need to be configured to minimise any delays and maximise the proportion of patients suitable.

Patients receiving these treatments require more intensive observation and monitoring to minimise risks and identify complications early when they can be most effectively treated. Therefore, post intervention, they should be cared for in a stroke unit enabling close, non-invasive monitoring of physiological parameters to detect the early complications of treatment and of their stroke.

Assessment to determine eligibility for these treatments is outlined in <u>Section 7.2</u>: <u>Assessment of eligibility for hyperacute treatments</u>. This section will therefore focus on the logistics of delivering these treatments as quickly as possible once a patient has been identified as eligible.

8.1 Intravenous thrombolysis

Outcomes from ischaemic stroke treated with thrombolysis are time critical and can be improved by minimising the delay from stroke onset to thrombolysis treatment. There are a number of performance measures within the Scottish Stroke Care Audit relating to the delivery of thrombolysis, and performance measures for thrombectomy are in development.

Thrombolysis is carried out at 22 ASCs and 3 CSCs in Scotland. There is variation in the proportions of patients receiving thrombolysis and variation in door-to-needle time between hospitals.

In most hospitals offering thrombolysis the door-to-needle times are much shorter during normal working hours than at other times. However, in services where a stroke nurse is involved in "pulling" the patient through the pathway, or where specialist stroke doctors are available in person out of hours, door-to-needle times tend to be shorter overall, and the difference between in and out of hours is minimised. This reinforces the importance of adequate stroke specific staffing, including the important role played by stroke nurses⁷.

8.2 Thrombectomy

The most severe 10-20% of acute ischaemic strokes are due to a large vessel occlusion (LVO). Restoring blood flow with early thrombectomy, sometimes referred to as clot retrieval, significantly reduces dependency^{8,9}. In some cases, thrombolysis is given prior to the thrombectomy procedure.

Approximately 800 cases per annum in Scotland, 10% of all stroke presentations, could be treated by a 24/7, Scotland wide, thrombectomy service¹⁰.

Geographical modelling recommends three CSCs (sometimes called Thrombectomy hubs) serving 22 ASCs (sometimes referred to as spoke hospitals) where patients are first taken to their nearest ASC to be diagnosed, scanned, receive thrombolysis if appropriate, and then be transferred to a CSC for thrombectomy. This is known as the 'drip and ship model'¹¹.

There is a planned incremental development of services across the three CSCs (Queen Elizabeth University Hospital, Glasgow, Royal Infirmary of Edinburgh and Ninewells Hospital, Dundee) aiming for 24/7 availability across Scotland by 2023.

It will be important, as the service develops, that monitoring of referrals to the service is followed closely and accounted for in future service planning. This is because the number of people eligible for thrombectomy may increase due to advances in imaging, technology and research.

8.2.1 Transfer from ASC to CSC for thrombectomy

The transfer of patients between hospitals is an aspect of the thrombectomy pathway which can introduce delays to this time critical treatment. Therefore, it is important that safe, efficient and timely transfers take place.

An important aspect of transfer is ensuring agreed and robust communication processes and modalities for discussing cases between ASC, CSCs and the interventional neuro radiologists (INRs) /interventional radiologists (IRs) who will be

carrying out the procedure. It is vital that adequate infrastructure is in place for effective and reliable communications between all relevant teams and health boards.

Utilisation of electronic devices (using 4G/5G), capable of real time information sharing between the thrombectomy nurse escort (based at the ASC hospital), the ASC and CSC stroke physicians and INR/IR which integrate with patients' electronic health records would improve workflows and patient safety. Back-up systems (such as airwave radio systems) should be in place for when primary modes of communication fail or become unreliable due to connectivity or unplanned downtime.

The use of a mobile communication platform is currently being explored by the Thrombectomy Advisory Group (TAG)¹.

8.2.2 Repatriation

People who receive thrombectomy initially require intensive monitoring and support after the intervention in a stroke unit in the CSC until they are deemed to require less intensive care and are suitable for transfer to a stroke unit in the ASC. This is known as repatriation. Repatriation enables patients to receive as much of their care near their own home as possible. Prompt repatriation is vital to maintain flow and for CSCs to continue to take incoming referrals from ASCs.

It is important that there are shared protocols between CSCs, ASCs and the SAS for the delivery of agreed, safe and efficient repatriation. Decisions around repatriation after thrombectomy should be guided by the readiness for repatriation checklist, developed by TAG.

8.2.3 Interventional neuroradiology

Imaginative and flexible workforce solutions will be essential in a globally competitive employment market due to a shortage of specialist trained INRs. Incentivising rotas and job plans may be a partial solution if Scotland is to be an attractive workplace for specialist trained staff. Features of a sustainable interventional neuroradiology/radiology service for thrombectomy will include^{12,13,14}:

- A volume of work at CSCs that satisfies the agreed numbers for maintaining competency and training¹⁵ - training may involve remote mentoring and simulation technology-based teaching.
- Credentialing, supported by interventional neuroradiologists (INRs), may be necessary to train sufficient operators to populate 24/7 rotas across Scotland and enable cover of non- stroke INR work e.g., aneurysm coiling.
- Workforce planning futureproofed for the anticipated increase in workload once a service has commenced and the inevitable effect of extending time windows for intervention as advancements in therapies emerge.

¹ The Thrombectomy Advisory Group is a national group tasked with overseeing the delivery of a national thrombectomy service in Scotland.

- Cognisance that 60% of potential cases will present out of hours work patterns, job plans and rotas will need to reflect this in order to provide equity of access and avoid the "weekend effect".
- Adoption of cutting-edge technological innovation including advancements in AI and neurointerventional robotic solutions.
- Opportunities to participate in research and teaching.

8.3 Management of intracerebral haemorrhage (ICH)

Strokes due to intracerebral haemorrhage (ICH) represented 12% of stroke admissions in Scotland in 2019. Mortality rates and disability remain disproportionately high within this group worldwide¹⁶.

A progressive stroke service should aim to improve outcomes for this group of patients. Hyperacute stroke services for ICH should include^{17,18,19,20}:

- Expert supportive care on a stroke unit, aiming for consistent and optimal care and close observation for signs of deterioration²¹.
- Care that reflects emerging best evidence for reducing secondary brain injury
- Consideration of the adoption of care bundles to help consistency and reduce variation by standardising processes of care.
- Incorporate evidence-based interventions where available.
- Early communication with local or regional neurosurgical teams where the patient is at risk of developing hydrocephalus or other complications amenable to neurosurgical intervention²¹.
- Rapid anticoagulant reversal protocols responsive to emerging evidence as up to 20% of ICH cases occur in patients taking anticoagulant medication²².
- If required, the delivery of appropriate end of life care, consistent with the approach outlined in <u>Section 9.3: End of Life Care</u>, and the avoidance of harm and unintended limitations of care by ensuring timely senior level decision making regarding advanced care planning.

8.4 Recommendations

- 1. All patients eligible for thrombolysis should receive the intervention with the minimum delay. Therefore, there should be a sustained drive to improve door-to-needle times across Scotland.
- 2. Telestroke networks should be developed to support hospitals in achieving optimal thrombolysis treatment numbers and door-to-needle times.
- 3. There should be time efficient pathways and agreed processes for thrombectomy in place at all ASCs and CSCs to optimise patient outcomes and limit patient exclusions in those with ischaemic stroke due to LVO.

- 4. The provision of mobile communication platforms and adequate mobile technology will enable stroke physicians and INR/IRs to interpret hyperacute imaging remotely.
- 5. There should be nationally agreed pathway documentation, in digital and paper format, to facilitate movement of patients between NHS Boards and regions and to reduce duplication of imaging and investigations.
- 6. For patients referred for thrombectomy the door in, door out time in ASCs should be minimised.
- 7. Patients eligible for thrombectomy should be transferred to the CSC via the quickest and safest transport means available as determined by SAS.
- 8. Staff carrying out thrombectomies unsupervised should have completed recognised training and should perform a sufficient number of interventional procedures per annum to maintain their competencies.
- 9. The door-to-puncture time at thrombectomy hubs should be as short as is safely possible.
- 10. There should be agreed and sustainable rotas for anaesthetic staff, INRs/IRs, stroke physicians and theatre staff supporting the thrombectomy service.
- 11. There should be agreed, safe and efficient repatriation protocols in place between the CSCs and ASCs to ensure optimal patient flow.
- 12. There should be continuous review of the thrombectomy service model, processes of care and referral criteria as the evidence base grows. Regular multi-professional governance meetings should take place across Scotland with the intent of optimising learning for all involved in the process and embracing a culture of quality improvement.
- 13. Stroke services should have protocols for the monitoring, referral and urgent transfer of patients to regional neurosurgical centres.
- 14. A focus should be placed on improving outcomes for people with intracranial haemorrhage. This may be achieved by the adoption of care bundles to help consistency and reduce variation by standardising processes of care.

9. Acute stroke care

9.1 Provision of 'the bundle' of care.

The majority of people who experience a stroke will not be eligible to receive hyperacute treatments such as thrombolysis or thrombectomy. The emphasis of care for the majority of stroke patients, is therefore to deliver the stroke bundle.

There are four components to the bundle:

- Swallow screen (100% within 4 hours of arrival, and before any food, fluids or oral medication is administered)²³, we believe this reduces the risk of pneumonia, dehydration, malnutrition and death.
- Brain imaging (90% within 12 hours accepting that hyperacute patients require a scan as soon as possible after arrival), since confirmation of the stroke diagnosis and distinguishing strokes due to ischaemic and bleeding has wide-reaching effects on management from the earliest stages.
- Aspirin for those with ischaemic stroke (95% on day or admission or following day) which is a very simple and almost universally applicable treatment which improves patients outcome.
- Admission to stroke unit (90% on day of admission or following day) which reliably provides a wide range of targeted interventions. This reduces the risks of complications, improves the patients' experience and is known to improve functional outcomes and reduce mortality.

In general, brain imaging and aspirin standards are met across Scotland. However, there remains significant challenges in swallow screen and access to stroke units. Consequently, the overall adherence to the stroke bundle performance remains low.

Where patients are at risk of post stroke complications (e.g., infection, venous thromboembolism, dehydration, malnutrition, pressure sores), and depending on the established aims of treatment, patients should receive evidence-based interventions such as parenteral fluids, early tube feeding, intermittent pneumatic compression and antibiotics. At present, delivery of these important aspects of stroke care is assessed through sprint audits within the Scottish Stroke Care Audit or local audits. These have demonstrated variable delivery. Such audits had to rely on review of paper or electronic health records which identifies issues in delivery only in retrospect.

TRAKcare, the electronic health record used across Scotland does not support the sort of data capture, extraction and analysis to provide real-time data on delivery of important aspects of stroke unit care. An improved approach is required where failures of delivery are identified in real time, when they can be rectified to avoid patient harm. However, IT systems which are available to do this for only certain aspects of care (e.g. delivery of the National Early Warning System (NEWS) of observations to avoid in hospital deterioration and cardiac arrest) are not currently

used to provide improvements in delivering specialty specific aspects of care, such as those in a stroke unit.

9.2 Access to stroke unit care

Stroke unit care is the central feature of a modern stroke service²⁴. As it can benefit most stroke patients, even those who also undergo hyperacute treatments, it is important that the important role of stroke unit care within hospitals is recognized and supported²⁵.

Through engagement with the National Stroke Voices, we heard that receiving care in a stroke unit was important to people.

"My treatment was much better and much more focused when I was placed in the Stroke Unit" – National Stroke Voices participant.

Every stroke patient should receive the core service characteristics of stroke unit care²⁶ from initial assessment to discharge from hospital²⁷. Key features of a stroke unit in a progressive stroke pathway should include:

A geographically-defined unit

- A co-ordinated multi-disciplinary team that meets at least once a week for the exchange of information about in-patients with stroke.
- Information, advice and support for people with stroke and their family/carers.
- Management protocols for common problems, based upon the best available evidence.
- Close links and protocols for the transfer of care with other in-patient stroke services, early supported discharge teams and community services.
- Training for healthcare professionals in the specialty of stroke.
- The provision of holistic assessment of need for every patient which incorporates the views of patients and their families, which informs decisions about care.
- All interactions and interventions are carried out under a person-centred approach.

Although the core features are well described, services have sought to deliver stroke unit care in a variety of different ways²⁸. The size and configuration of stroke units depends on factors such as rurality and the other services and resources available within the local area.

Of the 22 ASCs, the seven smallest general hospitals in Scotland define stroke unit admission as entering the appropriate acute medical ward. While this means that the hospitals do not meet the first criteria of a geographically defined unit, they should meet all other criteria outlined above. In some instances, this may mean that remote stroke specialist support is required to provide early specialist assessments and a coordinated, regular multi-disciplinary team meeting. This is an appropriate response to maintaining local services, and reduced time to thrombolysis, for people with stroke in these areas.

The Scottish Stroke Care Audit 'bundle' reflects access to stroke unit care and shows that this is currently variable between health boards and sites. There are marked variations in the size of stroke units, their staffing levels (medical, nursing, allied health professionals, clinical and neuropsychologists and social work staff) and the training of those staff.

While every stroke patient should have access to stroke unit care as defined above, in some instances, patients may require more intensive care. This is the case for those who undergo thrombectomy. In such instances, those people should receive care within a stroke unit which can also provide:

- Specialist staffing and technology that provide close clinical and continuous physiological monitoring for all, and especially those at higher risk of early deterioration or complications.
- Seamless working with intensive care units and high dependency units where required.
- Continuous access to a consultant with expertise in stroke medicine, with consultant review seven days per week.
- Immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the hyperacute management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

These features are often available within a hyperacute stroke unit (HASU) where patients often stay for just the first couple of days, or a hyperacute bay within a stroke unit.

All stroke services should have protocols for the monitoring, referral and urgent transfer of patients, where there is a risk of patients requiring neurosurgical intervention, to regional neurosurgical centres.

Systems of joint working should be developed to establish broadly agreed referral criteria for carefully selected cases, e.g., those patients who might benefit from decompressive hemicraniectomy for malignant middle cerebral artery (MCA) syndrome.

As outlined in the introduction of this paper, supporting shared decision making helps to ensure treatments are delivered which are most likely to deliver the outcome valued by the patient and/or family. This remains important in the acute and hyperacute phases and is likely to be optimised by early involvement of senior clinicians with access to systems to share tailored information with patients and their family.

9.3 End of Life Care

About one in 20 people with acute stroke will be receiving end-of-life care within 72 hours of onset, and one in seven people with acute stroke will die in hospital²⁹.

Therefore, providing high quality end-of-life care should be a core activity for the multi-disciplinary stroke team. The key aim is to appropriately and holistically manage distress associated with the end-of-life experience for the person and the family/carers, in line with guideline advice³⁰.

Patients with severe stroke resulting in a high risk of death or poor functional outcome, should be involved at an early stage in shared decision making about the aims of treatments including cardiopulmonary resuscitation, critical care, hemicraniectomy, and treatments to reduce the risk of serious complications. Where the patient lacks capacity then next of kin or advocate should be involved.

Advanced care planning should take place for those people who may survive the acute stroke with limited life expectancy, to facilitate timely referral to specialist palliative care services, where required³¹.

9.4 Recommendations

- 1. Patients with acute stroke should have their clinical status monitored closely and managed according to clinical guidelines.
- 2. Stroke services should deliver the stroke bundle, meeting the Scottish Stroke Care Audit Standards for:
 - Swallow screen
 - Brain imaging
 - Provision of aspirin for those with ischaemic stroke
 - Admission to stroke unit
- 3. Healthcare professionals responsible for the assessment and management of patients with acute stroke should be trained in how to position and mobilise patients in a way that is safe and consistent with clinical guidelines.
- 4. Acute stroke patients should be managed in a stroke unit that meets the core requirements outlined in Section 9.2.
- 5. A stroke unit should have continuous access to a consultant with expertise in stroke medicine, with consultant review 5 days per week.
- 6. Staff working in stroke units should have completed the necessary training as outlined in the national educational template and should follow standardised management protocols for the assessment & management of acute stroke according to clinical guidelines.
- 7. Staff working in stroke units should have access to IT systems which optimise the reliability of assessments and treatment delivery.

- 8. People with rehabilitation needs should be assessed by a therapist and ongoing management planned according to clinical guidelines and in line with the progressive vision of rehabilitation outlined in Section 10.
- 9. Services providing acute and ongoing care for people with stroke should provide high quality end-of-life care for those who need it, including advanced care planning and timely access to specialist palliative care if required.
- 10. All stroke services should have protocols for the monitoring, referral and urgent transfer of patients, where there is a risk of patients requiring neurosurgical intervention, to regional neurosurgical centres.
- 11. In addition, for patients who require closer monitoring:
 - A so called hyperacute stroke unit or area which is providing close monitoring of patients post thrombectomy should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week.
 - These units should in addition have immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

10. Rehabilitation and long-term support

10.1 Stroke Rehabilitation

People who have had a stroke should have access to high quality, evidence-based, person-centred stroke rehabilitation which reflects their needs and preferences. Stroke rehabilitation aims to optimise function, reduce disability, promote independence and work alongside people and their families to achieve meaningful outcomes³². It helps people to be as independent as possible in everyday activities and enables participation in education, work, recreation and meaningful life roles. An inter-disciplinary team approach to stroke rehabilitation is essential, with the individual and their family or carers at the centre and given the opportunity to see the right professional at the right time to support their needs.

The United Nations has set out the right of people with disabilities to have access to rehabilitation to achieve participation and inclusion in all aspects of life³³. The World Health Organisation Rehabilitation in Health Framework highlights a tiered approach to rehabilitation which should be community based and focussed on the needs of the population³⁴.

Access to rehabilitation should be equally available to those in urban and remote and rural areas and across socio-demographic areas, using technology to deliver when appropriate.

Stroke rehabilitation should be based on a holistic biopsychosocial approach which seeks to understand the interactions of a diverse range of factors in a person's presentation (i.e. biological, psychological and social factors). This is essential for defining the aims of rehabilitation and to ensure that interventions are appropriate for, and meet the needs and preferences of, the individual. This shared understanding promotes interdisciplinary working between health and social care professionals to support effective and efficient stroke rehabilitation services³⁵.

The foundations of a progressive stroke rehabilitation service are underpinned by a holistic rehabilitation model and appropriate service infrastructure, leadership and expertise, as depicted in the infographic below.

Holistic Model of Stroke Rehabilitation (Williams, Hamilton & Evans, 2021)



The core elements of rehabilitation include person-centred care, the setting of personal goals, and supported self-management. Personalised and evidence based therapeutic interventions delivered by stroke specialists should be offered to support recovery, adaptation to new functional status, and to support self-management and longer-term health and wellbeing.

10.1.1 Key principles of stroke rehabilitation

Person-centred - Person-centred care is about treating people as individuals and working with them to develop the knowledge skills and confidence to manage and make decisions about their own health and social care needs. Rehabilitation should be personalised, co-ordinated and enabling, and above all ensure that people are treated with dignity, compassion and respect³⁶. Person-centred rehabilitation considers the person's needs, capacity, preferences, wishes, values, lifestyle, environment, family and social circumstances. The rehabilitation team works in partnership with them to understand their priorities and to develop solutions.

Personal goals - Goal setting is the process by which the person with stroke (and their family or carers if they wish) and members of the stroke team identify individual goals which are meaningful, challenging and have personal value³⁷.

Supported Self-management - A person-centred approach in which the individual is empowered and has ownership over the management of their life and condition.

Co-ordinated Services- Areas in which Managed Clinical Networks (MCN's) operate with clear clinical and operational leadership are more able to connect services via clear service pathways. Stroke rehabilitation services should co-ordinate across clinical and service pathways and be tailored to individual needs based on a range of personal, environmental and social factors.

Rehabilitation team - Expertise from an interdisciplinary team who work in partnership with the person who has had a stroke and who collectively tailor rehabilitation input towards the person's goals. Where appropriate, this partnership should include family and carers.

Clinical Leadership - Clinical and service leadership should be provided by senior allied health professionals, medical and nursing staff, ensuring an equal focus on hospital and community rehabilitation pathways.

Appropriate care setting - In-patient rehabilitation is required for people with complex physical, cognitive, psychological and/or social needs, who could not be supported in a community setting. Rehabilitation of stroke patients in hospital should occur in an integrated stroke unit (a mixed acute and rehabilitation ward) or a specialist rehabilitation area. Early supported discharge (ESD) and community stroke

rehabilitation services should be offered in a community setting whenever that best meets the needs and wishes of the patient.

Evaluation - Data on service delivery, patient outcomes and experiences should be collected systematically³⁸. Outcome measures used should be standardised, valid and reliable³⁹ as well as being focused on what matters to patients^{40,41}. The effectiveness of progressive stroke rehabilitation services will be reviewed via the Scottish Stroke Improvement Programme utilising rehabilitation data from the Scottish Stroke Care Audit and by at least one annual review.

10.1.2 Stroke Rehabilitation Service Provision

Stroke rehabilitation services should include inpatient rehabilitation, ESD and community stroke or neuro rehabilitation teams who work closely to ensure services are delivered in the most appropriate setting for each person's needs. This relies on having the right infrastructures in place, including sufficient access to rehabilitation professionals and close links with social care and the voluntary sector as part of an MCN.

Rehabilitation for people with stroke in all settings should ensure:

- That people receive a holistic assessment to determine their rehabilitation needs as quickly as possible.
- That the delivery of rehabilitation takes place in the most appropriate setting and at the right time for that person's needs.

To achieve this, stroke rehabilitation plans should be agreed and initiated in the acute phase and be available, according to need, along the entire stroke pathway.

The duration of stroke rehabilitation services should be led by the needs of the person who has had a stroke and be defined by their goals and should not be time limited. A clear life-long pathway for people to be able to re-engage with stroke rehabilitation services and to re-access specialist support should be available to patients and families⁴².

It is important that families and carers are included in rehabilitation planning and goal setting, if agreed by the person who has had the stroke. If agreed, then carers should be

- Included in assessments to identify needs.
- Provided with tailored information about stroke and the caring role.
- Provided with advice, access to emotional support to adjust to their caring role and maintain their wellbeing.
- Signposted to peer support to reduce the impact of loneliness and social isolation if required.

Evidence supports increased frequency and intensity of therapy especially in the first six months post-stroke which can improve recovery rate and outcome. Provision of greater amounts of stroke therapy is associated with higher therapy and nursing staffing levels, a weekend therapy service and specialist stroke rehabilitation teams⁴³. Stroke rehabilitation services should therefore be available as required across the pathway seven days per week at an appropriate intensity with appropriate workforce skill mix.

Factors which impede the amount of therapy provision include time spent in information exchange and administration. Patient focussed reorganisation of working practices including shared documentation, and individual patient therapy timetabling is recommended to enable therapy provision in line with clinical guideline recommendations⁴⁴.

10.1.3 The Rehabilitation Team

Stroke rehabilitation services must include regular access to an inter-disciplinary team who work in a co-ordinated manner and collaborate towards common goals.

The inpatient stroke rehabilitation team should include stroke specialists in medicine, nursing, occupational therapy, physiotherapy, speech and language therapy, and dietetics. It should also ensure timely access to other specialist clinical services as required, such as orthotics, pharmacy, orthoptics, and social work. The psychological, emotional and cognitive effects of stroke should be understood and supported by the whole team. Specialist input from clinical psychology and neuropsychology should also be part of the core team and service provision throughout the patient journey from acute to longer term.

ESD and community stroke/neuro rehabilitation teams should include occupational therapy, physiotherapy, speech and language therapy, nursing and neuro/psychology, with easy access to other professionals as required.

Rehabilitation and recovery should be embedded within all aspects of stroke rehabilitation by all team members on a 24/7 basis. Teams should work to engage people in as much therapeutic activity (including specialist therapy interventions and self-practice) as required at a frequency and intensity that enables them to reach their rehabilitation goals.

The stroke rehabilitation environment should facilitate patient engagement in a range of physical, cognitive and social activities out with formal therapy time. This can be supported by staff, carers and volunteers. This whole system approach to stroke rehabilitation should be promoted to improve recovery and rehabilitation outcomes⁴⁵.

10.1.4 Rehabilitation settings

Inpatient stroke rehabilitation is required for those who have complex physical, cognitive and psychological needs which are unable to be managed in a community setting.

Community stroke rehabilitation can be offered by a range of services including ESD and community stroke/neuro rehabilitation teams, with varying intensity for up to seven days per week depending on the individual's needs.

All hospital in-patients with stroke who have mild to moderate disability should have the opportunity for early supported discharge⁴⁶ which enables rehabilitation to commence in their home environment within one working day of hospital discharge and at an intensity and frequency that would be provided if they remained in hospital. To enable this, strong links are required between the inpatient and community rehabilitation teams^{47,48}.

Regardless of the health board in which the patient receives acute stroke care, it is important that rehabilitation is provided in their local area. This should be facilitated by effective communication and clear referral pathways between health boards.

To ensure equitable access to ongoing support and self-management resources, all those who have had a stroke or TIA should be provided with high quality, tailored information at the point of discharge from outpatient clinic, emergency department or hospital and be followed up as soon after discharge as possible and thereafter, as indicated by the individual's needs, by a community stroke nurse or other stroke specialist healthcare professional to provide further specialist advice and support.

Everyone with residual difficulties following a stroke on discharge from hospital should be provided with a documented plan for community rehabilitation and self-management support.

In addition, everyone who has experienced a stroke should receive a review by a stroke specialist health care professional within six months of their event.

10.1.5 Key interventions delivered by a progressive stroke rehabilitation service

Many aspects of stroke rehabilitation require a tiered approach whereby aspects of care are the responsibility of the whole interdisciplinary team with specialists within the team focusing on more complex presentations. Each stroke rehabilitation network should have clearly defined pathways about how these services are provided.

Activities of Daily Living

Activities of daily living (ADL) include personal activities, e.g., washing and dressing; domestic activities, e.g., cooking and housework, and extended activities, e.g., work, driving and leisure. People experiencing difficulty with ADLs should be seen by an occupational therapist for assessment and the implementation of a personalised intervention programme. Evidence supports continued ADL training from occupational therapy and interventions can include direct training in an activity, training in adapted methods of performing an activity and the training in the use of adaptive equipment, assistive technology and environmental adaptation to maintain independence⁴⁹.

Arm function

Rehabilitation interventions that comprise intensive, graded practice of tasks and activities that focus on an individual's goals have been shown to be effective⁵⁰.

Progressive arm rehabilitation, usually provided by occupational therapists and physiotherapists, comprises comprehensive assessment, person-centred goal setting and the provision of a structured, goal-orientated programme of intensive practice. This may include assistive technologies (e.g., functional electrical stimulation, mirror-box therapy and virtual reality⁵¹) as well as involving their affected arm in activities of daily living as much as possible in order to increase the intensity of meaningful practice and to improve outcomes.

Bowel and Bladder rehabilitation

Bladder and bowel dysfunction (including urinary incontinence, faecal incontinence, constipation and nocturia) are common and can be persistent following stroke but are amenable to rehabilitation intervention. Progressive rehabilitation will feature structured assessment by a nurse to identify the type of bladder/bowel dysfunction, agreement of individual goals and a programme of mainly behavioural interventions targeted to the type of dysfunction, to support active recovery of bladder/bowel function and use of the toilet. Regular review of the rehabilitation programme and avoidance of containment approaches (including indwelling catheters) are key to recovery of independent bladder/bowel functioning and toilet use⁵².

Balance, walking and mobility

Problems with balance, walking and mobility are likely to increase the risk of falls, deconditioning, becoming housebound and social isolation. People who have had a stroke should have their mobilisation needs assessed and once medically stable, they should be assisted to mobilise, overseen by a physiotherapist. Walking training should be task specific and include a cardiovascular component. Treadmill training with or without body weight support can improve walking and should be available for those who are able to walk independently⁵³. For those who are not able to walk independently⁵⁴ and this technology should be made available. Early access to orthotic assessment for the provision of an ankle foot orthosis (AFO) should be available, with reassessment when necessary, in order to facilitate walking and prevent falls. Functional electrical stimulation (FES) should be available to facilitate gait and prevent falls in those with persistent mild lower limb weakness.

Communication

Post-stroke communication disorders occur frequently. Aphasia and dysarthria each affect around a third of people following a stroke. People who are identified as having a communication disorder after a stroke should be assessed by a speech and language therapist and provided with an individualised rehabilitation programme using evidence-based interventions⁵⁵ to reduce the impairment and/or support functional improvement and long-term adaptation. Such interventions may include

group work, computer-based therapy, assistive technology and conversation partner training⁵⁶.

Cognition

Cognitive impairment is common following a stroke and can have a significant impact on social recovery and re-integration with overall poorer rehabilitation outcomes. Services should have a documented pathway for the identification and assessment of cognitive problems. Cognitive rehabilitation should be integrated into the broader rehabilitation programme and goals should include cognitive rehabilitation interventions with the aim of restoring, compensating or adapting for reduced cognitive ability.

Driving

A documented pathway should be available to advise on national and local services for further assessment and advice about resuming driving or alternative mobility options. Stroke service should ensure that driver status and intention to return to driving should be ascertained and advice and tailored information is made available.

Fatigue

Fatigue is commonly reported following stroke and can impact on longer term recovery and wellbeing. A range of physical and mental factors may contribute to fatigue and a documented pathway for the identification and assessment of fatigue and its impact on activity and participation should be available. Rehabilitation programmes should include strategies to anticipate and manage fatigue as well as education for patients and families/carers.

Pain management

Pain following stroke can be due to several causes including neuropathic pain, musculoskeletal pain and shoulder pain and subluxation. Each element requires specialised assessment and a range of evidence-based interventions which should be available in documented pathway.

Physical activity, exercise and fitness training

Physical activity, exercise and fitness training should be provided through partnerships between health and exercise professionals, the third sector and local authority services. Exercise and fitness training should begin, as appropriate, in hospital and continue in the community⁵⁷. It should be provided by therapists or exercise professionals who have evidence of stroke specific knowledge and skills to adapt and tailor exercise programmes for people after stroke.

Physical activity should also be encouraged. Many people who have had a stroke experience barriers to becoming more active and sedentary behaviour tends to persist after stroke^{58,59}. Evidence-based counselling strategies are effective to

encourage stroke survivors to engage and maintain physical activity after stroke⁶⁰ and these should be provided as required along the entire stroke pathway.

Posture and movement – spasticity services

Stroke services should implement a systematic approach to identify all those who need specialist spasticity assessment and treatment. Stroke services should also implement a documented programme for prevention and management, including self-management, of post stroke spasticity. All those who need it will have access to a specialist spasticity service which may include Botulinum toxin injections, electromyography (EMG) or ultrasound guided approach, appropriate clinical expertise to deliver, and co-ordinated multidisciplinary community follow up including occupational therapy, orthotics and physiotherapy.

Positioning and seating

Following stroke, many people will find it challenging to control their position when in bed and when sitting in a chair. Effective positioning and seating is essential for reducing the risk of aspiration, falls, skin breakdown, and contracture development in addition to providing maximum comfort and supporting participation in ADL. All staff from statutory and voluntary sector organisations and carers involved along the whole pathway should be aware of correct positioning. People with stroke, their carers, and all services should have access to clinicians with training in postural management. Appropriate beds, specialist chairs and positioning equipment should be available from inpatient and community rehabilitation services when required.

Psychological Care (cognitive and emotional)

In the aftermath of stroke, patients and families experience a wide range of psychological, cognitive and emotional difficulties which impact profoundly on function and rehabilitation.

Stroke services should implement a documented programme for promoting awareness of, screening for and treatment of psychological consequences of stroke, led by a specialist clinical/neuropsychologist as detailed in the National Model of Psychological care for stroke⁶¹. Psychological care should be available to all patients in line with local delivery plans.

Relationships and sexuality

Sexuality includes physical and psychosocial aspects of intimacy. Approximately 50% of individuals experience sexual dysfunction following stroke⁶², however it is not commonly included as part of a rehabilitation programme⁶³. Services to address these aspects of life after stroke are variable and professional education is lacking. Education with regards to sexuality following stroke should be provided to the stroke rehabilitation team and specialised support should be made available to those who require it.

Swallowing

Post-stroke swallowing difficulties (dysphagia) are common and can persist longterm. Management of such difficulties should be led by a dysphagia specialist, such as a trained speech and language therapist (SLT), and should include evidencebased rehabilitation and restorative strategies which aim to improve oropharyngeal function. Management of swallowing difficulties will additionally include compensatory strategies, swallowing manoeuvres, sensory modification and texture modification of food and fluids as appropriate. All interventions should take into consideration the factors which may limit ability to participate, such as physical and cognitive impairment, as well as encompass shared decision-making and a shared responsibility for management of risk. There should be access to instrumental assessments such as videofluoroscopy and flexible endoscopic evaluation of swallowing (FEES) to determine the specific rehabilitation programme/management approach. There should also be pathways for people with long-term dysphagia to reaccess services for review.

Technology and tele rehabilitation

Stroke rehabilitation services should include the use of robotics and software programmes which support rehabilitation interventions as appropriate.

Vision

Comprehensive assessment and rehabilitation services should be provided to all those with visual problems due to their stroke including:

- Comprehensive visual screening completed before discharge.
- Direct referral to appropriate professionals for assessment of suspected visual problems.
- Follow up to determine the level of spontaneous recovery of visual problems.
- Provision of treatment and rehabilitation, tailored to the specific visual problems by the most suitable profession in that locality (this may vary across NHS and Social Care areas).
- Provision of tailored information and clear explanation of visual problems, and their possible impact, at each possible opportunity.
- Ensuring individuals have knowledge of, and access to, relevant low vision services initiating direct referral if required⁶⁴.

Vocational rehabilitation

Stroke rehabilitation services should identify work status and offer advice, signposting and referral for specialised return to work support as appropriate. A documented pathway should identify local and regional access to specialised vocational rehabilitation services.

10.2 Supported Self-Management and Longer-term support

Supported self-management and longer-term care & support should be an integral element of stroke rehabilitation pathway⁶⁵ and should be provided in partnership with health, social care and the voluntary sector.

Supported self-management is a core component of person-centred care and is an interdisciplinary approach which supports people to develop skills, knowledge, and confidence to manage the impact of stroke and to maintain an ability to engage in meaningful activities and life roles.

Not everyone who experiences a stroke or TIA will have ongoing rehabilitation needs identified at the time of their discharge. However, feedback from people with lived experience was that often, this meant that there was a missed opportunity to identify routes to access support.

Everyone who experiences a stroke or TIA should receive tailored information provision and be signposted to community-based support and advice. It is important that people who have had a stroke or TIA are provided with the necessary skills, resources and support to continue self-management in the longer term along with management of other long-term conditions they may have⁶⁶.

There is considerable variation across the country in the longer-term support for people who have had a stroke. This may comprise nurse or other healthcare professional follow up, peer support groups and exercise classes. In some places these aspects of care are provided directly by NHS stroke services, in others they are commissioned from charities including Chest Heart and Stroke Scotland (CHSS) and the Stroke Association.

Primary care services are the main source of medical care for stroke survivors in the longer-term after their stroke. It is common practice that routine annual reviews for people with stroke take place alongside reviews of other long-term conditions. In addition, people who have had a stroke identify health issues that arise and contact primary care services for assessment.

Primary and secondary care services should communicate effectively to enable the provision of patient-centred care, for example primary care may identify a further rehabilitation need and refer the person back to the community rehabilitation team.

People with lived experience of stroke highlighted that a key issue was the lack of a 'joined up' approach, and outlined how important it would be to have a person who could support them by signposting to advice and support services, and act as a point of return for when issues arose further down the line in their journey.

"'One of the big aspects is going to be having someone who is responsible for ensuring that the service is joined up. I think that's what's missing" – National Stroke Voices participant.

It is therefore important that people who experience stroke are provided with clear and easily accessible contact information once discharged from community services, enabling the provision of continued advice, support and signposting. A clear life-long pathway for people to be able to re-engage with stroke services and re-access specialist support should be available to patients and families⁶⁷.

To ensure equitable access to ongoing support and self-management resources every person who has had a stroke should be contacted by a community stroke nurse or other appropriate stroke professional as soon as possible following their discharge from outpatient clinic, emergency department or hospital to provide review and an opportunity to access specialist advice and support⁶⁸.

10.3 Recommendations

- 1. Stroke rehabilitation services should be underpinned by a holistic rehabilitation model, appropriate service infrastructure, clinical leadership and expertise.
- 2. Stroke rehabilitation in all settings should be person-centred and optimise outcomes with evidence-based interventions, enabling appropriate long-term support and self-management.
- 3. Rehabilitation should be a process that begins as soon as a stroke is diagnosed and continues as long as required. The duration of stroke rehabilitation should be needs led and not time limited.
- 4. An early holistic assessment of a person's rehabilitation needs should be provided by specialist stroke teams and a personalised, documented rehabilitation and self-management plan agreed with the person who has had a stroke and, if they wish, their family/carers.
- 5. Stroke rehabilitation services must include a specialised and coordinated team who work in an interdisciplinary manner and collaborate towards common, person-centred goals.
- 6. The psychological, emotional, cognitive effects of stroke should be understood and supported by the whole team. Specialist input from clinical psychology and neuropsychology should be part of the core team and service provision throughout the patient journey from acute to longer term.
- 7. Evidence based stroke rehabilitation services should be available in inpatient and community settings seven days per week at an appropriate intensity, with an appropriate workforce skill mix.

- 8. Each stroke rehabilitation network should have clearly defined pathways about how key stroke rehabilitation interventions and services are provided.
- 9. Stroke rehabilitation services should be provided as part of a managed clinical network which includes inpatient rehabilitation services, ESD and community stroke or neuro rehabilitation teams who work closely with social care and the voluntary sector to ensure services are delivered in the most appropriate setting for each person's needs and ensure equity of service provision across all geographical and socio demographic areas.
- 10. Inpatient stroke rehabilitation is required for those who have complex physical, cognitive and psychological needs which are unable to be managed in a community setting.
- 11. Community stroke rehabilitation can be offered by a range of services with a range of intensities according to individual needs, including Early Supported Discharge and community stroke / neuro rehabilitation teams.
- 12. Clinical and service leadership should be provided by senior allied health professionals, medical, nursing and neuropsychology staff, ensuring an equal focus on hospital and community rehabilitation pathways
- 13. Every person who has had a stroke should be followed up by a community stroke nurse or other appropriate healthcare professional, as soon as possible following discharge from hospital and thereafter, as indicated by the individual's needs, ideally in their own home.
- 14. A clear lifelong pathway for people to re-engage with stroke rehabilitation services and re-access specialist support should be available to patients and families
- 15. A formal review should also be carried out for everyone who has experienced a stroke, six months post event, to provide another opportunity to access specialist advice and support, regardless of the rehabilitation needs identified at the time of their discharge from hospital.
- 16. People who have had a stroke should be signposted to relevant resources and support to continue self-management in the longer term along with management of other long-term conditions they may have.
- 17. Demonstration of a person-centred approach should be evaluated via the approach used by stroke rehabilitation services to deliver activities which are deemed to be central to person centred care e.g., regular holistic assessment of need; goal setting; supported self-management and family/carer involvement, as well as the patient experience of these activities and the
treatment and communication they experience with the professionals working with them.

11. Workforce

The quality of stroke services provided is hugely dependent on the availability of knowledgeable, skilled and experienced healthcare professionals. This is influenced by access to high quality education and supported learning, and staff turnover.

Stroke services should provide specialist medical, nursing, allied health professional neuropsychology, and other rehabilitation staffing levels matching the Royal College of Physicians ⁶⁹ and British Association of Stroke Physicians Guidelines⁷⁰.

It is recognised that there is significant attrition of stroke trained staff from acute stroke rotas and services and retention of trained staff remains a challenge for future service provision. It is imperative that burnout risk is minimised in a speciality with unpredictable intensity and requiring complex decision making. To support this, it will be necessary to:

- Ensure that working patterns and staffing levels, especially for healthcare staff contributing to out of hours care, are sustainable to attract and retain staff.
- Consider novel remuneration rates for unsociable hours which may save on external locum costs for rota gaps.
- Ensure that there are adequate levels of support staff and access to IT to optimise the efficiency of clinical staff and optimise patient facing time.

Through the review process for this document, staffing available to deliver equitable rehabilitation services was raised as a concern, with particular reference to limited access to psychology & neuropsychology services across the country.

The rehabilitation workforce challenges mean that in practice, few stroke rehabilitation services are able to offer a seven-day service with appropriate intensity. To be able to provide a progressive stroke rehabilitation service these workforce challenges should be addressed.

11.1.1 Education and training

Stroke services should have an education programme for all staff providing acute, hyperacute stroke care and rehabilitation.

There is currently a national education template which outlines the training required for staff involved in the care of stroke patients. It is important that all NHS boards enable staff involved in delivery stroke care to undertake the education outlined by this template. Dedicated trainers can support this.

- All professional groups potentially dealing with hyperacute patients should have been trained in core stroke competencies, STAT+, STARS Advanced Modules and Hyperacute stroke treatment decision making for clinicians.
- Stroke physicians and radiologists should have up to date training in advanced imaging for stroke.
- Training should be supported by rolling educational plans with blended learning, web based and simulation-based training.
- Training should include a focus on supporting staff with having difficult conversations.
- Regular national educational sessions will support shared learning amongst professional groups.
- Education development framework with clear career progression opportunities important for retaining staff.
- Mentoring for junior staff, opportunities to rotate into other parts of the stroke pathway or undertake secondments and gain wider knowledge and appreciation of their role within the entire system.

To support health boards to deliver effective training and education, at a national level, there will be a continued:

- Investment in developing and maintaining interactive online training which can be accessed at the convenience of the learner.
- Delivery of live training sessions which can be delivered remotely via an appropriate online platform (e.g., MS Teams) to a large live audience across many NHS Boards, and also be recorded for others to access later.
- Coordinated national training programmes tailored to each group of healthcare staff involved in stroke services.

NHS Boards should keep records of the staff working within stroke services, their training needs and training received. When new staff join a stroke service their training needs should be identified and a plan made to meet those needs promptly.

12. Glossary

ACTATS (Acute CTA for Thrombectomy in Stroke): An online training package aimed at stroke clinicians and radiologists to help them interpret CT (see computerized tomography) & CTA (see computed tomography angiography) in the context of thrombectomy.

Acute Stroke Centre: A hospital which has staffing and facilities to acute assess acute stroke patients, carry out an early CT brain scan and deliver thrombolysis. They will also have a stroke unit, or equivalent facility for ongoing care of stroke patients.

AF: Atrial Fibrillation is an irregular and often very rapid heart rhythm (arrhythmia) that can lead to blood clots in the heart. AF increases the risk of stroke.

AFO: Ankle Foot Orthoses are external biomechanical devices utilized on lower limbs to stabilize the joints, improve the gait and physical functioning of the affected lower limb.

AI: Artificial intelligence: In the context of stroke services this term refers to digital systems which provide a rapid interpretation of brain imaging, and communication of the images and its interpretation to those involved in delivering time sensitive stroke treatments.

Aneurysm coiling: a procedure performed to block blood flow into an aneurysm (a weakened area in the wall of an artery).

Aphasia: a disorder of language which can affect speech, reading and writing. It's usually caused by damage to the left side of the brain.

Botulinum toxin injections: Botulinum toxin can help to relax overactive muscles for a short period of time. During this time a therapy programme can be implemented to stretch shortened muscles and stiff joints. This may help improve function e.g., walking or grip, or could help care staff manage personal hygiene.

Carotid endarterectomy: An operation to remove the narrowing in a carotid artery to reduce the risk of future stroke.

Carotid Ultrasound: Carotid ultrasound is an imaging test that uses high-frequency sound waves to create pictures of the inside of carotid arteries. It is used to identify patients who may benefit from carotid endarterectomy or angioplasty and stenting

CHI number: Community Health Index number is a unique patient identifier used across Scotland. The first 6 digits include the patient's date of birth.

CSC: A Comprehensive Stroke Centre is a hospital which in addition to the facilities of the ASC can also provide thrombectomy and neurosurgery with associated critical care support.

CT: A computerized tomography (CT) scan combines a series of X-ray images taken from different angles around your body and uses computer processing to create cross-sectional images (slices) of the inside of the body.

CTA: Computed tomography angiography (CTA) uses an injection of contrast material into your blood vessels and CT scanning to help diagnose and evaluate blood vessel disease or related conditions.

CTP: Computed tomographic perfusion (CTP) imaging is an advanced modality that can aid in diagnosis, management, and prognosis of acute stroke patients by clarifying acute cerebral physiology.

Decompressive hemicraniectomy: A surgical treatment for cerebral oedema (when the brain swells, causing an increase in pressure). Has been performed for several different pathologies, including malignant middle cerebral artery syndrome, one of the most widely recognized large vessel strokes.

Door In, Door Out time: The delay between a patient's arrival at an Acute Stroke Centre (ASC) and their departure from that hospital to go to a Comprehensive Stroke Centre (CSC) for thrombectomy.

DTN: Door-to-Needle Time is the delay between arrival at a hospital and the administration of a bolus of thrombolysis medication.

Dysarthria: Slurred speech caused by disturbance of muscular control.

Dysphagia: Medical term for swallowing difficulties.

Endovascular therapy: Minimally invasive procedures that are done inside the blood vessels.

ESD: Early supported discharge services comprise a stroke specific interdisciplinary team and sufficient care staff to allow hospital admitted stroke patients to be discharged home earlier than otherwise to continue their rehabilitation in the community

Flexible endoscopic evaluation of swallowing (FEES): FEES is a procedure designed to assess swallowing function through visualization of the pharyngeal and laryngeal (throat) structures.

FLORENCE: Flo or Florence is a simple telehealth system that uses text messages to support patients to manage their high blood pressure and related aspects of health.

FES: Functional Electrical Stimulation is a treatment that uses small electrical charges to produce muscle activity or a muscle contraction.

Hydrocephalus: a build-up of fluid around the brain, which increases pressure and can cause brain damage.

Integrated Joint Boards: Bodies that lead the planning of health and social care services. IJB's commissions the local authority and health board to deliver services in line with a strategic plan.

Interdisciplinary team: a group of professionals from a range of disciplines who work in a coordinated manner toward the same goal for the patient

Intermittent pneumatic compression comprises sleeves wrapped around the legs which are inflated regularly to squeeze the legs, increasing blood flow to reduce the risk of blood clots in the legs).

Interventional Neuroradiologists: doctors who specialise in minimally invasive treatment of neurovascular disease including thrombectomy

Interventional Radiologists: Doctors who performs image guided procedures, fully interpret the imaging required to guide and monitor response of those procedures, as well as provides the pre and post procedural care for those patients receiving procedures including thrombectomy.

LDL: **Low density lipoprotein** (LDL) cholesterol is often referred to as "bad cholesterol" because too much is unhealthy.

Large Vessel Occlusion a blockage in one of the major arteries of the brain which may be opened up with thrombectomy.

Managed Clinical Networks: linked groups of health professionals and organisations from primary, secondary and tertiary care, working in a co-ordinated manner to ensure equitable provision of clinically effective services throughout Scotland.

MRA: Magnetic resonance angiography (MRA) uses a powerful magnetic field, radio waves and a computer to evaluate blood vessels and help identify abnormalities.

MRI: Magnetic resonance imaging (MRI) is a type of scan that uses strong magnetic fields and radio waves to produce detailed images of the inside of the body.

Musculoskeletal pain is pain which affects the muscles, ligaments, tendons, and bones.

Mirror-box therapy: a rehabilitation therapy in which a mirror is placed between the arms or legs so that the image of a moving non-affected limb gives the illusion of normal movement in the affected limb.

Multi-disciplinary team: a group of professionals from one or more clinical disciplines who together make decisions regarding recommended treatment of individual

Near Me: A secure form of video consulting approved for use by the Scottish Government and NHS Scotland.

Neuropathic pain: Neuropathic pain is often described as a shooting or burning pain. It often is the result of nerve damage or a malfunctioning nervous system.

Neurosurgery: Specialty concerned with the diagnosis and treatment of patients with injury to, or diseases/disorders of the brain, spinal cord and spinal column, and peripheral nerves within all parts of the body.

Nocturia: The medical term for excessive urination at night.

Orthoptics: Allied health professionals who specialise in the diagnosis and nonsurgical management of eye problems that affect eye movement and the development of vision.

Orthotics: Allied health professionals who make and fit braces and splints (orthoses) for people who need added support for body parts that have been weakened by injury, disease, or disorders of the nerves, muscles, or bones.

Patent Foramen Ovale: A hole in the heart that didn't close the way it should after

Post stroke spasticity: Following stroke, muscles may become stiff, tighten up and resist stretching. This is called spasticity.

SCI Gateway: Scottish Care Information (SCI) Gateway is a national system that integrates primary and secondary care systems using highly secure Internet technology. SCI Gateway enables GPs to access SCI services on-line.

Scottish Stroke Care Audit: An audit coordinated by Public Health Scotland. Measures the performance of stroke services against national standards

STAT+, STARS Advanced Modules: Professional training:

STAT+: Stroke and Transient Ischaemic Attack (TIA) Assessment Training (STAT) and STAT+. Training incorporates simulated scenarios to improve the emergency response to stroke and TIA.

STARS: Stroke Training and Awareness Resources. An e-learning resource providing a learning tool for health and social care staff to enable them to become more knowledgeable and skilful in the area of stroke care.

Stroke: Occurs when the blood supply to part of the brain is interrupted and brain cells are starved of oxygen. **Ischaemic strokes** occur when a blood clot blocks the flow of blood. A **haemorrhagic stroke** can happen when blood from an artery begins bleeding into the brain after a blood vessel bursts.

Subluxation: Shoulder subluxation happens when the upper arm bone, called the humerus, becomes partially dislocated from the shoulder socket. This condition starts when the muscles around the shoulder become weak or paralyzed after stroke.

Telestroke: A service which uses telephone, video conferencing and access to Picture Archiving and Communication System (PACS) to allow clinicians to remotely assess patients to enable the clinician to advise on management.

Thrombectomy: The physical removal of a thrombus (clot) which is blocking an artery causing a stroke.

Thrombolysis: The use of medicine which dissolves blood clots and restores blood flow to the brain.

Transient Ischaemic Attack (TIA): A temporary disruption in the blood supply to part of the brain. The symptoms last only minutes or hours.

TRAKCare: An electronic health record management system which is available in all NHS Boards.

Treadmill training: Used to aid walking rehabilitation with or without the use of body weight support

Transthoracic echocardiogram: The most common type of echocardiogram, which provides a moving image of the internal parts of the heart using ultrasound.

Transoesophageal Echocardiography: A type of echocardiogram where a small probe is passed down the throat into the gullet and stomach.

Transcranial Doppler: A test that uses sound waves to detect medical problems that affect blood flow in the brain.

Triage: The assignment of degrees of urgency to illnesses to decide the order of treatment of a large number of patients.

Vascular surgery: Vascular surgeons are trained in the diagnosis and management of conditions affecting the circulation, including disease of the arteries, veins and lymphatic vessels.

Venous thromboembolism: Blood clots that can develop in the deep veins in the legs or pelvis and can travel to the lungs to cause pulmonary embolism.

Videofluoroscopy: Assesses swallowing ability. It takes place in the X-ray department and provides a moving image of swallowing in real time.

13. Acknowledgements

This document has been delivered through contributions of a number of individuals during the Covid-19 pandemic. We are grateful for their support and contributions and pay special thanks to;

Scottish Government

Katrina Brennan MBE Professor Martin Dennis Thérèse Lebedis OBE Neil Muir Dr Fiona Wright Susan Wallace Kylie Barclay John Wilson

National Stroke Voices Lived Experience Group.

Thrombectomy Advisory Group

Sub Group advisors (Pre- Hospital, TIA, Hyperacute, stroke unit, rehabilitation and long-term support)

Craig Henderson Dr Stephen Makin Karen Garrott **Dr** Alison Brooks Dr Gareth Clegg **Prof Mark Barber** Sandi Haines Dr Gethin Williams Dr Neil Hunter Dr Helen Slavin Dr Gareth Blayney Dr John Reid Dr Ronnie Burns Dr Luke Yates Dr Matt Lambert Dr Mary Joan Macleod **Dr Tracey Baird** Elizabeth Barrie Dr Anthony Byrne Linda Campbell **Christine Carter** Dr Vera Cvoro **Prof Peter Langhorne**

Dr Christine McAlpine Keri-Ann Van-Nuil Dr Richard O'Brien Anne Armstrong Dr Fiona Brodie Professor Jo Booth **Gillian Crighton** Gillian Capriotti Andrea Cail Dr Emma Coutts Dr Charlie Chung Dr Alastair Cozens Dr Jackie Hamilton Dr Christine Hazelton Lesley Kane Dr Lisa Kidd Dr Ashish Macaden **Dr Alex Pollock Dr Lesley Scobbie** Mark Smith Prof. Frederike van Wijck Dr Luke Williams

¹ Public Health Scotland, (2021), *Scottish Stroke statistics - Year ending 31 March 2020*, available at <u>https://publichealthscotland.scot/publications/scottish-stroke-statistics/scottish-stroke-statistics-year-ending-31-march-2020/</u>, accessed 1st November 2021.

² Royal College of Physicians, (2016), *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition, available at https://www.strokeaudit.org/Guideline/Full-Guideline.aspx, accessed 1st November 2021.

³ Ajay Bhalla, Mehool Patel, Jonathan Birns, (2021), An update on hyper-acute management of ischaemic stroke, *Clinical Medicine*, 21 (3) pp 215-221

⁴ Hassan AE, Ringheanu VM, Rabah RR, et al, (2020). Early experience utilizing artificial intelligence shows significant reduction in transfer times and length of stay in a hub and spoke model, *Interventional Neuroradiology*, 26(5): pp 615-622.

⁵ Murray NM, Unberath M, Hager GD, et al (2020), Artificial intelligence to diagnose ischemic stroke and identify large vessel occlusions: A systematic review, *Journal of NeuroInterventional Surgery*, 2020, 12(2): pp 156-164.

⁶ Thomalla G, Boutitie F, Ma H, et al, (2020), Intravenous alteplase for stroke with unknown time of onset guided by advanced imaging: systematic review and meta-analysis of individual patient data, *Lancet,* Nov 14; 396(10262): pp 1574-1584.

⁷ McDermott M ,Skolarus LE ,Burke JF, (2019), A systematic review and meta-analysis of interventions to increase stroke thrombolysis, *BMC Neurology*, May 3;19(1): pp 86

⁸ Mortimer A, Lenthall R, Wiggam I, et al, (2021), To support safe provision of mechanical thrombectomy services for patients with acute ischaemic stroke: 2021 consensus guidance from BASP, BSNR, ICSWP, NACCS, and UKNG, *Clinical Radiology*, 76(2).

⁹ NICE,(2019), Stroke and transient ischaemic attack in over 16s: diagnosis and initial management NICE guideline: NG128, available at

https://www.nice.org.uk/guidance/ng128/chapter/Recommendations#thrombectomy-for-people-withacute-ischaemic-stroke, accessed 25th October 2021.

¹⁰McMeekin P, White P, James MA, et al, (2017), Estimating the number of UK stroke patients eligible for endovascular thrombectomy, *European Stroke Journal*, Dec;2(4): pp319-326.

¹¹ Zhang L, Ogungbemi A, Trippier S, et al, (2021), Hub-and-spoke model for thrombectomy service in UK NHS practice. *Clinical Medicine Journal*, Jan;21(1): pp e26-e31.

¹² British Society of Interventional Radiology and The Royal College of Radiologists, (2019), *Provision of Interventional Radiology: Second Edition*, London, The Royal College of Radiologists, available at https://www.rcr.ac.uk/system/files/publication/field_publication, The Royal College of Radiologists, (2019), *Provision of Interventional Radiology: Second Edition*, London, The Royal College of Radiologists, available at https://www.rcr.ac.uk/system/files/publication/field_publication_files/bfcr198-provision-interventional-radiology-services-second-ed.pdf, accessed 25th October 2021.

¹³ <u>https://bsnr.org.uk/_userfiles/pages/files/bsnrtrainingresponsetomtevidencefinal23116.pdf</u>

¹⁴ Mortimer A, Lenthall R, Wiggam I, et al, (2021), To support safe provision of mechanical thrombectomy services for patients with acute ischaemic stroke: 2021 consensus guidance from BASP, BSNR, ICSWP, NACCS, and UKNG, *Clinical Radiology*, 76(2).

¹⁵ Kim BM, Baek JH, Heo JH, et al, (2019), Effect of Cumulative Case Volume on Procedural and Clinical Outcomes in Endovascular Thrombectomy, *Stroke*, May; 50(5): pp1178-1183.

¹⁶ Feigin VL, Krishnamurthi RV, Parmar P, et al, (2015), Update on the global burden of ischemic and hemorrhagic stroke in 1990-2013: the GBD 2013 study, *Neuroepidemiology*, 45: pp161–76.

¹⁷ Canadian Stroke Best Practices, (2020), Emergency Management of Intracerebral Hemorrhage: 7th Edition – 2020 UPDATE, available at <u>https://www.strokebestpractices.ca/recommendations/management-of-intracerebral-hemorrhage/emergency-management-of-intracerebral-hemorrhage, accessed 15th November 2021.</u>

¹⁸ Hemphill JC, Greenberg SM, Anderson CS, et al, (2015), Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American heart Association/American stroke association, *Stroke*, Volume 46, No7: pp2032–60

¹⁹ Parry-Jones AR, Sammut-Powell C, Paroutoglou K, et al, (2019), An intracerebral hemorrhage care bundle is associated with lower case fatality, *Annals of Neurology*, 86 (4): pp495–503

²⁰ Parry-Jones AR, Moullaali TJ, Ziai WC, (2020), Treatment of intracerebral hemorrhage: From specific interventions to bundles of care, *International Journal of Stroke*, 15(9): pp945-953.

²¹ Canadian Stroke Best Practices, (2020), Emergency Management of Intracerebral Hemorrhage: 7th Edition – 2020 UPDATE, available at <u>https://www.strokebestpractices.ca/recommendations/management-of-intracerebral-hemorrhage/emergency-management-of-intracerebral-hemorrhage</u>, accessed 15th November 2021.

²² Canadian Stroke Best Practices, (2020), Emergency Management of Intracerebral Hemorrhage: 7th Edition – 2020 UPDATE, available at <u>https://www.strokebestpractices.ca/recommendations/management-of-intracerebral-hemorrhage/emergency-management-of-intracerebral-hemorrhage, accessed 15th November 2021.</u>

²³ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at https://www.strokeaudit.org/Guideline/Full-Guideline.aspx, accessed 22nd October 2021.

²⁴ (RCP 2016; Appendix Figure 1 - Purple box)

²⁵ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

²⁶ Langhorne P, Ramachandra S, (2020), Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke: network meta-analysis, *Cochrane Database of Systematic Reviews*, 4(4):CD000197

²⁷ Busingye D, Kilkenny MF, Purvis T, et al, (2018), Is length of time in a stroke unit associated with better outcomes for patients with stroke in Australia? An observational study, *BMJ Open*, 12;8(11):e022536

²⁸ (Appendix Table 1 and 2).

²⁹ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

³⁰ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

³¹ NHS Quality Improvement Scotland, (2010), Best Practice Statement: End of life care following acute stroke, available at <u>Best_Practice_Statement_End_of_life_care_following_acute_stroke.pdf</u> (scot.nhs.uk), accessed 15th November 2021.

³² Wright J, Zeeman H, Biezaitis V, et al, (2016), Holistic Practice in Traumatic Brain Injury Rehabilitation: Perspectives of Health Practitioners, *PLOS ONE*, 11(6): e0156826.

³³ United Nations, Convention on the Rights of Persons with Disabilities and Optional Protocol, available at <u>https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html#Fulltext</u>, accessed 1st November 2021.

³⁴ World Health Organisation, (2019), Rehabilitation in health systems: guide for action, available at <u>https://www.who.int/publications/i/item/9789241515986</u>, accessed 15th November 2021.

³⁵ Wade DT & Halligan PW, (2017), The biopsychosocial model of illness: a model whose time has come, Clinical Rehabilitation, Vol. 31(8) 995–1004

³⁶ The Health Foundation, Person-centred care made simple: What everyone should know about person-centred care, January 2016, available at https://www.health.org.uk/publications/person-centred-care-made-simple, accessed 24th January 2021

³⁷ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

³⁸ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

³⁹ Kwakkel G, van Peppen R, Wagenaar RC, et al, (2004), Effects of augmented exercise therapy time after stroke a metaanalysis, *Stroke*, 35(11): pp2529–2539

⁴⁰ Duncan-Millar D, van Wijck F, Pollock A, Ali M, (2021), International consensus recommendations for outcome measurement in post-stroke arm rehabilitation trials, *European Journal of Physical and Rehabilitation Medicine*, 57(1): pp61-68.

⁴¹ Duncan-Millar J, van Wijck F, Pollock A, Ali M. Outcome measures in post-stroke arm rehabilitation trials: do existing measures capture outcomes that are important to stroke survivors, carers, and clinicians? Clinical Rehabilitation 2019, Vol. 33(4) 737 –749. DOI: 10.1177/0269215518823248

⁴² Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁴³ Gittins M, Vail A, Bowen A, et al on behalf of the SSNAP collaboration, (2020), Factors influencing the amount of therapy received during inpatient stroke care: an analysis of data from the UK Sentinel Stroke National Audit Programme, *Clinical Rehabilitation*, Volume: 34 issue: 7, page(s): 981-991

⁴⁴ Clarke DJ, Burton LJ, Tyson SF et al, (2018), Why do stroke survivors not receive recommended amounts of active therapy? Findings from the ReAcT study, a mixed-methods case-study evaluation in eight stroke units, *Clinical Rehabilitation*, Vol. 32(8) pp1119 - 1132

⁴⁵ Clarke D, Gombert-Waldron K, Honey S, et al, (2021), Co-designing organisational improvements and interventions to increase inpatient activity in four stroke units in England : a mixed-methods process evaluation using normalisation process theory. *BMJ Open*, 11(1):e042723

⁴⁶ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁴⁷ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁴⁸ Langhorne P, Baylan S, (2017, Early supported discharge services for people with acute stroke, *Cochrane Database of Systematic Reviews*, Issue 7. Art. No: CD000443.

⁴⁹ Legg LA, Lewis SR, Schofield-Robinson OJ et al, (2017), Occupational Therapy for adults with problems in activities of daily living after stroke. *Cochrane Database of Systematic Reviews*, Issue 7, Article No: CD003316

⁵⁰ Bosomworth H, Rodgers H, Shaw L, (2020), Evaluation of the enhanced upper limb therapy programme within the Robot-Assisted Training for the Upper Limb after Stroke trial: descriptive analysis of intervention fidelity, goal selection and goal achievement, *Clinical Rehabilitation*, 35(1): pp119-134

⁵¹ Pollock A, Baer G, Campbell P, et al, (2014), Physical rehabilitation approaches for the recovery of function and mobility following stroke, *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001920.

⁵² Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁵³ Mehrholz J, Thomas S, Elsner B, (2017), Treadmill training and body weight support for walking after stroke. *Cochrane Database of Systematic Reviews*, Issue 8. Art. No.: CD002840

⁵⁴ Mehrholz J, Thomas S, Elsner B, (2017), Treadmill training and body weight support for walking after stroke. *Cochrane Database of Systematic Reviews*, Issue 8. Art. No.: CD002840

⁵⁵ Brady MC, Kelly H, Godwin J, Enderby P, et al, 2016. Speech and language therapy for aphasia following stroke. *Cochrane Database of Systematic Reviews*, Issue 6, Art. No: CD000425.

⁵⁶ UK Government, Guidance: Assistive technology: definition and safe use, Updated 28 October 2021, available at <u>Assistive technology: definition and safe use - GOV.UK (www.gov.uk)</u>, accessed 15th November 2021.

⁵⁷ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁵⁸ Tieges, Z. et al, (2015), Sedentary behavior in the first year after stroke: a longitudinal cohort study with objective measures. *Archives of Physical Medicine and Rehabilitation*, 96(1), pp15-23

⁵⁹ Fini NA, Holland AE, Keating J, et al, (2017), How physically active are people following stroke? systematic review and quantitative synthesis, *Physical Therapy*, 97: pp707–717

⁶⁰ Pollock A, Baer G, Campbell P et al, (2014), Physical rehabilitation approaches for the recovery of function and mobility following stroke, *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001920

⁶¹ National Model of Psychological Care in Stroke (Scotland) (NMPCS) in *Improving Psychological Care in Stroke Service: A National Model for Scotland, October 2020*, Scottish Stroke Psychology Forum.

⁶² Stratton, H., Sansom, J., Brown-Major, A et al, (2020). Interventions for sexual dysfunction following stroke, *Cochrane Database of Systematic Reviews*, Issue 5. Art. No.: CD011189

⁶³ Winstein, C.J., et al (2016). Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke, 47(6), e98-169

⁶⁴ Pollock, A, Hazelton, C., Rowe, F et al, (2019), Interventions for visual field defects in people with stroke, *Cochrane Database of Systematic Reviews*, Issue 5, Art. No.: CD008388

⁶⁵ Kidd L, Booth J, Lawrence M, & Rowat A (2020) Implementing Supported Self-Management in Community-Based Stroke Care: A Secondary Analysis of Nurses' Perspectives. Journal of Clinical Medicine. 9(4):985. <u>https://doi.org/10.3390/jcm9040985</u>

⁶⁶ Kidd L, Booth J, Lawrence M, & Rowat A (2020) Implementing Supported Self-Management in Community-Based Stroke Care: A Secondary Analysis of Nurses' Perspectives. Journal of Clinical Medicine. 9(4):985. <u>https://doi.org/10.3390/jcm9040985</u>

⁶⁷ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁶⁸ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁶⁹ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁷⁰ British Association of Stroke Physicians, (2019), Meeting the Future Consultant Workforce Challenges: Stroke Medicine, available at <u>BASP-Stroke-Medicine-Workforce-Requirements-Report-FINAL.pdf</u>, accessed 23rd October 2021.

Contents

1.	Inti	Introduction					
	1.1	.1	Realistic Medicine and shared decision making	5			
	1.1.2		Information technology (IT)	5			
	1.1	.3	Research	6			
2.	Go	vern	ance	6			
3.	Pri	Primary Prevention					
	3.1	Red	commendations	7			
4.	Re	Recognition and Referral					
	4.1	Imp	proving individual awareness and recognition of stroke	8			
	4.2	Imp	proving referral pathways	8			
	4.2	2.1	Referral to TIA services	9			
	4.2	2.2	Suspected acute stroke – taking prompt action	9			
	4.3	Red	commendations	10			
5.	TIA	TIA Services					
	5.1	Spe	ecialist assessment	11			
	5.2	Inve	estigations	12			
	5.3	Tre	atment and care	12			
	5.4	Red	commendations	14			
6.	Transfer to Hospital		er to Hospital	14			
	6.1	Imp	proving pre-hospital assessment	15			
	6.2	Pre	-Alert	15			
	6.3	Red	commendations	16			
7.	As	Assessment and diagnostics					
	7.1	Inte	erface between stroke services and emergency departments	16			
	7.2 Assessment of eligibility for hyperacute treatment						
	7.3	Acc	cess to brain and vascular imaging and cardiac investigations	18			
	7.3	8.1	Brain imaging	18			
	7.3	3.2	Vascular imaging	19			
	7.3	3.3	Cardiac investigations	19			
	7.4	Red	commendations	20			
8.	Hyperacute Stroke Treatment						
	8.1	Intr	avenous thrombolysis	21			
	8.2	Thr	ombectomy	22			
	8.2	2.1	Transfer from ASC to CSC for thrombectomy	22			
	8.2	2.2	Repatriation	23			
	8.2	2.3	Interventional neuroradiology	23			

8.3		Management of intracerebral haemorrhage (ICH)					
8.4		Recommendations					
9.	Асι	te stroke care					
9.	.1	Provi	sion of 'the bundle' of care	. 26			
9.	.2	Access to stroke unit care					
9.	.3	End of Life Care					
9.	.4 Recc		mmendations	. 29			
10.	R	ehabi	litation and long-term support	. 30			
1(0.1	Str	oke Rehabilitation	. 30			
10.1		1.1	Key principles of stroke rehabilitation	. 31			
	10.1.2 10.1.3		Stroke Rehabilitation Service Provision	. 32			
			The Rehabilitation Team	. 33			
10.1.4		1.4	Rehabilitation settings	. 34			
10. sei		1.5 vice	Key interventions delivered by a progressive stroke rehabilitation 34				
1(0.2	Su	oported Self-Management and Longer-term support	. 39			
1(0.3	Re	commendations	. 40			
11.	V	/orkfo	rce	. 42			
	11.	1.1	Education and training	. 43			
12.	2. Glossary			. 44			
13.	А	Acknowledgements					

1. Introduction

Stroke develops as a result of problems with the blood vessels supplying blood to the brain.

There were 3,754 deaths in Scotland in 2019 where cerebrovascular disease, including stroke, was the underlying cause. While there has been a decrease in deaths due to stroke over the last decade, it is important to note that it remains a leading cause of death and the leading cause of disability in Scotland¹. This highlights that there is still work to do to improve prevention of, and outcomes from, stroke and to ensure that people across Scotland have equitable access to treatment and care.

Stroke remains a national clinical priority for Scottish Government. The <u>2019/20</u> and <u>2020/21</u> Programmes for Government made a number of commitments on stroke, including commitments to develop a national thrombectomy service and to 'scope out and define what a progressive stroke service looks like'.

This document defines a progressive stroke pathway in the Scottish context and sets out a vision of stroke services in Scotland. It has been produced by the National Advisory Committee for Stroke (NACS) in collaboration with the groups and individuals outlined in <u>section 13 (Acknowledgements)</u> We are grateful to the many health care professionals who shared their expertise with us, and to the National Stroke Voices who shared their lived experience of stroke to support the development of this document. A refreshed Stroke Improvement Plan will follow to support in the delivery of this vision.

The infographic below depicts an overview of the 'Progressive stroke pathway' defined in this document. This pathway includes prevention, recognition of stroke, transfer to hospital, hyperacute and acute care through to rehabilitation and supported self-management.



1. Reduction in Door-to-Needle times across Scotland

2. Role of stroke nurse/interface with ED 3. Care in a stroke unit for post thrombolysis monitoring

Eligible for Thrombectomy:

1. Timely transfer to Comprehensive Stroke Centre 2. Care delivered within a stroke unit enabling increased monitoring post intervention.

3. Specialist staff with recognised training experience

4. Repatriation protocols in place

Intracerebral Haemorrhage

1. Care provided within Stroke Unit if no surgical intervention required.

2. Engagement with local or regional neurosurgical teams where necessary.

Acute Care

1. Delivery of stroke care bundle

- 2. Provision of care within stroke unit
- 3. End of life care where appropriate

Rehabilitation:

1. Started early in person's journey 2. Person-centred and holistic 3. Appropriate frequency and intensity 4. Provided by an interdisciplinary team 5. Delivered in appropriate setting 5. Appropriate follow-up 6. Supported self-management

There are number of principles underpinning delivery of a progressive stroke pathway. These include the principles of Realistic Medicine, the importance of good information technology (IT) and digital systems to facilitate seamless delivery of care, and an effective research environment.

1.1.1 Realistic Medicine and shared decision making

Delivery of a Realistic Medicine approach means ensuring that people who experience stroke are supported to take part in shared decision making about their treatment and care, to ensure that what matters to them is at the heart of the delivery of care throughout the whole pathway.

This should be incorporated into all aspects of the progressive stroke pathway. Specific shared decision-making tools, including those which facilitate sharing of individualised information about patients' diagnosis, prognosis and treatments and goal setting, can support such an approach.

Involvement of specific healthcare staff such as speech and language therapy for patients with communication difficulties, and clinical psychology for those with cognitive problems, can further enable communication and shared decision making.

1.1.2 Information technology (IT)

The delivery of a progressive stroke pathway is facilitated by digital health systems which facilitate networking between clinicians, the use of artificial intelligence (AI) in decision making, the ability to support the movement of patients across different NHS Boards and enable digital models of care to provide people with stroke access to remote care and self-management tools based on their needs and preferences.

In a progressive stroke pathway, stroke services should have access to systems which:

- Support shared electronic health record keeping, reduce duplication and allow information sharing across a network of care along the whole pathway.
- Plan, prompt and record important aspects of care digitally to optimise delivery whilst making best use of clinicians' time.
- Support secure communication (voice, video, text, shared documents and images) between clinicians working across networks.
- Alert a responsible clinician or team to referrals or abnormal investigations to maximise safety and minimise delays.
- Capture data in real-time for audit/quality improvement and monitoring as a by-product of clinical care.
- Support healthcare professionals in using "Tailored Talks". This is a tool which facilitates the provision of tailored digital information and/or signposting for patients, their relatives and carers.
- Establish electronic documentation for remote consultation outcomes (e.g. Clinical Portal) when cases are referred and discussed. An audit trail of

referrals, decisions and outcomes will help inform practice development and processes.

1.1.3 Research

Clinical research has an important function in delivering progressive stroke services. It helps to produce the knowledge on which to base more effective stroke services and ensures that healthcare staff are aware of the most up-to-date evidence and the latest developments in diagnostics and treatment. To facilitate continued clinical research activity, it is important to:

- Maintain the research infrastructures (e.g., University departments, NHS Research & Development, the Scottish Stroke Research Network (SRN) and Cochrane Stroke Review Group) which have helped make Scotland one of the leading countries for stroke research worldwide.
- Ensure that stroke patients and their families or carers can shape and participate in research in all parts of their pathway, wherever they are being cared for.

2. Governance

This vision document will be supported by a refreshed Stroke Improvement Plan, the delivery of which will be overseen by the National Advisory Committee on Stroke, and monitored through the Scottish Stroke Care Audit and Scottish Stroke Improvement Programme.

While Scottish Government sets the overall policy direction and vision, NHS Boards have a statutory responsibility for the delivery of health care within their area. It is therefore important that NHS Boards seek to deliver the vision outlined within this document, giving an equivalent level of prioritisation to stroke services as outlined by Scottish Government.

To achieve this requires that:

- NHS Boards have a clear management structure for stroke services relating to the whole patient pathway covering inpatients, outpatients and community services.
- Each NHS board should identify a member of their Senior Management Team to be accountable for the delivery of stroke services.
- Managed Clinical Networks (MCNs) should serve to coordinate professionals, services and organisations to ensure equitable, high quality clinical services.
- MCNs should operate with clear clinical and operational leadership to connect services via service pathways.
- Stroke services should coordinate across clinical, professional and service pathways, and be tailored to individual needs based on a range of personal, environmental and social factors.
- Stroke services should capture data which reflects performance in real-time, to support quality improvement activities.

- The NHS Board senior management team should take responsibility for ensuring that stroke services meet all important quality indicators within the Scottish Stroke Care Audit.
- NHS Boards should, where necessary, work collaboratively with other NHS Boards in the delivery of services. This is essential in the delivery of thrombectomy, which requires a national approach, and for thrombolysis, vascular surgery and sometimes TIA and rehabilitation services, which often require a regional approach.
- NHS Boards should work as part of integrated joint boards, alongside social care delivery partners and the third sector to deliver effective rehabilitation and supported self-management.

3. **Primary Prevention**

This refers to interventions aimed at reducing the risk of a stroke in people who have not yet had a stroke. This is distinct from secondary prevention which aims to reduce the risk of a recurrent stroke.

A progressive stroke pathway should focus preventative efforts on the identification and treatment of atrial fibrillation (AF) and raised blood pressure which are of specific importance to reduce the incidence of stroke. Secondary prevention (detection of AF or high blood pressure after stroke) is also important and more fully addressed within Section 7.3: Access to imaging and other investigations.

Actions on other risk factors for cardiovascular disease, including stroke, such as obesity (<u>A Healthier Future: Scotland's Diet & Healthy Weight Delivery Plan 2018</u>), smoking (<u>Raising Scotland's Tobacco-Free Generation: Tobacco Control Action Plan 2018</u>) and alcohol consumption (<u>Alcohol Framework 2018</u>: <u>Preventing Harm</u>) are covered by other Scotlish Government policy commitments and therefore are out of scope for this document.

Improving the primary identification and management of AF and blood pressure will involve a focus on improving data collection in primary care to better measure improvement, supporting community models of detection, and improving access to technology to support self-management.

3.1 Recommendations

- 1. Encourage improved detection, diagnosis and management of AF and high blood pressure, through quality improvement within primary care and community settings.
- 2. Support the development of pathways of care for AF which ensure prompt assessment and, where appropriate, treatments including anticoagulation, ablation and left atrial appendage occlusion to reduce the risk of future stroke.

3. Enable the use of proven technology to support detection, tele-monitoring and the provision of tailored self-management support for people with risk factors for stroke such as high blood pressure or AF.

4. Recognition and Referral

Raising and maintaining awareness of the symptoms of stroke and transient ischaemic attack (TIA) in the population, its recognition, and the need to immediately seek help are key to optimising treatment and outcomes.

4.1 Improving individual awareness and recognition of stroke

The FAST campaign is a UK wide awareness campaign designed to help detect and enhance responsiveness to the needs of a person having a stroke. The acronym stands for:

- Facial drooping
- Arm weakness
- **S**peech difficulties
- Time to call emergency services

Awareness campaigns should be shaped by evidence about what methods (e.g. TV/radio advertising, social media) most effectively reach target populations. It is especially important to consider how best to reach people who may face inequalities in access to information, or awareness of stroke. This includes:

- People for whom English is not a first language
- People living in areas of deprivation
- Younger people who may not be aware of their risk of stroke

4.2 Improving referral pathways

Early assessment and triage for people with stroke or TIA is important because the time windows for delivering the most effective interventions, such as thrombolysis, thrombectomy & commencement of secondary prevention, are measured in hours. The earlier treatment is started the more effective it is.

Most services in Scotland have a system in place to allow urgent patient referral for rapid specialist assessment, though unwarranted variation should be identified and addressed.

The National Stroke Voices highlighted the importance of raising awareness about recognition of stroke and TIA within primary care, and identified emergency departments as a key area for improvement. Targeted education on FAST and clear referral guidelines could support health care professionals to recognise symptoms and signs of stroke, including in circumstances where presentation may not be typical (for example where the FAST test might be negative, or where the person experiencing stroke is young).

4.2.1 Referral to TIA services

In instances where the symptoms of stroke have resolved rapidly and an acute stroke is not suspected, then the person should be referred into TIA services. Key aspects of these services are outlined in detail in <u>Section 5: TIA Services</u>. The most common sources of referral to TIA services will be from primary care, emergency departments, ophthalmology/optometry services, medical wards and Scottish Ambulance Service. Clear pathways should be in place for all referrers.

In some locations TIA telephone hotlines are in place which allow paramedics, primary care clinicians and emergency department professionals to talk directly to a stroke physician at the time of the patient first accessing healthcare. This enables early specialist intervention and treatment whilst the patient is waiting to have the diagnosis and treatment refined.

All patients referred to TIA services should be told that they must not drive for one month - as per <u>Driver and Vehicle Licensing Agency (DVLA) recommendations</u> - and should be advised regarding current regulations around resuming driving. This should be supported by a robust and rapid electronic referral system e.g., SCI gateway or TRAK workbench, which should prompt driving advice and secondary prevention prescription. These referrals should be monitored, or have notification systems, to ensure prompt appointing to specialist review.

4.2.2 Suspected acute stroke – taking prompt action

In instances where symptoms of stroke persist and an acute stroke is suspected, the patient should be transferred by ambulance to the nearest 'stroke ready' hospital – that is a hospital with facilities to scan patients, offer hyperacute treatment with thrombolysis and provide assessment of eligibility for thrombectomy.

There are 25 such hospitals across Scotland, 22 of these are Acute Stroke Centres (ASCs). The remaining three are Comprehensive Stroke Centres (CSCs), which in addition to the facilities described above, can also deliver thrombectomy and neurosurgical interventions.

All stroke centres will have stroke units unless they serve a very small population (such as occurs in remote and rural areas where the essential features of a stroke unit are delivered within a single ward area). This is <u>described in more detail in</u> <u>Section 9.2</u>.

In a progressive stroke pathway, it will be important to ensure ambulance response times are as short as possible, through appropriate assessment and prioritisation of emergency calls².

NHS 24 or 999 call handlers use algorithms to assess the urgency of calls and the likelihood that the person has had a stroke. Improved algorithms based on analysis of linked data about triage and resulting actual diagnoses could help reduce delays to effective treatments. Such an approach would be maximised by targeted training for call handlers in awareness and identification of stroke.

Ambulance crews should be supported with continued training in the most up-to date tools to improve diagnosis and assessment of the patients' need for hyperacute treatments and early secondary prevention.

Once the ambulance crew has made an assessment it is necessary to consider robust and transparent algorithms for the prioritisation of SAS resources, including air transfers, which take account of availability, the benefits and risks to the patient, the time urgency of the interventions and the cost effectiveness to ensure that the optimum improvement in outcomes from the available resources can be achieved. These should be developed through analysis of linked data from SAS and the Scottish Stroke Care Audit.

4.3 Recommendations

- 1. Effective campaigns to raise awareness of stroke and TIA, their impact on people who experience them, and tools for timely recognition should consider how best to reach people who may face inequalities in access to information, or awareness of stroke.
- 2. Support the use of FAST and work to embed other pre-hospital stroke tools particularly those which support assessment for hyperacute treatment - in a standardised way across NHS 24, primary care and SAS.
- 3. Improved algorithms and training for NHS 24 or SAS call handlers and crews should be deployed to support the assessment of the urgency of calls and the likelihood that the patient has had a stroke, and enable effective prioritisation of SAS resources, including air transfers.
- 4. Ensure appropriate referral of people with all stroke events, including those with acute ongoing symptoms, acute but resolved symptoms and other stroke-like events.
- 5. Referral systems should prompt driving advice and secondary prevention prescription.
- 6. All patients referred to TIA services should be told not to drive for one month (as per DVLA recommendations) at the point of referral and advised on current regulations for resuming driving.

5. TIA Services

Many people who develop mild or transient symptoms which might represent a TIA or mild stroke do not require immediate admission to hospital but do need specialist assessment by a clinician experienced in stroke care, early access to investigations and same day initiation of treatment to reduce the risk of a disabling stroke.

TIA services aim to offer these functions flexibly and provide access to support to reduce long-term risks and optimise the person's physical, psychological and social outcomes.

These services may be delivered in a variety of settings including, but not limited to, specialist TIA outpatients' clinics. However, people with suspected TIA can also be supported effectively through the provision of services within ambulatory care units, stroke units, or through rapid inpatient ward reviews. A proportion of patients with TIA are seen in an Emergency Department. These models of care, so long as they are supported by stroke specialists and have early access to investigations, or backup from a TIA clinic, can provide excellent care which minimises the risk of further stroke.

The Scottish Stroke Care Audit does not fully capture or monitor routinely activity which takes place outside of TIA clinics as it has proven challenging to capture data in these more varied settings. This should be addressed to enable us to understand and compare all models of care for people with TIA.

The performance of TIA clinics is currently monitored by the Scottish Stroke Care Audit which measures the proportion of patients seen in the TIA clinics within 4 days of referral. Whilst the majority of services meet the standard of 80%, there remain opportunities for improvement and to address variation.

As the risk of recurrent stroke is higher in the first day or two following a TIA, the faster a person can be seen the better. Therefore, the Scottish Stroke Improvement Programme will work with services across Scotland to minimise delays.

At present, the Scottish Stroke Care Audit measures the referral time to TIA services, but there is an opportunity to look in more detail at the care for people who have experienced a TIA. Therefore, development of a TIA bundle including times to important investigations and treatments should be included within the audit.

5.1 Specialist assessment

Specialist assessment for people with suspected TIA helps to expedite additional imaging where this is necessary and ensure that a diagnosis and treatment plan is refined and tailored to the individual's needs. This should take place in a timely manner, as specified by relevant clinical guidelines.

Where in-person specialist assessment cannot always be rapidly available, TIA services should consider how targeted access to local or remote stroke specialists (for patients meeting agreed criteria) can minimise delay to time-sensitive interventions.

Due to the Covid-19 pandemic many NHS boards had started to incorporate virtual assessments using telephone and Near Me into their assessments. This more flexible approach has led to reduced waiting times for specialist input in some areas. It is important to ensure that where virtual assessments are performed, patients should have the same access to rapid investigations and immediate secondary prevention as those who are seen face-to-face.

5.2 Investigations

People with suspected TIA or minor ischaemic stroke require timely access to investigations to confirm a diagnosis and guide treatment.

High risk TIAs and patients with uncertain presentations may be assessed as inpatients, and so rapid access to necessary radiology and cardiac investigations should be available in both outpatient and inpatient settings. There should be a robust system in place to ensure that the results of radiology and cardiac investigation results are available rapidly and are flagged to the responsible clinicians.

Full details of access to investigations for people with suspected TIA or stroke is outlined in <u>Section 7.3: Access to imaging and other investigations.</u>

5.3 Treatment and care

Where necessary, people seen in TIA services should be able to rapidly access appropriate support from a Multi-Disciplinary Team including speech and language therapy, occupational therapy, clinical psychology, orthotics, ophthalmology and orthoptics.

Some patients seen in TIA services turn out not to have had a TIA or stroke. Alternative pathways should be available if input is required from another specialist service. There should also be a system for rapid feedback to referrers when a person would not benefit from attendance at a TIA service, and clear communication of an alternative pathway or approach.

For people who are identified as having had a TIA, treatment involves access to secondary prevention medication and advice. All NHS Boards should therefore have accessible pathways and secondary prevention guidelines for TIA patient management, which should be up-to-date and responsive to change in the evidence base. These should ensure that:

- For TIA (with full recovery) antiplatelet agents and a statin should be commenced immediately (as per local guidance, including any necessary investigations) pending specialist review, unless specialist review is immediate.
- Guidelines should recommend which secondary prevention medication to prescribe but should also have a plan for situations where medication should not be stopped (e.g., for some cases anticoagulants after TIA).
- Secondary preventative medications should be immediately available e.g., from ward stock, hospital pharmacy or written prescription to take straight to a 24/7 chemist.

People who have experienced a TIA or minor stroke may also require advice or onward referral to support them in their longer-term self-management. The following should be available from the TIA service:

- Referral to addiction support teams
- Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
- Recommendations to optimise physical activity and reduce sedentary behaviour, including referral to exercise services where appropriate
- Referral to Dietetics
- Vocational advice and support
- Recommendations to support emotional and psychological wellbeing including referral to psychological services where appropriate

Communication between health professionals following TIA assessment is important. There should be a rapid electronic communication system back to the referrer following assessment in a TIA service. If using a traditional dictated letter system, then the letter should be sent electronically and within 48 hours of the specialist assessment.

It is important that referrers are made aware of individual treatment targets:

- Remote blood pressure monitoring should be available where required e.g., FLORENCE programme or 24-hour ambulatory monitoring
- Selected patients may benefit from more aggressive lipid management aiming for lower LDL targets where appropriate, pathways should be in place for this e.g., a pharmacist led stroke lipid clinic, primary care follow up system.
- Furthermore, any request to referrer to make urgent prescribing changes or other key changes to management should be transmitted immediately.

Following discharge from TIA services, patients who have experienced TIA or minor stroke should receive lifelong follow-up in primary care and long-term conditions monitoring. This will require ongoing education to support primary care professionals with:

- Current best practice for longer-term care of TIA or stroke survivors
- Managing stroke in people with co-existing conditions

• Current guidance and pathways for referring a person back to stroke services

Follow up appointments for people who have experienced TIA should be available when needed, potentially through the TIA clinic or a stroke liaison nurse team.

5.4 Recommendations

- 1. People with suspected TIA should have specialist assessment by a clinician experienced in stroke care, early access to investigations and same day initiation of treatment to reduce the risk of further stroke.
- 2. Where in-person specialist review cannot always be rapidly available, TIA services should consider how to enable access to local or remote stroke specialists for patients meeting agreed criteria.
- 3. There should be appropriate pathways in place for onward referral of people who have had neither stroke nor TIA but require input from another specialist service.
- 4. All NHS Boards should have accessible pathways and secondary prevention guidelines for TIA patient management.
- 5. TIA services should support the following, where required:
 - Referral to addiction support teams
 - Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
 - Recommendations to optimise physical activity and reduce sedentary behaviour, including referral to exercise services where appropriate.
 - Referral to Dietetics
 - Recommendations to support emotional and psychological wellbeing including referral to psychological services where appropriate
 - Vocational advice and support
- 7. The Scottish Stroke Care Audit should develop a TIA bundle which takes account of the varied models of providing care for people with TIA.

6. Transfer to Hospital

Most patients with symptoms of acute stroke will be transferred to hospital by the Scottish Ambulance Service (SAS). In general, SAS transport patients with suspected hyperacute stroke to the nearest hospital which can provide thrombolysis (Acute Stroke Centre).

Transfer to hospital is a vital part of a progressive stroke pathway. There are important opportunities to:

- Improve pre-hospital diagnostic accuracy including assessment of eligibility for hyperacute treatments, enabling possible bypass of the local Acute Stroke Centre (sometimes referred to as a spoke hospital in the thrombectomy pathway) to a Comprehensive Stroke Centre (sometimes referred to as a thrombectomy hub).
- Provide receiving clinicians with information to enable quick decision making upon arrival at hospital.

6.1 Improving pre-hospital assessment

It is important to continue providing training and support to ambulance crews in the use of pre-hospital clinical assessment tools and to explore the use of more detailed tools or technologies which might improve diagnostic accuracy and triage for stroke, TIA and the identification of people potentially suitable for thrombolysis and thrombectomy.

Improving pre-hospital assessment of people who would benefit from hyperacute treatment will reduce time to treatment by ensuring that they can be quickly placed on the pathway for the most appropriate treatment.

It is also important that ambulance crews have the capacity to seek advice from stroke specialists to support with triage and diagnosis while a patient is being transferred. This can be provided via telestroke services. For example, there have been pilot projects indicating that providing ambulance crews with access to specialist support via a Professional to Professional audio and/or video call can enhance the pre hospital diagnostic accuracy and decision making with respect to TIA and stroke.

6.2 Pre-Alert

Ensuring that appropriate information is available to clinicians receiving the patient at the hospital enables quicker decision making and enables timely access to imaging and treatment upon arrival.

Pre-alert refers to the sharing of information about a patient with the hospital during transfer by an ambulance crew. Through our review process, hospital clinicians highlighted the vital importance of the pre-alert including patient identifiers such as the CHI number, name and date of birth. Despite this, the reviews identified that there is variation in appropriate pre-alerting of patients with stroke, and of the information included with the pre-alert.

At present, there is a lack of timely data available from NHS boards and sites, concerning the number of patients with suspected hyperacute stroke that are prealerted by SAS. This in turn means that there is no robust measure to ensure the correct patients are being taken to the most suitable hospital, and then placed on the most appropriate pathway. It is therefore important to have access to better information about pre-alerting across Scotland, to address variation and to improve pre-alerting in general.

6.3 Recommendations

- 1. To improve pre-hospital assessment ambulance crews should continue to be trained and supported in the use of pre-hospital clinical assessment tools.
- 2. The use of more detailed tools or technologies, which might improve diagnostic accuracy and triage for stroke, TIA and the identification of people potentially suitable for thrombolysis and thrombectomy, should be explored.
- 3. Telestroke systems should be available for use in ambulances and air transport to enable professional-to-professional calls to support ambulance crews in decision making regarding hyperacute stroke.
- 4. A single communication platform should facilitate voice, data and video communication between paramedics, ambulance control, stroke physicians in ASCs and CSCs, stroke nurses and interventional radiologists.
- 5. Communication of patient identifiers during pre-alert should be enabled to support timely decision making and improve time to treatment upon arrival at hospital.
- 6. A mechanism should be developed to provide routine feedback of confirmed diagnosis and treatment pathway to SAS to support staff development and improve performance and patient pathways.

7. Assessment and diagnostics

Early assessment and diagnosis are vital to ensuring that people can receive prompt and appropriate treatment, thus improving their chances of positive outcomes.

7.1 Interface between stroke services and emergency departments

Seamless joint working between stroke services and emergency departments is paramount for optimal patient care and outcomes in the acute stage of the stroke pathway.

To minimise delays to assessment and treatment for people with stroke, emergency department services should include:

• Systems supporting pre-registered imaging requests from the stroke team clinicians.

- Staff competent in acute stroke management and familiar with thrombolysis and thrombectomy eligibility criteria and pre-transfer procedures, checklists and processes.
- Video links for optimal virtual communication between the emergency department and stroke teams, where required.
- Senior stroke decision maker and senior leadership involvement at the front door to minimise door-to-needle times for thrombolysis e.g., straight to CT protocols.
- Systems and resources agreed with SAS to minimise door in, door out times for patients eligible for thrombectomy.
- Goal of minimising inappropriate or futile transfers to the CSC for thrombectomy.
- "Straight to MRI protocols" for some strokes where this is the most appropriate imaging modality.
- Agreed stroke mimic pathways where non stroke patients are cared for out with the stroke service, when possible, enabling efficient use of stroke beds and workforce.

Performance and protocols should be audited, and cases reviewed.

7.2 Assessment of eligibility for hyperacute treatment

People with suspected acute stroke should be assessed immediately to determine the best approach to treatment. This is particularly important for identifying people who would benefit from specific hyperacute stroke treatments such as thrombolysis and/or thrombectomy.

Assessment for emergency hyperacute stroke treatments should be undertaken by a stroke specialist clinician without delay. In locations where that specialist clinician is not available on site then telestroke services should provide access to specialist assessment and decision making.

Telestroke involves the use of mobile technologies to provide audio and/or video calls between patients and local and remote healthcare professionals. It has a major role in improving access to hyperacute specialist care, decision making and the safe delivery of hyperacute treatments.

Electronic documentation for remote consultation outcomes (e.g., Clinical Portal) should be established. An audit trail of referrals, decisions and outcomes will help inform practice development and processes.

Telestroke can be used to support filtering and triage of referrals from remote sites into designated stroke units and reduce delays in time critical decisions, including on the delivery of appropriate treatments and identification of patients not suitable for specific interventions or transfer to another site.

Eligibility for thrombolysis should be guided by available clinical support tools. Further information on thrombolysis is included in <u>Section 8.1: Intravenous</u> <u>Thrombolysis</u>. Eligibility for thrombectomy should be guided by available clinical support tools. Patients who are identified as eligible for thrombectomy should be transferred to the relevant CSC for further assessment to confirm eligibility and to receive this intervention. They should then be admitted to a stroke unit to receive appropriate post intervention monitoring and care. Further detail on the core components of the delivery of thrombectomy are outlined in <u>Section 8.2: Thrombectomy</u>

The majority of patients with acute stroke will not be eligible for thrombolysis or thrombectomy. The key focus for these patients is ensuring access to the stroke bundle, including care within a designated stroke unit. Full information on this is included in <u>Section 9: Acute Stroke Care</u>.

7.3 Access to brain and vascular imaging and cardiac investigations

The role of diagnostic imaging and other investigations in stroke management is integral to achieving the best outcomes by supporting time critical decision making.

7.3.1 Brain imaging

For people with acute stroke Computed Tomography (CT) of the brain is a useful tool in detecting recent bleeding in and around the brain and can sometimes detect ischaemic changes present as a result of thrombotic stroke. CT Angiography (CTA) and CT Perfusion (CTP) are important in identifying large vessel occlusion, collateral circulation and salvageable tissue for reperfusion interventions. Magnetic Resonance Imaging (MRI) is particularly useful in detecting early or minor ischaemic changes, previous bleeding and can also be used to assess the blood vessels and salvageable brain tissue³.

Decision support systems based on Artificial Intelligence (AI) can provide clinicians and radiologists with very early access to the results of imaging, on laptops or even mobile phones. These platforms support them in the immediate interpretation of the images to confirm the diagnosis and identify a large vessel occlusion and thus speed up the appropriate decision making to refer a patient for hyperacute treatment or not^{4,5}.

However, it is important to recognise that AI is not a standalone decision-making technology and therefore, the process of using AI for decision support should be closely supported by radiology professionals. Formal reporting of images within 24 hours is important as a governance and learning tool.

The additional logistical link in delivering thrombectomy (patients are transferred to a CSC for this treatment) requires a clear plan between the ASC (spoke) and CSC (hub) regarding investigations to avoid duplication and minimise time to treatment. It also requires effective acquisition, transfer and interpretation of images between the ASC and CSCs.

There is also a need to ensure adequate imaging resources in ASCs and CSCs to cope with increasing numbers of patients needing assessments to determine

eligibility for thrombolysis or thrombectomy. Improved access to advanced imaging will maximise the number of patients who present on waking, or present late, to receive thrombolysis and/or thrombectomy⁶.

7.3.2 Vascular imaging

Imaging of the arteries and veins supplying the brain is not only important to determine suitability for thrombectomy but also guides the use of medication, interventional neuro radiology and surgery to reduce risks of stroke recurrence.

All ASCs and CSCs should have a pathway for carotid vascular imaging (using Carotid Doppler and/or CTA or MRA), enabling early identification of vascular pathology and rapid access to the vascular Multi-Disciplinary Team (MDT) to inform secondary prevention strategies where indicated.

- Carotid Ultrasound +/- CTA or MRA should be used for carotid imaging when required
- Where carotid stenosis is detected, there should be rapid access to a vascular MDT
- Carotid intervention should be performed within the standard time as recommended and monitored by the Scottish Stroke Care Audit – a Carotid Co-ordinator role may help this process

7.3.3 Cardiac investigations

Post-stroke cardiac investigations are important for identifying an underlying cardiac cause of stroke, such as AF or Patent Foramen Ovale (PFO). When judged to be required by the stroke specialist there should be early access to prolonged cardiac monitoring to detect paroxysmal AF. Prolonged cardiac monitoring should be carried out and reported within two weeks.

Cardiac rhythm monitoring systems should, where technically possible, have realtime reporting of paroxysmal AF with immediate notification of the service to allow verification of the diagnosis and, if appropriate, immediate anticoagulation. Where patients need anticoagulation, there should be a pathway in place for early anticoagulation with counselling and monitoring systems.

For patient work up for PFO, there should be 'soon' access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal echocardiography with a pathway in place ensuring that PFO closure is carried out within six months of the index stroke.

Monitoring of Boards' ability to perform cardiac investigations for people with stroke within these time frames will be via the Stroke Action Plan and Scottish Stroke Improvement Programme team.

7.4 Recommendations

- 1. People with suspected acute stroke should be assessed for hyperacute stroke treatments by a specialist clinician without delay.
- 2. Where telemedicine is used for the rapid assessment of people with suspected stroke, the system should include the option of a high-quality video link.
- 3. Staff providing care via telemedicine should be appropriately trained in hyperacute stroke assessment, the delivery of thrombolysis and the use of this approach and technology.
- 4. All stroke services should have access to CT, CTA, and CTP on a 24/7 basis whether the patient is an inpatient or outpatient.
- 5. Departments offering CT, CTA, CTP and MRI should have systems in place which ensure that patients with stroke or TIA are prioritised appropriately in order to enable rapid access to these time-sensitive investigations.
- 6. When the stroke specialist feels that brain imaging is required in patients attending the TIA service, there should be same day access to this. MRI will usually be the preferred imaging modality in TIA/minor stroke patients who require a brain scan.
- 7. Where the above investigations are not delivered within one location, stroke services should have a clear plan for a) assessing the gain in outcome if a transfer takes place, and b) enabling a transfer for investigations where the outcome would be improved.
- 8. Where AI is used to support interpretation of imaging and enable timely decisions around transfer for thrombectomy, formal reporting of all radiology investigations should take place the following working day after the investigation is conducted.
- Each stroke service should have a pathway in place enabling same day access to MRI in instances where this would be the most appropriate imaging modality.
- 10. There should be nationally agreed imaging protocols to be followed by ASCs and CSCs for non-contrast CT, CT Angiography (CTA) and CT perfusion (CTP) to avoid duplication.

- 11. All stroke centres should have a clear pathway ensuring that carotid imaging and intervention is performed within the standard time as recommended and monitored by the Scottish Stroke Care Audit. A Carotid Co-ordinator role is recommended to support delivery of this pathway.
- 12. People who have experienced stroke should have access to cardiac investigations including:
 - Prolonged cardiac monitoring to identify paroxysmal AF (within two weeks)
 - Access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal echocardiography with a pathway in place ensuring that PFO closure is carried out within six months of the index stroke.
- 13. IT systems should be in place which highlight that the results of tests are available to the referring clinician. This enables prompt action to be taken on the results of the investigation.

8. Hyperacute Stroke Treatment

For some people, treatment of stroke within the first few hours can include treatments such as thrombolysis and thrombectomy. These are aimed at unblocking the artery. Both have the potential to greatly reduce the brain damage caused, and thus improve functional outcomes and probably survival.

Early blood pressure lowering, in some cases of intracerebral haemorrhage (ICH) may be beneficial and continues to be researched.

The earlier these treatments are given, the more chance the person will have of an improved outcome. Therefore, stroke services need to be configured to minimise any delays and maximise the proportion of patients suitable.

Patients receiving these treatments require more intensive observation and monitoring to minimise risks and identify complications early when they can be most effectively treated. Therefore, post intervention, they should be cared for in a stroke unit enabling close, non-invasive monitoring of physiological parameters to detect the early complications of treatment and of their stroke.

Assessment to determine eligibility for these treatments is outlined in <u>Section 7.2</u>: <u>Assessment of eligibility for hyperacute treatments</u>. This section will therefore focus on the logistics of delivering these treatments as quickly as possible once a patient has been identified as eligible.

8.1 Intravenous thrombolysis

Outcomes from ischaemic stroke treated with thrombolysis are time critical and can be improved by minimising the delay from stroke onset to thrombolysis treatment. There are a number of performance measures within the Scottish Stroke Care Audit relating to the delivery of thrombolysis, and performance measures for thrombectomy are in development.

Thrombolysis is carried out at 22 ASCs and 3 CSCs in Scotland. There is variation in the proportions of patients receiving thrombolysis and variation in door-to-needle time between hospitals.

In most hospitals offering thrombolysis the door-to-needle times are much shorter during normal working hours than at other times. However, in services where a stroke nurse is involved in "pulling" the patient through the pathway, or where specialist stroke doctors are available in person out of hours, door-to-needle times tend to be shorter overall, and the difference between in and out of hours is minimised. This reinforces the importance of adequate stroke specific staffing, including the important role played by stroke nurses⁷.

8.2 Thrombectomy

The most severe 10-20% of acute ischaemic strokes are due to a large vessel occlusion (LVO). Restoring blood flow with early thrombectomy, sometimes referred to as clot retrieval, significantly reduces dependency^{8,9}. In some cases, thrombolysis is given prior to the thrombectomy procedure.

Approximately 800 cases per annum in Scotland, 10% of all stroke presentations, could be treated by a 24/7, Scotland wide, thrombectomy service¹⁰.

Geographical modelling recommends three CSCs (sometimes called Thrombectomy hubs) serving 22 ASCs (sometimes referred to as spoke hospitals) where patients are first taken to their nearest ASC to be diagnosed, scanned, receive thrombolysis if appropriate, and then be transferred to a CSC for thrombectomy. This is known as the 'drip and ship model'¹¹.

There is a planned incremental development of services across the three CSCs (Queen Elizabeth University Hospital, Glasgow, Royal Infirmary of Edinburgh and Ninewells Hospital, Dundee) aiming for 24/7 availability across Scotland by 2023.

It will be important, as the service develops, that monitoring of referrals to the service is followed closely and accounted for in future service planning. This is because the number of people eligible for thrombectomy may increase due to advances in imaging, technology and research.

8.2.1 Transfer from ASC to CSC for thrombectomy

The transfer of patients between hospitals is an aspect of the thrombectomy pathway which can introduce delays to this time critical treatment. Therefore, it is important that safe, efficient and timely transfers take place.

An important aspect of transfer is ensuring agreed and robust communication processes and modalities for discussing cases between ASC, CSCs and the interventional neuro radiologists (INRs) /interventional radiologists (IRs) who will be
carrying out the procedure. It is vital that adequate infrastructure is in place for effective and reliable communications between all relevant teams and health boards.

Utilisation of electronic devices (using 4G/5G), capable of real time information sharing between the thrombectomy nurse escort (based at the ASC hospital), the ASC and CSC stroke physicians and INR/IR which integrate with patients' electronic health records would improve workflows and patient safety. Back-up systems (such as airwave radio systems) should be in place for when primary modes of communication fail or become unreliable due to connectivity or unplanned downtime.

The use of a mobile communication platform is currently being explored by the Thrombectomy Advisory Group (TAG)¹.

8.2.2 Repatriation

People who receive thrombectomy initially require intensive monitoring and support after the intervention in a stroke unit in the CSC until they are deemed to require less intensive care and are suitable for transfer to a stroke unit in the ASC. This is known as repatriation. Repatriation enables patients to receive as much of their care near their own home as possible. Prompt repatriation is vital to maintain flow and for CSCs to continue to take incoming referrals from ASCs.

It is important that there are shared protocols between CSCs, ASCs and the SAS for the delivery of agreed, safe and efficient repatriation. Decisions around repatriation after thrombectomy should be guided by the readiness for repatriation checklist, developed by TAG.

8.2.3 Interventional neuroradiology

Imaginative and flexible workforce solutions will be essential in a globally competitive employment market due to a shortage of specialist trained INRs. Incentivising rotas and job plans may be a partial solution if Scotland is to be an attractive workplace for specialist trained staff. Features of a sustainable interventional neuroradiology/radiology service for thrombectomy will include^{12,13,14}:

- A volume of work at CSCs that satisfies the agreed numbers for maintaining competency and training¹⁵ - training may involve remote mentoring and simulation technology-based teaching.
- Credentialing, supported by interventional neuroradiologists (INRs), may be necessary to train sufficient operators to populate 24/7 rotas across Scotland and enable cover of non- stroke INR work e.g., aneurysm coiling.
- Workforce planning futureproofed for the anticipated increase in workload once a service has commenced and the inevitable effect of extending time windows for intervention as advancements in therapies emerge.

¹ The Thrombectomy Advisory Group is a national group tasked with overseeing the delivery of a national thrombectomy service in Scotland.

- Cognisance that 60% of potential cases will present out of hours work patterns, job plans and rotas will need to reflect this in order to provide equity of access and avoid the "weekend effect".
- Adoption of cutting-edge technological innovation including advancements in AI and neurointerventional robotic solutions.
- Opportunities to participate in research and teaching.

8.3 Management of intracerebral haemorrhage (ICH)

Strokes due to intracerebral haemorrhage (ICH) represented 12% of stroke admissions in Scotland in 2019. Mortality rates and disability remain disproportionately high within this group worldwide¹⁶.

A progressive stroke service should aim to improve outcomes for this group of patients. Hyperacute stroke services for ICH should include^{17,18,19,20}:

- Expert supportive care on a stroke unit, aiming for consistent and optimal care and close observation for signs of deterioration²¹.
- Care that reflects emerging best evidence for reducing secondary brain injury
- Consideration of the adoption of care bundles to help consistency and reduce variation by standardising processes of care.
- Incorporate evidence-based interventions where available.
- Early communication with local or regional neurosurgical teams where the patient is at risk of developing hydrocephalus or other complications amenable to neurosurgical intervention²¹.
- Rapid anticoagulant reversal protocols responsive to emerging evidence as up to 20% of ICH cases occur in patients taking anticoagulant medication²².
- If required, the delivery of appropriate end of life care, consistent with the approach outlined in <u>Section 9.3: End of Life Care</u>, and the avoidance of harm and unintended limitations of care by ensuring timely senior level decision making regarding advanced care planning.

8.4 Recommendations

- 1. All patients eligible for thrombolysis should receive the intervention with the minimum delay. Therefore, there should be a sustained drive to improve door-to-needle times across Scotland.
- 2. Telestroke networks should be developed to support hospitals in achieving optimal thrombolysis treatment numbers and door-to-needle times.
- 3. There should be time efficient pathways and agreed processes for thrombectomy in place at all ASCs and CSCs to optimise patient outcomes and limit patient exclusions in those with ischaemic stroke due to LVO.

- 4. The provision of mobile communication platforms and adequate mobile technology will enable stroke physicians and INR/IRs to interpret hyperacute imaging remotely.
- 5. There should be nationally agreed pathway documentation, in digital and paper format, to facilitate movement of patients between NHS Boards and regions and to reduce duplication of imaging and investigations.
- 6. For patients referred for thrombectomy the door in, door out time in ASCs should be minimised.
- 7. Patients eligible for thrombectomy should be transferred to the CSC via the quickest and safest transport means available as determined by SAS.
- 8. Staff carrying out thrombectomies unsupervised should have completed recognised training and should perform a sufficient number of interventional procedures per annum to maintain their competencies.
- 9. The door-to-puncture time at thrombectomy hubs should be as short as is safely possible.
- 10. There should be agreed and sustainable rotas for anaesthetic staff, INRs/IRs, stroke physicians and theatre staff supporting the thrombectomy service.
- 11. There should be agreed, safe and efficient repatriation protocols in place between the CSCs and ASCs to ensure optimal patient flow.
- 12. There should be continuous review of the thrombectomy service model, processes of care and referral criteria as the evidence base grows. Regular multi-professional governance meetings should take place across Scotland with the intent of optimising learning for all involved in the process and embracing a culture of quality improvement.
- 13. Stroke services should have protocols for the monitoring, referral and urgent transfer of patients to regional neurosurgical centres.
- 14. A focus should be placed on improving outcomes for people with intracranial haemorrhage. This may be achieved by the adoption of care bundles to help consistency and reduce variation by standardising processes of care.

9. Acute stroke care

9.1 Provision of 'the bundle' of care.

The majority of people who experience a stroke will not be eligible to receive hyperacute treatments such as thrombolysis or thrombectomy. The emphasis of care for the majority of stroke patients, is therefore to deliver the stroke bundle.

There are four components to the bundle:

- Swallow screen (100% within 4 hours of arrival, and before any food, fluids or oral medication is administered)²³, we believe this reduces the risk of pneumonia, dehydration, malnutrition and death.
- Brain imaging (90% within 12 hours accepting that hyperacute patients require a scan as soon as possible after arrival), since confirmation of the stroke diagnosis and distinguishing strokes due to ischaemic and bleeding has wide-reaching effects on management from the earliest stages.
- Aspirin for those with ischaemic stroke (95% on day or admission or following day) – which is a very simple and almost universally applicable treatment which improves patients outcome.
- Admission to stroke unit (90% on day of admission or following day) which reliably provides a wide range of targeted interventions. This reduces the risks of complications, improves the patients' experience and is known to improve functional outcomes and reduce mortality.

In general, brain imaging and aspirin standards are met across Scotland. However, there remains significant challenges in swallow screen and access to stroke units. Consequently, the overall adherence to the stroke bundle performance remains low.

Where patients are at risk of post stroke complications (e.g., infection, venous thromboembolism, dehydration, malnutrition, pressure sores), and depending on the established aims of treatment, patients should receive evidence-based interventions such as parenteral fluids, early tube feeding, intermittent pneumatic compression and antibiotics. At present, delivery of these important aspects of stroke care is assessed through sprint audits within the Scottish Stroke Care Audit or local audits. These have demonstrated variable delivery. Such audits had to rely on review of paper or electronic health records which identifies issues in delivery only in retrospect.

TRAKcare, the electronic health record used across Scotland does not support the sort of data capture, extraction and analysis to provide real-time data on delivery of important aspects of stroke unit care. An improved approach is required where failures of delivery are identified in real time, when they can be rectified to avoid patient harm. However, IT systems which are available to do this for only certain aspects of care (e.g. delivery of the National Early Warning System (NEWS) of observations to avoid in hospital deterioration and cardiac arrest) are not currently

used to provide improvements in delivering specialty specific aspects of care, such as those in a stroke unit.

9.2 Access to stroke unit care

Stroke unit care is the central feature of a modern stroke service²⁴. As it can benefit most stroke patients, even those who also undergo hyperacute treatments, it is important that the important role of stroke unit care within hospitals is recognized and supported²⁵.

Through engagement with the National Stroke Voices, we heard that receiving care in a stroke unit was important to people.

"My treatment was much better and much more focused when I was placed in the Stroke Unit" – National Stroke Voices participant.

Every stroke patient should receive the core service characteristics of stroke unit care²⁶ from initial assessment to discharge from hospital²⁷. Key features of a stroke unit in a progressive stroke pathway should include:

A geographically-defined unit

- A co-ordinated multi-disciplinary team that meets at least once a week for the exchange of information about in-patients with stroke.
- Information, advice and support for people with stroke and their family/carers.
- Management protocols for common problems, based upon the best available evidence.
- Close links and protocols for the transfer of care with other in-patient stroke services, early supported discharge teams and community services.
- Training for healthcare professionals in the specialty of stroke.
- The provision of holistic assessment of need for every patient which incorporates the views of patients and their families, which informs decisions about care.
- All interactions and interventions are carried out under a person-centred approach.

Although the core features are well described, services have sought to deliver stroke unit care in a variety of different ways²⁸. The size and configuration of stroke units depends on factors such as rurality and the other services and resources available within the local area.

Of the 22 ASCs, the seven smallest general hospitals in Scotland define stroke unit admission as entering the appropriate acute medical ward. While this means that the hospitals do not meet the first criteria of a geographically defined unit, they should meet all other criteria outlined above. In some instances, this may mean that remote stroke specialist support is required to provide early specialist assessments and a coordinated, regular multi-disciplinary team meeting. This is an appropriate response to maintaining local services, and reduced time to thrombolysis, for people with stroke in these areas.

The Scottish Stroke Care Audit 'bundle' reflects access to stroke unit care and shows that this is currently variable between health boards and sites. There are marked variations in the size of stroke units, their staffing levels (medical, nursing, allied health professionals, clinical and neuropsychologists and social work staff) and the training of those staff.

While every stroke patient should have access to stroke unit care as defined above, in some instances, patients may require more intensive care. This is the case for those who undergo thrombectomy. In such instances, those people should receive care within a stroke unit which can also provide:

- Specialist staffing and technology that provide close clinical and continuous physiological monitoring for all, and especially those at higher risk of early deterioration or complications.
- Seamless working with intensive care units and high dependency units where required.
- Continuous access to a consultant with expertise in stroke medicine, with consultant review seven days per week.
- Immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the hyperacute management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

These features are often available within a hyperacute stroke unit (HASU) where patients often stay for just the first couple of days, or a hyperacute bay within a stroke unit.

All stroke services should have protocols for the monitoring, referral and urgent transfer of patients, where there is a risk of patients requiring neurosurgical intervention, to regional neurosurgical centres.

Systems of joint working should be developed to establish broadly agreed referral criteria for carefully selected cases, e.g., those patients who might benefit from decompressive hemicraniectomy for malignant middle cerebral artery (MCA) syndrome.

As outlined in the introduction of this paper, supporting shared decision making helps to ensure treatments are delivered which are most likely to deliver the outcome valued by the patient and/or family. This remains important in the acute and hyperacute phases and is likely to be optimised by early involvement of senior clinicians with access to systems to share tailored information with patients and their family.

9.3 End of Life Care

About one in 20 people with acute stroke will be receiving end-of-life care within 72 hours of onset, and one in seven people with acute stroke will die in hospital²⁹.

Therefore, providing high quality end-of-life care should be a core activity for the multi-disciplinary stroke team. The key aim is to appropriately and holistically manage distress associated with the end-of-life experience for the person and the family/carers, in line with guideline advice³⁰.

Patients with severe stroke resulting in a high risk of death or poor functional outcome, should be involved at an early stage in shared decision making about the aims of treatments including cardiopulmonary resuscitation, critical care, hemicraniectomy, and treatments to reduce the risk of serious complications. Where the patient lacks capacity then next of kin or advocate should be involved.

Advanced care planning should take place for those people who may survive the acute stroke with limited life expectancy, to facilitate timely referral to specialist palliative care services, where required³¹.

9.4 Recommendations

- 1. Patients with acute stroke should have their clinical status monitored closely and managed according to clinical guidelines.
- 2. Stroke services should deliver the stroke bundle, meeting the Scottish Stroke Care Audit Standards for:
 - Swallow screen
 - Brain imaging
 - Provision of aspirin for those with ischaemic stroke
 - Admission to stroke unit
- 3. Healthcare professionals responsible for the assessment and management of patients with acute stroke should be trained in how to position and mobilise patients in a way that is safe and consistent with clinical guidelines.
- 4. Acute stroke patients should be managed in a stroke unit that meets the core requirements outlined in Section 9.2.
- 5. A stroke unit should have continuous access to a consultant with expertise in stroke medicine, with consultant review 5 days per week.
- 6. Staff working in stroke units should have completed the necessary training as outlined in the national educational template and should follow standardised management protocols for the assessment & management of acute stroke according to clinical guidelines.
- 7. Staff working in stroke units should have access to IT systems which optimise the reliability of assessments and treatment delivery.

- 8. People with rehabilitation needs should be assessed by a therapist and ongoing management planned according to clinical guidelines and in line with the progressive vision of rehabilitation outlined in Section 10.
- 9. Services providing acute and ongoing care for people with stroke should provide high quality end-of-life care for those who need it, including advanced care planning and timely access to specialist palliative care if required.
- 10. All stroke services should have protocols for the monitoring, referral and urgent transfer of patients, where there is a risk of patients requiring neurosurgical intervention, to regional neurosurgical centres.
- 11. In addition, for patients who require closer monitoring:
 - A so called hyperacute stroke unit or area which is providing close monitoring of patients post thrombectomy should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week.
 - These units should in addition have immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

10. Rehabilitation and long-term support

10.1 Stroke Rehabilitation

People who have had a stroke should have access to high quality, evidence-based, person-centred stroke rehabilitation which reflects their needs and preferences. Stroke rehabilitation aims to optimise function, reduce disability, promote independence and work alongside people and their families to achieve meaningful outcomes³². It helps people to be as independent as possible in everyday activities and enables participation in education, work, recreation and meaningful life roles. An inter-disciplinary team approach to stroke rehabilitation is essential, with the individual and their family or carers at the centre and given the opportunity to see the right professional at the right time to support their needs.

The United Nations has set out the right of people with disabilities to have access to rehabilitation to achieve participation and inclusion in all aspects of life³³. The World Health Organisation Rehabilitation in Health Framework highlights a tiered approach to rehabilitation which should be community based and focussed on the needs of the population³⁴.

Access to rehabilitation should be equally available to those in urban and remote and rural areas and across socio-demographic areas, using technology to deliver when appropriate.

Stroke rehabilitation should be based on a holistic biopsychosocial approach which seeks to understand the interactions of a diverse range of factors in a person's presentation (i.e. biological, psychological and social factors). This is essential for defining the aims of rehabilitation and to ensure that interventions are appropriate for, and meet the needs and preferences of, the individual. This shared understanding promotes interdisciplinary working between health and social care professionals to support effective and efficient stroke rehabilitation services³⁵.

The foundations of a progressive stroke rehabilitation service are underpinned by a holistic rehabilitation model and appropriate service infrastructure, leadership and expertise.

The core elements of rehabilitation include person-centred care, the setting of personal goals, and supported self-management. Personalised and evidence based therapeutic interventions delivered by stroke specialists should be offered to support recovery, adaptation to new functional status, and to support self-management and longer-term health and wellbeing.

10.1.1 Key principles of stroke rehabilitation

Person-centred - Person-centred care is about treating people as individuals and working with them to develop the knowledge skills and confidence to manage and make decisions about their own health and social care needs. Rehabilitation should be personalised, co-ordinated and enabling, and above all ensure that people are treated with dignity, compassion and respect³⁶. Person-centred rehabilitation considers the person's needs, capacity, preferences, wishes, values, lifestyle, environment, family and social circumstances. The rehabilitation team works in partnership with them to understand their priorities and to develop solutions.

Personal goals - Goal setting is the process by which the person with stroke (and their family or carers if they wish) and members of the stroke team identify individual goals which are meaningful, challenging and have personal value³⁷.

Supported Self-management - A person-centred approach in which the individual is empowered and has ownership over the management of their life and condition.

Co-ordinated Services- Areas in which Managed Clinical Networks (MCN's) operate with clear clinical and operational leadership are more able to connect services via clear service pathways. Stroke rehabilitation services should co-ordinate across clinical and service pathways and be tailored to individual needs based on a range of personal, environmental and social factors.

Rehabilitation team - Expertise from an interdisciplinary team who work in partnership with the person who has had a stroke and who collectively tailor rehabilitation input towards the person's goals. Where appropriate, this partnership should include family and carers.

Clinical Leadership - Clinical and service leadership should be provided by senior allied health professionals, medical and nursing staff, ensuring an equal focus on hospital and community rehabilitation pathways.

Appropriate care setting - In-patient rehabilitation is required for people with complex physical, cognitive, psychological and/or social needs, who could not be supported in a community setting. Rehabilitation of stroke patients in hospital should occur in an integrated stroke unit (a mixed acute and rehabilitation ward) or a specialist rehabilitation area. Early supported discharge (ESD) and community stroke rehabilitation services should be offered in a community setting whenever that best meets the needs and wishes of the patient.

Evaluation - Data on service delivery, patient outcomes and experiences should be collected systematically³⁸. Outcome measures used should be standardised, valid and reliable³⁹ as well as being focused on what matters to patients^{40,41}. The effectiveness of progressive stroke rehabilitation services will be reviewed via the Scottish Stroke Improvement Programme utilising rehabilitation data from the Scottish Stroke Care Audit and by at least one annual review.

10.1.2 Stroke Rehabilitation Service Provision

Stroke rehabilitation services should include inpatient rehabilitation, ESD and community stroke or neuro rehabilitation teams who work closely to ensure services are delivered in the most appropriate setting for each person's needs. This relies on having the right infrastructures in place, including sufficient access to rehabilitation professionals and close links with social care and the voluntary sector as part of an MCN.

Rehabilitation for people with stroke in all settings should ensure:

- That people receive a holistic assessment to determine their rehabilitation needs as quickly as possible.
- That the delivery of rehabilitation takes place in the most appropriate setting and at the right time for that person's needs.

To achieve this, stroke rehabilitation plans should be agreed and initiated in the acute phase and be available, according to need, along the entire stroke pathway.

The duration of stroke rehabilitation services should be led by the needs of the person who has had a stroke and be defined by their goals and should not be time limited. A clear life-long pathway for people to be able to re-engage with stroke

rehabilitation services and to re-access specialist support should be available to patients and families⁴².

It is important that families and carers are included in rehabilitation planning and goal setting, if agreed by the person who has had the stroke. If agreed, then carers should be

- Included in assessments to identify needs.
- Provided with tailored information about stroke and the caring role.
- Provided with advice, access to emotional support to adjust to their caring role and maintain their wellbeing.
- Signposted to peer support to reduce the impact of loneliness and social isolation if required.

Evidence supports increased frequency and intensity of therapy especially in the first six months post-stroke which can improve recovery rate and outcome. Provision of greater amounts of stroke therapy is associated with higher therapy and nursing staffing levels, a weekend therapy service and specialist stroke rehabilitation teams⁴³. Stroke rehabilitation services should therefore be available as required across the pathway seven days per week at an appropriate intensity with appropriate workforce skill mix.

Factors which impede the amount of therapy provision include time spent in information exchange and administration. Patient focussed reorganisation of working practices including shared documentation, and individual patient therapy timetabling is recommended to enable therapy provision in line with clinical guideline recommendations⁴⁴.

10.1.3 The Rehabilitation Team

Stroke rehabilitation services must include regular access to an inter-disciplinary team who work in a co-ordinated manner and collaborate towards common goals.

The inpatient stroke rehabilitation team should include stroke specialists in medicine, nursing, occupational therapy, physiotherapy, speech and language therapy, and dietetics. It should also ensure timely access to other specialist clinical services as required, such as orthotics, pharmacy, orthoptics, and social work. The psychological, emotional and cognitive effects of stroke should be understood and supported by the whole team. Specialist input from clinical psychology and neuropsychology should also be part of the core team and service provision throughout the patient journey from acute to longer term.

ESD and community stroke/neuro rehabilitation teams should include occupational therapy, physiotherapy, speech and language therapy, nursing and neuro/psychology, with easy access to other professionals as required.

Rehabilitation and recovery should be embedded within all aspects of stroke rehabilitation by all team members on a 24/7 basis. Teams should work to engage people in as much therapeutic activity (including specialist therapy interventions and

self-practice) as required at a frequency and intensity that enables them to reach their rehabilitation goals.

The stroke rehabilitation environment should facilitate patient engagement in a range of physical, cognitive and social activities out with formal therapy time. This can be supported by staff, carers and volunteers. This whole system approach to stroke rehabilitation should be promoted to improve recovery and rehabilitation outcomes⁴⁵.

10.1.4 Rehabilitation settings

Inpatient stroke rehabilitation is required for those who have complex physical, cognitive and psychological needs which are unable to be managed in a community setting.

Community stroke rehabilitation can be offered by a range of services including ESD and community stroke/neuro rehabilitation teams, with varying intensity for up to seven days per week depending on the individual's needs.

All hospital in-patients with stroke who have mild to moderate disability should have the opportunity for early supported discharge⁴⁶ which enables rehabilitation to commence in their home environment within one working day of hospital discharge and at an intensity and frequency that would be provided if they remained in hospital. To enable this, strong links are required between the inpatient and community rehabilitation teams^{47,48}.

Regardless of the health board in which the patient receives acute stroke care, it is important that rehabilitation is provided in their local area. This should be facilitated by effective communication and clear referral pathways between health boards.

To ensure equitable access to ongoing support and self-management resources, all those who have had a stroke or TIA should be provided with high quality, tailored information at the point of discharge from outpatient clinic, emergency department or hospital and be followed up as soon after discharge as possible and thereafter, as indicated by the individual's needs, by a community stroke nurse or other stroke specialist healthcare professional to provide further specialist advice and support.

Everyone with residual difficulties following a stroke on discharge from hospital should be provided with a documented plan for community rehabilitation and self-management support.

In addition, everyone who has experienced a stroke should receive a review by a stroke specialist health care professional within six months of their event.

10.1.5 Key interventions delivered by a progressive stroke rehabilitation service

Many aspects of stroke rehabilitation require a tiered approach whereby aspects of care are the responsibility of the whole interdisciplinary team with specialists within the team focusing on more complex presentations. Each stroke rehabilitation

network should have clearly defined pathways about how these services are provided.

Activities of Daily Living

Activities of daily living (ADL) include personal activities, e.g., washing and dressing; domestic activities, e.g., cooking and housework, and extended activities, e.g., work, driving and leisure. People experiencing difficulty with ADLs should be seen by an occupational therapist for assessment and the implementation of a personalised intervention programme. Evidence supports continued ADL training from occupational therapy and interventions can include direct training in an activity, training in adapted methods of performing an activity and the training in the use of adaptive equipment, assistive technology and environmental adaptation to maintain independence⁴⁹.

Arm function

Rehabilitation interventions that comprise intensive, graded practice of tasks and activities that focus on an individual's goals have been shown to be effective⁵⁰. Progressive arm rehabilitation, usually provided by occupational therapists and physiotherapists, comprises comprehensive assessment, person-centred goal setting and the provision of a structured, goal-orientated programme of intensive practice. This may include assistive technologies (e.g., functional electrical stimulation, mirror-box therapy and virtual reality⁵¹) as well as involving their affected arm in activities of daily living as much as possible in order to increase the intensity of meaningful practice and to improve outcomes.

Bowel and Bladder rehabilitation

Bladder and bowel dysfunction (including urinary incontinence, faecal incontinence, constipation and nocturia) are common and can be persistent following stroke but are amenable to rehabilitation intervention. Progressive rehabilitation will feature structured assessment by a nurse to identify the type of bladder/bowel dysfunction, agreement of individual goals and a programme of mainly behavioural interventions targeted to the type of dysfunction, to support active recovery of bladder/bowel function and use of the toilet. Regular review of the rehabilitation programme and avoidance of containment approaches (including indwelling catheters) are key to recovery of independent bladder/bowel functioning and toilet use⁵².

Balance, walking and mobility

Problems with balance, walking and mobility are likely to increase the risk of falls, deconditioning, becoming housebound and social isolation. People who have had a stroke should have their mobilisation needs assessed and once medically stable, they should be assisted to mobilise, overseen by a physiotherapist. Walking training should be task specific and include a cardiovascular component. Treadmill training with or without body weight support can improve walking and should be available for those who are able to walk independently⁵³. For those who are not able to walk

independently after stroke, electromechanical-assisted gait training devices (i.e. automated electromechanical gait machines) together with physiotherapy can improve the ability to walk independently⁵⁴ and this technology should be made available. Early access to orthotic assessment for the provision of an ankle foot orthosis (AFO) should be available, with reassessment when necessary, in order to facilitate walking and prevent falls. Functional electrical stimulation (FES) should be available to facilitate gait and prevent falls in those with persistent mild lower limb weakness.

Communication

Post-stroke communication disorders occur frequently. Aphasia and dysarthria each affect around a third of people following a stroke. People who are identified as having a communication disorder after a stroke should be assessed by a speech and language therapist and provided with an individualised rehabilitation programme using evidence-based interventions⁵⁵ to reduce the impairment and/or support functional improvement and long-term adaptation. Such interventions may include group work, computer-based therapy, assistive technology and conversation partner training⁵⁶.

Cognition

Cognitive impairment is common following a stroke and can have a significant impact on social recovery and re-integration with overall poorer rehabilitation outcomes. Services should have a documented pathway for the identification and assessment of cognitive problems. Cognitive rehabilitation should be integrated into the broader rehabilitation programme and goals should include cognitive rehabilitation interventions with the aim of restoring, compensating or adapting for reduced cognitive ability.

Driving

A documented pathway should be available to advise on national and local services for further assessment and advice about resuming driving or alternative mobility options. Stroke service should ensure that driver status and intention to return to driving should be ascertained and advice and tailored information is made available.

Fatigue

Fatigue is commonly reported following stroke and can impact on longer term recovery and wellbeing. A range of physical and mental factors may contribute to fatigue and a documented pathway for the identification and assessment of fatigue and its impact on activity and participation should be available. Rehabilitation programmes should include strategies to anticipate and manage fatigue as well as education for patients and families/carers.

Pain management

Pain following stroke can be due to several causes including neuropathic pain, musculoskeletal pain and shoulder pain and subluxation. Each element requires specialised assessment and a range of evidence-based interventions which should be available in documented pathway.

Physical activity, exercise and fitness training

Physical activity, exercise and fitness training should be provided through partnerships between health and exercise professionals, the third sector and local authority services. Exercise and fitness training should begin, as appropriate, in hospital and continue in the community⁵⁷. It should be provided by therapists or exercise professionals who have evidence of stroke specific knowledge and skills to adapt and tailor exercise programmes for people after stroke.

Physical activity should also be encouraged. Many people who have had a stroke experience barriers to becoming more active and sedentary behaviour tends to persist after stroke^{58,59}. Evidence-based counselling strategies are effective to encourage stroke survivors to engage and maintain physical activity after stroke⁶⁰ and these should be provided as required along the entire stroke pathway.

Posture and movement – spasticity services

Stroke services should implement a systematic approach to identify all those who need specialist spasticity assessment and treatment. Stroke services should also implement a documented programme for prevention and management, including self-management, of post stroke spasticity. All those who need it will have access to a specialist spasticity service which may include Botulinum toxin injections, electromyography (EMG) or ultrasound guided approach, appropriate clinical expertise to deliver, and co-ordinated multidisciplinary community follow up including occupational therapy, orthotics and physiotherapy.

Positioning and seating

Following stroke, many people will find it challenging to control their position when in bed and when sitting in a chair. Effective positioning and seating is essential for reducing the risk of aspiration, falls, skin breakdown, and contracture development in addition to providing maximum comfort and supporting participation in ADL. All staff from statutory and voluntary sector organisations and carers involved along the whole pathway should be aware of correct positioning. People with stroke, their carers, and all services should have access to clinicians with training in postural management. Appropriate beds, specialist chairs and positioning equipment should be available from inpatient and community rehabilitation services when required.

Psychological Care (cognitive and emotional)

In the aftermath of stroke, patients and families experience a wide range of psychological, cognitive and emotional difficulties which impact profoundly on function and rehabilitation.

Stroke services should implement a documented programme for promoting awareness of, screening for and treatment of psychological consequences of stroke, led by a specialist clinical/neuropsychologist as detailed in the National Model of Psychological care for stroke⁶¹. Psychological care should be available to all patients in line with local delivery plans.

Relationships and sexuality

Sexuality includes physical and psychosocial aspects of intimacy. Approximately 50% of individuals experience sexual dysfunction following stroke⁶², however it is not commonly included as part of a rehabilitation programme⁶³. Services to address these aspects of life after stroke are variable and professional education is lacking. Education with regards to sexuality following stroke should be provided to the stroke rehabilitation team and specialised support should be made available to those who require it.

Swallowing

Post-stroke swallowing difficulties (dysphagia) are common and can persist longterm. Management of such difficulties should be led by a dysphagia specialist, such as a trained speech and language therapist (SLT), and should include evidencebased rehabilitation and restorative strategies which aim to improve oropharyngeal function. Management of swallowing difficulties will additionally include compensatory strategies, swallowing manoeuvres, sensory modification and texture modification of food and fluids as appropriate. All interventions should take into consideration the factors which may limit ability to participate, such as physical and cognitive impairment, as well as encompass shared decision-making and a shared responsibility for management of risk. There should be access to instrumental assessments such as videofluoroscopy and flexible endoscopic evaluation of swallowing (FEES) to determine the specific rehabilitation programme/management approach. There should also be pathways for people with long-term dysphagia to reaccess services for review.

Technology and tele rehabilitation

Stroke rehabilitation services should include the use of robotics and software programmes which support rehabilitation interventions as appropriate.

Vision

Comprehensive assessment and rehabilitation services should be provided to all those with visual problems due to their stroke including:

- Comprehensive visual screening completed before discharge.
- Direct referral to appropriate professionals for assessment of suspected visual problems.
- Follow up to determine the level of spontaneous recovery of visual problems.

- Provision of treatment and rehabilitation, tailored to the specific visual problems by the most suitable profession in that locality (this may vary across NHS and Social Care areas).
- Provision of tailored information and clear explanation of visual problems, and their possible impact, at each possible opportunity.
- Ensuring individuals have knowledge of, and access to, relevant low vision services initiating direct referral if required⁶⁴.

Vocational rehabilitation

Stroke rehabilitation services should identify work status and offer advice, signposting and referral for specialised return to work support as appropriate. A documented pathway should identify local and regional access to specialised vocational rehabilitation services.

10.2 Supported Self-Management and Longer-term support

Supported self-management and longer-term care & support should be an integral element of stroke rehabilitation pathway⁶⁵ and should be provided in partnership with health, social care and the voluntary sector.

Supported self-management is a core component of person-centred care and is an interdisciplinary approach which supports people to develop skills, knowledge, and confidence to manage the impact of stroke and to maintain an ability to engage in meaningful activities and life roles.

Not everyone who experiences a stroke or TIA will have ongoing rehabilitation needs identified at the time of their discharge. However, feedback from people with lived experience was that often, this meant that there was a missed opportunity to identify routes to access support.

Everyone who experiences a stroke or TIA should receive tailored information provision and be signposted to community-based support and advice. It is important that people who have had a stroke or TIA are provided with the necessary skills, resources and support to continue self-management in the longer term along with management of other long-term conditions they may have⁶⁶.

There is considerable variation across the country in the longer-term support for people who have had a stroke. This may comprise nurse or other healthcare professional follow up, peer support groups and exercise classes. In some places these aspects of care are provided directly by NHS stroke services, in others they are commissioned from charities including Chest Heart and Stroke Scotland (CHSS) and the Stroke Association.

Primary care services are the main source of medical care for stroke survivors in the longer-term after their stroke. It is common practice that routine annual reviews for

people with stroke take place alongside reviews of other long-term conditions. In addition, people who have had a stroke identify health issues that arise and contact primary care services for assessment.

Primary and secondary care services should communicate effectively to enable the provision of patient-centred care, for example primary care may identify a further rehabilitation need and refer the person back to the community rehabilitation team.

People with lived experience of stroke highlighted that a key issue was the lack of a 'joined up' approach, and outlined how important it would be to have a person who could support them by signposting to advice and support services, and act as a point of return for when issues arose further down the line in their journey.

"One of the big aspects is going to be having someone who is responsible for ensuring that the service is joined up. I think that's what's missing" – National Stroke Voices participant.

It is therefore important that people who experience stroke are provided with clear and easily accessible contact information once discharged from community services, enabling the provision of continued advice, support and signposting. A clear life-long pathway for people to be able to re-engage with stroke services and re-access specialist support should be available to patients and families⁶⁷.

To ensure equitable access to ongoing support and self-management resources every person who has had a stroke should be contacted by a community stroke nurse or other appropriate stroke professional as soon as possible following their discharge from outpatient clinic, emergency department or hospital to provide review and an opportunity to access specialist advice and support⁶⁸.

10.3 Recommendations

- 1. Stroke rehabilitation services should be underpinned by a holistic rehabilitation model, appropriate service infrastructure, clinical leadership and expertise.
- 2. Stroke rehabilitation in all settings should be person-centred and optimise outcomes with evidence-based interventions, enabling appropriate long-term support and self-management.
- 3. Rehabilitation should be a process that begins as soon as a stroke is diagnosed and continues as long as required. The duration of stroke rehabilitation should be needs led and not time limited.
- 4. An early holistic assessment of a person's rehabilitation needs should be provided by specialist stroke teams and a personalised, documented

rehabilitation and self-management plan agreed with the person who has had a stroke and, if they wish, their family/carers.

- 5. Stroke rehabilitation services must include a specialised and coordinated team who work in an interdisciplinary manner and collaborate towards common, person-centred goals.
- 6. The psychological, emotional, cognitive effects of stroke should be understood and supported by the whole team. Specialist input from clinical psychology and neuropsychology should be part of the core team and service provision throughout the patient journey from acute to longer term.
- 7. Evidence based stroke rehabilitation services should be available in inpatient and community settings seven days per week at an appropriate intensity, with an appropriate workforce skill mix.
- 8. Each stroke rehabilitation network should have clearly defined pathways about how key stroke rehabilitation interventions and services are provided.
- 9. Stroke rehabilitation services should be provided as part of a managed clinical network which includes inpatient rehabilitation services, ESD and community stroke or neuro rehabilitation teams who work closely with social care and the voluntary sector to ensure services are delivered in the most appropriate setting for each person's needs and ensure equity of service provision across all geographical and socio demographic areas.
- 10. Inpatient stroke rehabilitation is required for those who have complex physical, cognitive and psychological needs which are unable to be managed in a community setting.
- 11. Community stroke rehabilitation can be offered by a range of services with a range of intensities according to individual needs, including Early Supported Discharge and community stroke / neuro rehabilitation teams.
- 12. Clinical and service leadership should be provided by senior allied health professionals, medical, nursing and neuropsychology staff, ensuring an equal focus on hospital and community rehabilitation pathways
- 13. Every person who has had a stroke should be followed up by a community stroke nurse or other appropriate healthcare professional, as soon as possible following discharge from hospital and thereafter, as indicated by the individual's needs, ideally in their own home.

- 14. A clear lifelong pathway for people to re-engage with stroke rehabilitation services and re-access specialist support should be available to patients and families
- 15. A formal review should also be carried out for everyone who has experienced a stroke, six months post event, to provide another opportunity to access specialist advice and support, regardless of the rehabilitation needs identified at the time of their discharge from hospital.
- 16. People who have had a stroke should be signposted to relevant resources and support to continue self-management in the longer term along with management of other long-term conditions they may have.
- 17. Demonstration of a person-centred approach should be evaluated via the approach used by stroke rehabilitation services to deliver activities which are deemed to be central to person centred care e.g., regular holistic assessment of need; goal setting; supported self-management and family/carer involvement, as well as the patient experience of these activities and the treatment and communication they experience with the professionals working with them.

11. Workforce

The quality of stroke services provided is hugely dependent on the availability of knowledgeable, skilled and experienced healthcare professionals. This is influenced by access to high quality education and supported learning, and staff turnover.

Stroke services should provide specialist medical, nursing, allied health professional neuropsychology, and other rehabilitation staffing levels matching the Royal College of Physicians ⁶⁹ and British Association of Stroke Physicians Guidelines⁷⁰.

It is recognised that there is significant attrition of stroke trained staff from acute stroke rotas and services and retention of trained staff remains a challenge for future service provision. It is imperative that burnout risk is minimised in a speciality with unpredictable intensity and requiring complex decision making. To support this, it will be necessary to:

- Ensure that working patterns and staffing levels, especially for healthcare staff contributing to out of hours care, are sustainable to attract and retain staff.
- Consider novel remuneration rates for unsociable hours which may save on external locum costs for rota gaps.
- Ensure that there are adequate levels of support staff and access to IT to optimise the efficiency of clinical staff and optimise patient facing time.

Through the review process for this document, staffing available to deliver equitable rehabilitation services was raised as a concern, with particular reference to limited access to psychology & neuropsychology services across the country.

The rehabilitation workforce challenges mean that in practice, few stroke rehabilitation services are able to offer a seven-day service with appropriate intensity. To be able to provide a progressive stroke rehabilitation service these workforce challenges should be addressed.

11.1.1 Education and training

Stroke services should have an education programme for all staff providing acute, hyperacute stroke care and rehabilitation.

There is currently a national education template which outlines the training required for staff involved in the care of stroke patients. It is important that all NHS boards enable staff involved in delivery stroke care to undertake the education outlined by this template. Dedicated trainers can support this.

- All professional groups potentially dealing with hyperacute patients should have been trained in core stroke competencies, STAT+, STARS Advanced Modules and Hyperacute stroke treatment decision making for clinicians.
- Stroke physicians and radiologists should have up to date training in advanced imaging for stroke.
- Training should be supported by rolling educational plans with blended learning, web based and simulation-based training.
- Training should include a focus on supporting staff with having difficult conversations.
- Regular national educational sessions will support shared learning amongst professional groups.
- Education development framework with clear career progression opportunities important for retaining staff.
- Mentoring for junior staff, opportunities to rotate into other parts of the stroke pathway or undertake secondments and gain wider knowledge and appreciation of their role within the entire system.

To support health boards to deliver effective training and education, at a national level, there will be a continued:

- Investment in developing and maintaining interactive online training which can be accessed at the convenience of the learner.
- Delivery of live training sessions which can be delivered remotely via an appropriate online platform (e.g., MS Teams) to a large live audience across many NHS Boards, and also be recorded for others to access later.
- Coordinated national training programmes tailored to each group of healthcare staff involved in stroke services.

NHS Boards should keep records of the staff working within stroke services, their training needs and training received. When new staff join a stroke service their training needs should be identified and a plan made to meet those needs promptly.

12. Glossary

ACTATS (Acute CTA for Thrombectomy in Stroke): An online training package aimed at stroke clinicians and radiologists to help them interpret CT (see computerized tomography) & CTA (see computed tomography angiography) in the context of thrombectomy.

Acute Stroke Centre: A hospital which has staffing and facilities to acute assess acute stroke patients, carry out an early CT brain scan and deliver thrombolysis. They will also have a stroke unit, or equivalent facility for ongoing care of stroke patients.

AF: Atrial Fibrillation is an irregular and often very rapid heart rhythm (arrhythmia) that can lead to blood clots in the heart. AF increases the risk of stroke.

AFO: Ankle Foot Orthoses are external biomechanical devices utilized on lower limbs to stabilize the joints, improve the gait and physical functioning of the affected lower limb.

AI: Artificial intelligence: In the context of stroke services this term refers to digital systems which provide a rapid interpretation of brain imaging, and communication of the images and its interpretation to those involved in delivering time sensitive stroke treatments.

Aneurysm coiling: a procedure performed to block blood flow into an aneurysm (a weakened area in the wall of an artery).

Aphasia: a disorder of language which can affect speech, reading and writing. It's usually caused by damage to the left side of the brain.

Botulinum toxin injections: Botulinum toxin can help to relax overactive muscles for a short period of time. During this time a therapy programme can be implemented to stretch shortened muscles and stiff joints. This may help improve function e.g., walking or grip, or could help care staff manage personal hygiene.

Carotid endarterectomy: An operation to remove the narrowing in a carotid artery to reduce the risk of future stroke.

Carotid Ultrasound: Carotid ultrasound is an imaging test that uses high-frequency sound waves to create pictures of the inside of carotid arteries. It is used to identify patients who may benefit from carotid endarterectomy or angioplasty and stenting

CHI number: Community Health Index number is a unique patient identifier used across Scotland. The first 6 digits include the patient's date of birth.

CSC: A Comprehensive Stroke Centre is a hospital which in addition to the facilities of the ASC can also provide thrombectomy and neurosurgery with associated critical care support.

CT: A computerized tomography (CT) scan combines a series of X-ray images taken from different angles around your body and uses computer processing to create cross-sectional images (slices) of the inside of the body.

CTA: Computed tomography angiography (CTA) uses an injection of contrast material into your blood vessels and CT scanning to help diagnose and evaluate blood vessel disease or related conditions.

CTP: Computed tomographic perfusion (CTP) imaging is an advanced modality that can aid in diagnosis, management, and prognosis of acute stroke patients by clarifying acute cerebral physiology.

Decompressive hemicraniectomy: A surgical treatment for cerebral oedema (when the brain swells, causing an increase in pressure). Has been performed for several different pathologies, including malignant middle cerebral artery syndrome, one of the most widely recognized large vessel strokes.

Door In, Door Out time: The delay between a patient's arrival at an Acute Stroke Centre (ASC) and their departure from that hospital to go to a Comprehensive Stroke Centre (CSC) for thrombectomy.

DTN: Door-to-Needle Time is the delay between arrival at a hospital and the administration of a bolus of thrombolysis medication.

Dysarthria: Slurred speech caused by disturbance of muscular control.

Dysphagia: Medical term for swallowing difficulties.

Endovascular therapy: Minimally invasive procedures that are done inside the blood vessels.

ESD: Early supported discharge services comprise a stroke specific interdisciplinary team and sufficient care staff to allow hospital admitted stroke patients to be discharged home earlier than otherwise to continue their rehabilitation in the community

Flexible endoscopic evaluation of swallowing (FEES): FEES is a procedure designed to assess swallowing function through visualization of the pharyngeal and laryngeal (throat) structures.

FLORENCE: Flo or Florence is a simple telehealth system that uses text messages to support patients to manage their high blood pressure and related aspects of health.

FES: Functional Electrical Stimulation is a treatment that uses small electrical charges to produce muscle activity or a muscle contraction.

Hydrocephalus: a build-up of fluid around the brain, which increases pressure and can cause brain damage.

Integrated Joint Boards: Bodies that lead the planning of health and social care services. IJB's commissions the local authority and health board to deliver services in line with a strategic plan.

Interdisciplinary team: a group of professionals from a range of disciplines who work in a coordinated manner toward the same goal for the patient

Intermittent pneumatic compression comprises sleeves wrapped around the legs which are inflated regularly to squeeze the legs, increasing blood flow to reduce the risk of blood clots in the legs).

Interventional Neuroradiologists: doctors who specialise in minimally invasive treatment of neurovascular disease including thrombectomy

Interventional Radiologists: Doctors who performs image guided procedures, fully interpret the imaging required to guide and monitor response of those procedures, as well as provides the pre and post procedural care for those patients receiving procedures including thrombectomy.

LDL: **Low density lipoprotein** (LDL) cholesterol is often referred to as "bad cholesterol" because too much is unhealthy.

Large Vessel Occlusion a blockage in one of the major arteries of the brain which may be opened up with thrombectomy.

Managed Clinical Networks: linked groups of health professionals and organisations from primary, secondary and tertiary care, working in a co-ordinated manner to ensure equitable provision of clinically effective services throughout Scotland.

MRA: Magnetic resonance angiography (MRA) uses a powerful magnetic field, radio waves and a computer to evaluate blood vessels and help identify abnormalities.

MRI: Magnetic resonance imaging (MRI) is a type of scan that uses strong magnetic fields and radio waves to produce detailed images of the inside of the body.

Musculoskeletal pain is pain which affects the muscles, ligaments, tendons, and bones.

Mirror-box therapy: a rehabilitation therapy in which a mirror is placed between the arms or legs so that the image of a moving non-affected limb gives the illusion of normal movement in the affected limb.

Multi-disciplinary team: a group of professionals from one or more clinical disciplines who together make decisions regarding recommended treatment of individual

Near Me: A secure form of video consulting approved for use by the Scottish Government and NHS Scotland.

Neuropathic pain: Neuropathic pain is often described as a shooting or burning pain. It often is the result of nerve damage or a malfunctioning nervous system.

Neurosurgery: Specialty concerned with the diagnosis and treatment of patients with injury to, or diseases/disorders of the brain, spinal cord and spinal column, and peripheral nerves within all parts of the body.

Nocturia: The medical term for excessive urination at night.

Orthoptics: Allied health professionals who specialise in the diagnosis and nonsurgical management of eye problems that affect eye movement and the development of vision.

Orthotics: Allied health professionals who make and fit braces and splints (orthoses) for people who need added support for body parts that have been weakened by injury, disease, or disorders of the nerves, muscles, or bones.

Patent Foramen Ovale: A hole in the heart that didn't close the way it should after

Post stroke spasticity: Following stroke, muscles may become stiff, tighten up and resist stretching. This is called spasticity.

SCI Gateway: Scottish Care Information (SCI) Gateway is a national system that integrates primary and secondary care systems using highly secure Internet technology. SCI Gateway enables GPs to access SCI services on-line.

Scottish Stroke Care Audit: An audit coordinated by Public Health Scotland. Measures the performance of stroke services against national standards

STAT+, STARS Advanced Modules: Professional training:

STAT+: Stroke and Transient Ischaemic Attack (TIA) Assessment Training (STAT) and STAT+. Training incorporates simulated scenarios to improve the emergency response to stroke and TIA.

STARS: Stroke Training and Awareness Resources. An e-learning resource providing a learning tool for health and social care staff to enable them to become more knowledgeable and skilful in the area of stroke care.

Stroke: Occurs when the blood supply to part of the brain is interrupted and brain cells are starved of oxygen. **Ischaemic strokes** occur when a blood clot blocks the flow of blood. A **haemorrhagic stroke** can happen when blood from an artery begins bleeding into the brain after a blood vessel bursts.

Subluxation: Shoulder subluxation happens when the upper arm bone, called the humerus, becomes partially dislocated from the shoulder socket. This condition starts when the muscles around the shoulder become weak or paralyzed after stroke.

Telestroke: A service which uses telephone, video conferencing and access to Picture Archiving and Communication System (PACS) to allow clinicians to remotely assess patients to enable the clinician to advise on management.

Thrombectomy: The physical removal of a thrombus (clot) which is blocking an artery causing a stroke.

Thrombolysis: The use of medicine which dissolves blood clots and restores blood flow to the brain.

Transient Ischaemic Attack (TIA): A temporary disruption in the blood supply to part of the brain. The symptoms last only minutes or hours.

TRAKCare: An electronic health record management system which is available in all NHS Boards.

Treadmill training: Used to aid walking rehabilitation with or without the use of body weight support

Transthoracic echocardiogram: The most common type of echocardiogram, which provides a moving image of the internal parts of the heart using ultrasound.

Transoesophageal Echocardiography: A type of echocardiogram where a small probe is passed down the throat into the gullet and stomach.

Transcranial Doppler: A test that uses sound waves to detect medical problems that affect blood flow in the brain.

Triage: The assignment of degrees of urgency to illnesses to decide the order of treatment of a large number of patients.

Vascular surgery: Vascular surgeons are trained in the diagnosis and management of conditions affecting the circulation, including disease of the arteries, veins and lymphatic vessels.

Venous thromboembolism: Blood clots that can develop in the deep veins in the legs or pelvis and can travel to the lungs to cause pulmonary embolism.

Videofluoroscopy: Assesses swallowing ability. It takes place in the X-ray department and provides a moving image of swallowing in real time.

13. Acknowledgements

This document has been delivered through contributions of a number of individuals during the Covid-19 pandemic. We are grateful for their support and contributions and pay special thanks to;

Scottish Government

Katrina Brennan MBE
Professor Martin Dennis
Thérèse Lebedis OBE
Neil Muir

Dr Fiona Wright Susan Wallace Kylie Barclay John Wilson

National Stroke Voices Lived Experience Group.

Thrombectomy Advisory Group

Sub Group advisors (Pre- Hospital, TIA, Hyperacute, stroke unit, rehabilitation and long-term support)

Craig Henderson Dr Stephen Makin Karen Garrott Dr Alison Brooks Dr Gareth Clegg Prof Mark Barber Sandi Haines Dr Gethin Williams Dr Neil Hunter Dr Christine McAlpine Keri-Ann Van-Nuil Dr Richard O'Brien Anne Armstrong Dr Fiona Brodie Professor Jo Booth Gillian Crighton Gillian Capriotti Andrea Cail Dr Helen Slavin Dr Gareth Blayney Dr John Reid Dr Ronnie Burns Dr Luke Yates Dr Matt Lambert Dr Mary Joan Macleod Dr Tracey Baird Elizabeth Barrie Dr Anthony Byrne Linda Campbell Christine Carter Dr Vera Cvoro Prof Peter Langhorne Dr Emma Coutts Dr Charlie Chung Dr Alastair Cozens Dr Jackie Hamilton Dr Christine Hazelton Lesley Kane Dr Lisa Kidd Dr Ashish Macaden Dr Alex Pollock Dr Lesley Scobbie Mark Smith Prof. Frederike van Wijck Dr Luke Williams

¹ Public Health Scotland, (2021), *Scottish Stroke statistics - Year ending 31 March 2020*, available at <u>https://publichealthscotland.scot/publications/scottish-stroke-statistics/scottish-stroke-statistics-year-ending-31-march-2020/</u>, accessed 1st November 2021.

² Royal College of Physicians, (2016), *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 1st November 2021.

³ Ajay Bhalla, Mehool Patel, Jonathan Birns, (2021), An update on hyper-acute management of ischaemic stroke, *Clinical Medicine*, 21 (3) pp 215-221

⁴ Hassan AE, Ringheanu VM, Rabah RR, et al, (2020). Early experience utilizing artificial intelligence shows significant reduction in transfer times and length of stay in a hub and spoke model, *Interventional Neuroradiology*, 26(5): pp 615-622.

⁵ Murray NM, Unberath M, Hager GD, et al (2020), Artificial intelligence to diagnose ischemic stroke and identify large vessel occlusions: A systematic review, *Journal of NeuroInterventional Surgery*, 2020, 12(2): pp 156-164.

⁶ Thomalla G, Boutitie F, Ma H, et al, (2020), Intravenous alteplase for stroke with unknown time of onset guided by advanced imaging: systematic review and meta-analysis of individual patient data, *Lancet,* Nov 14; 396(10262): pp 1574-1584.

⁷ McDermott M ,Skolarus LE ,Burke JF, (2019), A systematic review and meta-analysis of interventions to increase stroke thrombolysis, *BMC Neurology*, May 3;19(1): pp 86

⁸ Mortimer A, Lenthall R, Wiggam I, et al, (2021), To support safe provision of mechanical thrombectomy services for patients with acute ischaemic stroke: 2021 consensus guidance from BASP, BSNR, ICSWP, NACCS, and UKNG, *Clinical Radiology*, 76(2).

⁹ NICE,(2019), Stroke and transient ischaemic attack in over 16s: diagnosis and initial management NICE guideline: NG128, available at

https://www.nice.org.uk/guidance/ng128/chapter/Recommendations#thrombectomy-for-people-withacute-ischaemic-stroke, accessed 25th October 2021. ¹⁰McMeekin P, White P, James MA, et al, (2017), Estimating the number of UK stroke patients eligible for endovascular thrombectomy, *European Stroke Journal*, Dec;2(4): pp319-326.

¹¹ Zhang L, Ogungbemi A, Trippier S, et al, (2021), Hub-and-spoke model for thrombectomy service in UK NHS practice. *Clinical Medicine Journal*, Jan;21(1): pp e26-e31.

¹² British Society of Interventional Radiology and The Royal College of Radiologists, (2019), *Provision of Interventional Radiology: Second Edition*, London, The Royal College of Radiologists, available at https://www.rcr.ac.uk/system/files/publication/field_publication, The Royal College of Radiologists, (2019), *Provision of Interventional Radiology: Second Edition*, London, The Royal College of Radiologists, available at https://www.rcr.ac.uk/system/files/publication/field_publication_files/bfcr198-provision-interventional-radiology-services-second-ed.pdf, accessed 25th October 2021.

¹³ https://bsnr.org.uk/_userfiles/pages/files/bsnrtrainingresponsetomtevidencefinal23116.pdf

¹⁴ Mortimer A, Lenthall R, Wiggam I, et al, (2021), To support safe provision of mechanical thrombectomy services for patients with acute ischaemic stroke: 2021 consensus guidance from BASP, BSNR, ICSWP, NACCS, and UKNG, *Clinical Radiology*, 76(2).

¹⁵ Kim BM, Baek JH, Heo JH, et al, (2019), Effect of Cumulative Case Volume on Procedural and Clinical Outcomes in Endovascular Thrombectomy, *Stroke*, May; 50(5): pp1178-1183.

¹⁶ Feigin VL, Krishnamurthi RV, Parmar P, et al, (2015), Update on the global burden of ischemic and hemorrhagic stroke in 1990-2013: the GBD 2013 study, *Neuroepidemiology*, 45: pp161–76.

¹⁷ Canadian Stroke Best Practices, (2020), Emergency Management of Intracerebral Hemorrhage: 7th Edition – 2020 UPDATE, available at <u>https://www.strokebestpractices.ca/recommendations/management-of-intracerebral-hemorrhage/emergency-management-of-intracerebral-hemorrhage</u>, accessed 15th November 2021.

¹⁸ Hemphill JC, Greenberg SM, Anderson CS, et al, (2015), Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American heart Association/American stroke association, *Stroke*, Volume 46, No7: pp2032–60

¹⁹ Parry-Jones AR, Sammut-Powell C, Paroutoglou K, et al, (2019), An intracerebral hemorrhage care bundle is associated with lower case fatality, *Annals of Neurology*, 86 (4): pp495–503

²⁰ Parry-Jones AR, Moullaali TJ, Ziai WC, (2020), Treatment of intracerebral hemorrhage: From specific interventions to bundles of care, *International Journal of Stroke*, 15(9): pp945-953.

²¹ Canadian Stroke Best Practices, (2020), Emergency Management of Intracerebral Hemorrhage: 7th Edition – 2020 UPDATE, available at

https://www.strokebestpractices.ca/recommendations/management-of-intracerebralhemorrhage/emergency-management-of-intracerebral-hemorrhage, accessed 15th November 2021.

²² Canadian Stroke Best Practices, (2020), Emergency Management of Intracerebral Hemorrhage: 7th Edition – 2020 UPDATE, available at

https://www.strokebestpractices.ca/recommendations/management-of-intracerebralhemorrhage/emergency-management-of-intracerebral-hemorrhage, accessed 15th November 2021.

²³ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

²⁴ (RCP 2016; Appendix Figure 1 - Purple box)

²⁵ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

²⁶ Langhorne P, Ramachandra S, (2020), Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke: network meta-analysis, *Cochrane Database of Systematic Reviews*, 4(4):CD000197

²⁷ Busingye D, Kilkenny MF, Purvis T, et al, (2018), Is length of time in a stroke unit associated with better outcomes for patients with stroke in Australia? An observational study, *BMJ Open*, 12;8(11):e022536

²⁸ (Appendix Table 1 and 2).

²⁹ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

³⁰ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

³¹ NHS Quality Improvement Scotland, (2010), Best Practice Statement: End of life care following acute stroke, available at <u>Best_Practice_Statement_End_of_life_care_following_acute_stroke.pdf</u> (scot.nhs.uk), accessed 15th November 2021.

³² Wright J, Zeeman H, Biezaitis V, et al, (2016), Holistic Practice in Traumatic Brain Injury Rehabilitation: Perspectives of Health Practitioners, *PLOS ONE*, 11(6): e0156826.

³³ United Nations, Convention on the Rights of Persons with Disabilities and Optional Protocol, available at <u>https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html#Fulltext</u>, accessed 1st November 2021.

³⁴ World Health Organisation, (2019), Rehabilitation in health systems: guide for action, available at <u>https://www.who.int/publications/i/item/9789241515986</u>, accessed 15th November 2021.

³⁵ Wade DT & Halligan PW, (2017), The biopsychosocial model of illness: a model whose time has come, Clinical Rehabilitation, Vol. 31(8) 995–1004

³⁶ The Health Foundation, Person-centred care made simple: What everyone should know about person-centred care, January 2016, available at https://www.health.org.uk/publications/person-centred-care-made-simple, accessed 24th January 2021

³⁷ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

³⁸ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

³⁹ Kwakkel G, van Peppen R, Wagenaar RC, et al, (2004), Effects of augmented exercise therapy time after stroke a metaanalysis, *Stroke*, 35(11): pp2529–2539

⁴⁰ Duncan-Millar D, van Wijck F, Pollock A, Ali M, (2021), International consensus recommendations for outcome measurement in post-stroke arm rehabilitation trials, *European Journal of Physical and Rehabilitation Medicine*, 57(1): pp61-68.

⁴¹ Duncan-Millar J, van Wijck F, Pollock A, Ali M. Outcome measures in post-stroke arm rehabilitation trials: do existing measures capture outcomes that are important to stroke survivors, carers, and clinicians? Clinical Rehabilitation 2019, Vol. 33(4) 737 –749. DOI: 10.1177/0269215518823248

⁴² Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁴³ Gittins M, Vail A, Bowen A, et al on behalf of the SSNAP collaboration, (2020), Factors influencing the amount of therapy received during inpatient stroke care: an analysis of data from the UK Sentinel Stroke National Audit Programme, *Clinical Rehabilitation*, Volume: 34 issue: 7, page(s): 981-991

⁴⁴ Clarke DJ, Burton LJ, Tyson SF et al, (2018), Why do stroke survivors not receive recommended amounts of active therapy? Findings from the ReAcT study, a mixed-methods case-study evaluation in eight stroke units, *Clinical Rehabilitation*, Vol. 32(8) pp1119 - 1132

⁴⁵ Clarke D, Gombert-Waldron K, Honey S, et al, (2021), Co-designing organisational improvements and interventions to increase inpatient activity in four stroke units in England : a mixed-methods process evaluation using normalisation process theory. *BMJ Open*, 11(1):e042723

⁴⁶ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁴⁷ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁴⁸ Langhorne P, Baylan S, (2017, Early supported discharge services for people with acute stroke, *Cochrane Database of Systematic Reviews*, Issue 7. Art. No: CD000443.

⁴⁹ Legg LA, Lewis SR, Schofield-Robinson OJ et al, (2017), Occupational Therapy for adults with problems in activities of daily living after stroke. *Cochrane Database of Systematic Reviews*, Issue 7, Article No: CD003316

⁵⁰ Bosomworth H, Rodgers H, Shaw L, (2020), Evaluation of the enhanced upper limb therapy programme within the Robot-Assisted Training for the Upper Limb after Stroke trial: descriptive analysis of intervention fidelity, goal selection and goal achievement, *Clinical Rehabilitation*, 35(1): pp119-134

⁵¹ Pollock A, Baer G, Campbell P, et al, (2014), Physical rehabilitation approaches for the recovery of function and mobility following stroke, *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001920.

⁵² Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁵³ Mehrholz J, Thomas S, Elsner B, (2017), Treadmill training and body weight support for walking after stroke. *Cochrane Database of Systematic Reviews*, Issue 8. Art. No.: CD002840

⁵⁴ Mehrholz J, Thomas S, Elsner B, (2017), Treadmill training and body weight support for walking after stroke. *Cochrane Database of Systematic Reviews*, Issue 8. Art. No.: CD002840

⁵⁵ Brady MC, Kelly H, Godwin J, Enderby P, et al, 2016. Speech and language therapy for aphasia following stroke. *Cochrane Database of Systematic Reviews*, Issue 6, Art. No: CD000425.

⁵⁶ UK Government, Guidance: Assistive technology: definition and safe use, Updated 28 October 2021, available at <u>Assistive technology: definition and safe use - GOV.UK (www.gov.uk)</u>, accessed 15th November 2021.

⁵⁷ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁵⁸ Tieges, Z. et al, (2015), Sedentary behavior in the first year after stroke: a longitudinal cohort study with objective measures. *Archives of Physical Medicine and Rehabilitation*, 96(1), pp15-23

⁵⁹ Fini NA, Holland AE, Keating J, et al, (2017), How physically active are people following stroke? systematic review and quantitative synthesis, *Physical Therapy*, 97: pp707–717

⁶⁰ Pollock A, Baer G, Campbell P et al, (2014), Physical rehabilitation approaches for the recovery of function and mobility following stroke, *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001920

⁶¹ National Model of Psychological Care in Stroke (Scotland) (NMPCS) in *Improving Psychological Care in Stroke Service: A National Model for Scotland, October 2020*, Scottish Stroke Psychology Forum.

⁶² Stratton, H., Sansom, J., Brown-Major, A et al, (2020). Interventions for sexual dysfunction following stroke, *Cochrane Database of Systematic Reviews*, Issue 5. Art. No.: CD011189

⁶³ Winstein, C.J., et al (2016). Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke, 47(6), e98-169

⁶⁴ Pollock, A, Hazelton, C., Rowe, F et al, (2019), Interventions for visual field defects in people with stroke, *Cochrane Database of Systematic Reviews*, Issue 5, Art. No.: CD008388

⁶⁵ Kidd L, Booth J, Lawrence M, & Rowat A (2020) Implementing Supported Self-Management in Community-Based Stroke Care: A Secondary Analysis of Nurses' Perspectives. Journal of Clinical Medicine. 9(4):985. <u>https://doi.org/10.3390/jcm9040985</u>

⁶⁶ Kidd L, Booth J, Lawrence M, & Rowat A (2020) Implementing Supported Self-Management in Community-Based Stroke Care: A Secondary Analysis of Nurses' Perspectives. Journal of Clinical Medicine. 9(4):985. <u>https://doi.org/10.3390/jcm9040985</u>

⁶⁷ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁶⁸ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁶⁹ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁷⁰ British Association of Stroke Physicians, (2019), Meeting the Future Consultant Workforce Challenges: Stroke Medicine, available at <u>BASP-Stroke-Medicine-Workforce-Requirements-Report-</u><u>FINAL.pdf</u>, accessed 23rd October 2021.

Contents

1.	Foreword3			
2.	Introduction			
	2.1.1	Realistic Medicine and shared decision making	6	
	2.1.2	Information technology (IT)	6	
	2.1.3	Research	7	
3.	Gove	rnance	7	
4.	4. Primary Prevention			
4	.1 R	ecommendations	8	
5.	Reco	gnition and Referral	9	
5	.1 In	nproving individual awareness and recognition of stroke	9	
5	.2 In	nproving referral pathways	9	
	5.2.1	Referral to TIA services	10	
	5.2.2	Suspected acute stroke – taking prompt action	10	
5	.3 R	ecommendations	11	
6.	TIA S	ervices	12	
6	.1 S	pecialist assessment	12	
6	.2 In	vestigations	13	
6	.3 Ti	reatment and care	13	
6	.4 R	ecommendations	15	
7.	Trans	fer to Hospital	15	
7	.1 In	nproving pre-hospital assessment	16	
7	.2 P	re-Alert	16	
7	.3 R	ecommendations	17	
8.	Asses	ssment and diagnostics	17	
8	.1 In	terface between stroke services and emergency departments	17	
8	.2 A	ssessment of eligibility for hyperacute treatment	18	
8	.3 A	ccess to brain and vascular imaging and cardiac investigations	19	
	8.3.1	Brain imaging	19	
	8.3.2	Vascular imaging	20	
	8.3.3	Cardiac investigations	20	
8	.4 R	ecommendations	21	
9.	Нуре	racute Stroke Treatment	22	
9	.1 In	travenous thrombolysis	22	
9	.2 TI	hrombectomy	23	
	9.2.1	Transfer from ASC to CSC for thrombectomy	23	
	9.2.2	Repatriation	24	

9.2.3 Interventional neuroradiology24
9.3 Management of intracerebral haemorrhage (ICH)
9.4 Recommendations
10. Acute stroke care
10.1 Provision of 'the bundle' of care
10.2 Access to stroke unit care
10.3 End of Life Care
10.4 Recommendations
11. Rehabilitation and long-term support
11.1 Stroke Rehabilitation
11.1.1 Key principles of stroke rehabilitation
11.1.2 Stroke Rehabilitation Service Provision
11.1.3 The Rehabilitation Team
11.1.4 Rehabilitation settings
11.1.5 Key interventions delivered by a progressive stroke rehabilitation service 37
11.2 Supported Self-Management and Longer-term support
11.3 Recommendations 43
12. Workforce
12.1.1 Education and training45
13. Glossary
14. Acknowledgements 52

1. Foreword

The <u>2019-20 Programme for Government</u> set out the Scottish Government's commitments on stroke care, including the ambition to scope and define a progressive model of stroke care.

As Chair of the National Advisory Committee for Stroke (NACS), I am pleased to have been able to lead this work. However, this document is the result of a huge amount of work by a large number of people who have committed their time during the COVID pandemic to describe The Progressive Stroke Pathway.

NACS is the national group which coordinates implementation of the <u>Stroke</u> <u>Improvement Plan</u> and aims to promote Scotland-wide collaboration, peer support and dissemination of best practice in the prevention, diagnosis, treatment and longterm management of stroke.

The Progressive Stroke Pathway draws on the expertise of a wide range of clinicians, as well as those with lived experience of stroke and the current treatment and rehabilitation pathway, to describe what we think progressive stroke care in Scotland should comprise. The pathway sets out an ambitious vision of a stroke service that fully meets the holistic needs of patients, as well as envisioning how future uses of novel technology and an evolving workforce can be incorporated into a progressive stroke service.

At every stage of the Progressive Stroke Pathway, we have outlined recommendations, based on best practice, clinical views and the experiences of stroke survivors.

Going forward, NACS will work with the Scottish Government, and continue to liaise with third sector organisations and those with lived experience, to support the delivery of the commitments in stroke care outlined in the Programme for Government.

MSDennis

Professor Martin Dennis

Chair, National Advisory Committee for Stroke (NACS)
2. Introduction

Stroke develops as a result of problems with the blood vessels supplying blood to the brain.

There were 3,754 deaths in Scotland in 2019 where cerebrovascular disease, including stroke, was the underlying cause. While there has been a decrease in deaths due to stroke over the last decade, it is important to note that it remains a leading cause of death and the leading cause of disability in Scotland¹. This highlights that there is still work to do to improve prevention of, and outcomes from, stroke and to ensure that people across Scotland have equitable access to treatment and care.

Stroke remains a national clinical priority for Scottish Government. The <u>2019/20</u> and <u>2020/21</u> Programmes for Government made a number of commitments on stroke, including commitments to develop a national thrombectomy service and to '*scope out and define what a progressive stroke service looks like*'.

This document defines a progressive stroke pathway in the Scottish context and sets out a vision of stroke services in Scotland. It has been produced by the National Advisory Committee for Stroke (NACS) in collaboration with the groups and individuals outlined in <u>section 13 (Acknowledgements)</u> We are grateful to the many health care professionals who shared their expertise with us, and to the National Stroke Voices who shared their lived experience of stroke to support the development of this document. A refreshed Stroke Improvement Plan will follow to support in the delivery of this vision.

The infographic below depicts an overview of the 'Progressive stroke pathway' defined in this document. This pathway includes prevention, recognition of stroke, transfer to hospital, hyperacute and acute care through to rehabilitation and supported self-management.



2. Appropriate awareness and onward referral by Healthcare professionals.

Acute Stroke Suspected, transfer to hospital:

 Improved pre-hospital assessments, enabled by better training and access to stroke specialists via technology and improved diagnostic tools.

2. Pre-alert including CHI number enabling quicker action upon arrival at hospital

TIA or Minor stroke suspected:

- 1. Early specialist assessment
- 2. Early access to investigations
- 3. Early initiation of treatment
- 4. Onward referral where necessary

5. Follow-up

Assessment/diagnosis (to determine diagnosis and assess eligibility for hyperacute stroke treatments): 1. Effective interface/collaboration with emergency

- department (as initial receivers).
 - 2. Early access to investigations

3. Assessment for hyperacute treatment eligibility should take place immediately and by a stroke specialist.

Eligible for Thrombolysis:

 Reduction in Door-to-Needle times across Scotland
Role of stroke nurse/interface with ED

3. Care in a stroke unit for post thrombolysis monitoring

Eligible for Thrombectomy:

 Timely transfer to Comprehensive Stroke Centre
Care delivered within a stroke unit enabling increased monitoring post intervention.

3. Specialist staff with recognised training experience

4. Repatriation protocols in place

Intracerebral Haemorrhage

1. Care provided within Stroke Unit if no surgical intervention required.

2. Engagement with local or regional neurosurgical teams where necessary.

Acute Care

- 1. Delivery of stroke care bundle
- 2. Provision of care within stroke unit
- 3. End of life care where appropriate

Rehabilitation:

Started early in person's journey
Person-centred and holistic
Appropriate frequency and intensity
Provided by an interdisciplinary team
Delivered in appropriate setting
Appropriate follow-up
Supported self-management

There are number of principles underpinning delivery of a progressive stroke pathway. These include the principles of Realistic Medicine, the importance of good information technology (IT) and digital systems to facilitate seamless delivery of care, and an effective research environment.

2.1.1 Realistic Medicine and shared decision making

Delivery of a Realistic Medicine approach means ensuring that people who experience stroke are supported to take part in shared decision making about their treatment and care, to ensure that what matters to them is at the heart of the delivery of care throughout the whole pathway.

This should be incorporated into all aspects of the progressive stroke pathway. Specific shared decision-making tools, including those which facilitate sharing of individualised information about patients' diagnosis, prognosis and treatments and goal setting, can support such an approach.

Involvement of specific healthcare staff such as speech and language therapy for patients with communication difficulties, and clinical psychology for those with cognitive problems, can further enable communication and shared decision making.

2.1.2 Information technology (IT)

The delivery of a progressive stroke pathway is facilitated by digital health systems which facilitate networking between clinicians, the use of artificial intelligence (AI) in decision making, the ability to support the movement of patients across different NHS Boards and enable digital models of care to provide people with stroke access to remote care and self-management tools based on their needs and preferences.

In a progressive stroke pathway, stroke services should have access to systems which:

- Support shared electronic health record keeping, reduce duplication and allow information sharing across a network of care along the whole pathway.
- Plan, prompt and record important aspects of care digitally to optimise delivery whilst making best use of clinicians' time.
- Support secure communication (voice, video, text, shared documents and images) between clinicians working across networks.
- Alert a responsible clinician or team to referrals or abnormal investigations to maximise safety and minimise delays.
- Capture data in real-time for audit/quality improvement and monitoring as a by-product of clinical care.
- Support healthcare professionals in using "Tailored Talks". This is a tool which facilitates the provision of tailored digital information and/or signposting for patients, their relatives and carers.
- Establish electronic documentation for remote consultation outcomes (e.g. Clinical Portal) when cases are referred and discussed. An audit trail of

referrals, decisions and outcomes will help inform practice development and processes.

2.1.3 Research

Clinical research has an important function in delivering progressive stroke services. It helps to produce the knowledge on which to base more effective stroke services and ensures that healthcare staff are aware of the most up-to-date evidence and the latest developments in diagnostics and treatment. To facilitate continued clinical research activity, it is important to:

- Maintain the research infrastructures (e.g., University departments, NHS Research & Development, the Scottish Stroke Research Network (SRN) and Cochrane Stroke Review Group) which have helped make Scotland one of the leading countries for stroke research worldwide.
- Ensure that stroke patients and their families or carers can shape and participate in research in all parts of their pathway, wherever they are being cared for.

3. Governance

This vision document will be supported by a refreshed Stroke Improvement Plan, the delivery of which will be overseen by the National Advisory Committee on Stroke, and monitored through the Scottish Stroke Care Audit and Scottish Stroke Improvement Programme.

While Scottish Government sets the overall policy direction and vision, NHS Boards have a statutory responsibility for the delivery of health care within their area. It is therefore important that NHS Boards seek to deliver the vision outlined within this document, giving an equivalent level of prioritisation to stroke services as outlined by Scottish Government.

To achieve this requires that:

- NHS Boards have a clear management structure for stroke services relating to the whole patient pathway covering inpatients, outpatients and community services.
- Each NHS board should identify a member of their Senior Management Team to be accountable for the delivery of stroke services.
- Managed Clinical Networks (MCNs) should serve to coordinate professionals, services and organisations to ensure equitable, high quality clinical services.
- MCNs should operate with clear clinical and operational leadership to connect services via service pathways.
- Stroke services should coordinate across clinical, professional and service pathways, and be tailored to individual needs based on a range of personal, environmental and social factors.
- Stroke services should capture data which reflects performance in real-time, to support quality improvement activities.

- The NHS Board senior management team should take responsibility for ensuring that stroke services meet all important quality indicators within the Scottish Stroke Care Audit.
- NHS Boards should, where necessary, work collaboratively with other NHS Boards in the delivery of services. This is essential in the delivery of thrombectomy, which requires a national approach, and for thrombolysis, vascular surgery and sometimes TIA and rehabilitation services, which often require a regional approach.
- NHS Boards should work as part of integrated joint boards, alongside social care delivery partners and the third sector to deliver effective rehabilitation and supported self-management.

4. **Primary Prevention**

This refers to interventions aimed at reducing the risk of a stroke in people who have not yet had a stroke. This is distinct from secondary prevention which aims to reduce the risk of a recurrent stroke.

A progressive stroke pathway should focus preventative efforts on the identification and treatment of atrial fibrillation (AF) and raised blood pressure which are of specific importance to reduce the incidence of stroke. Secondary prevention (detection of AF or high blood pressure after stroke) is also important and more fully addressed within <u>Section 7.3: Access to imaging and other investigations.</u>

Actions on other risk factors for cardiovascular disease, including stroke, such as obesity (<u>A Healthier Future: Scotland's Diet & Healthy Weight Delivery Plan 2018</u>), smoking (<u>Raising Scotland's Tobacco-Free Generation: Tobacco Control Action Plan 2018</u>) and alcohol consumption (<u>Alcohol Framework 2018</u>: <u>Preventing Harm</u>) are covered by other Scotlish Government policy commitments and therefore are out of scope for this document.

Improving the primary identification and management of AF and blood pressure will involve a focus on improving data collection in primary care to better measure improvement, supporting community models of detection, and improving access to technology to support self-management.

4.1 Recommendations

- 1. Encourage improved detection, diagnosis and management of AF and high blood pressure, through quality improvement within primary care and community settings.
- 2. Support the development of pathways of care for AF which ensure prompt assessment and, where appropriate, treatments including anticoagulation, ablation and left atrial appendage occlusion to reduce the risk of future stroke.

3. Enable the use of proven technology to support detection, tele-monitoring and the provision of tailored self-management support for people with risk factors for stroke such as high blood pressure or AF.

5. Recognition and Referral

Raising and maintaining awareness of the symptoms of stroke and transient ischaemic attack (TIA) in the population, its recognition, and the need to immediately seek help are key to optimising treatment and outcomes.

5.1 Improving individual awareness and recognition of stroke

The FAST campaign is a UK wide awareness campaign designed to help detect and enhance responsiveness to the needs of a person having a stroke. The acronym stands for:

- Facial drooping
- Arm weakness
- **S**peech difficulties
- Time to call emergency services

Awareness campaigns should be shaped by evidence about what methods (e.g. TV/radio advertising, social media) most effectively reach target populations. It is especially important to consider how best to reach people who may face inequalities in access to information, or awareness of stroke. This includes:

- People for whom English is not a first language
- People living in areas of deprivation
- Younger people who may not be aware of their risk of stroke

5.2 Improving referral pathways

Early assessment and triage for people with stroke or TIA is important because the time windows for delivering the most effective interventions, such as thrombolysis, thrombectomy & commencement of secondary prevention, are measured in hours. The earlier treatment is started the more effective it is.

Most services in Scotland have a system in place to allow urgent patient referral for rapid specialist assessment, though unwarranted variation should be identified and addressed.

The National Stroke Voices highlighted the importance of raising awareness about recognition of stroke and TIA within primary care, and identified emergency departments as a key area for improvement. Targeted education on FAST and clear referral guidelines could support health care professionals to recognise symptoms and signs of stroke, including in circumstances where presentation may not be typical (for example where the FAST test might be negative, or where the person experiencing stroke is young).

5.2.1 Referral to TIA services

In instances where the symptoms of stroke have resolved rapidly and an acute stroke is not suspected, then the person should be referred into TIA services. Key aspects of these services are outlined in detail in <u>Section 5: TIA Services</u>. The most common sources of referral to TIA services will be from primary care, emergency departments, ophthalmology/optometry services, medical wards and Scottish Ambulance Service. Clear pathways should be in place for all referrers.

In some locations TIA telephone hotlines are in place which allow paramedics, primary care clinicians and emergency department professionals to talk directly to a stroke physician at the time of the patient first accessing healthcare. This enables early specialist intervention and treatment whilst the patient is waiting to have the diagnosis and treatment refined.

All patients referred to TIA services should be told that they must not drive for one month - as per <u>Driver and Vehicle Licensing Agency (DVLA) recommendations</u> - and should be advised regarding current regulations around resuming driving. This should be supported by a robust and rapid electronic referral system e.g., SCI gateway or TRAK workbench, which should prompt driving advice and secondary prevention prescription. These referrals should be monitored, or have notification systems, to ensure prompt appointing to specialist review.

5.2.2 Suspected acute stroke – taking prompt action

In instances where symptoms of stroke persist and an acute stroke is suspected, the patient should be transferred by ambulance to the nearest 'stroke ready' hospital – that is a hospital with facilities to scan patients, offer hyperacute treatment with thrombolysis and provide assessment of eligibility for thrombectomy.

There are 25 such hospitals across Scotland, 22 of these are Acute Stroke Centres (ASCs). The remaining three are Comprehensive Stroke Centres (CSCs), which in addition to the facilities described above, can also deliver thrombectomy and neurosurgical interventions.

All stroke centres will have stroke units unless they serve a very small population (such as occurs in remote and rural areas where the essential features of a stroke unit are delivered within a single ward area). This is <u>described in more detail in</u> <u>Section 9.2</u>.

In a progressive stroke pathway, it will be important to ensure ambulance response times are as short as possible, through appropriate assessment and prioritisation of emergency calls².

NHS 24 or 999 call handlers use algorithms to assess the urgency of calls and the likelihood that the person has had a stroke. Improved algorithms based on analysis of linked data about triage and resulting actual diagnoses could help reduce delays to effective treatments. Such an approach would be maximised by targeted training for call handlers in awareness and identification of stroke.

Ambulance crews should be supported with continued training in the most up-to date tools to improve diagnosis and assessment of the patients' need for hyperacute treatments and early secondary prevention.

Once the ambulance crew has made an assessment it is necessary to consider robust and transparent algorithms for the prioritisation of SAS resources, including air transfers, which take account of availability, the benefits and risks to the patient, the time urgency of the interventions and the cost effectiveness to ensure that the optimum improvement in outcomes from the available resources can be achieved. These should be developed through analysis of linked data from SAS and the Scottish Stroke Care Audit.

5.3 Recommendations

- 1. Effective campaigns to raise awareness of stroke and TIA, their impact on people who experience them, and tools for timely recognition should consider how best to reach people who may face inequalities in access to information, or awareness of stroke.
- 2. Support the use of FAST and work to embed other pre-hospital stroke tools particularly those which support assessment for hyperacute treatment - in a standardised way across NHS 24, primary care and SAS.
- 3. Improved algorithms and training for NHS 24 or SAS call handlers and crews should be deployed to support the assessment of the urgency of calls and the likelihood that the patient has had a stroke, and enable effective prioritisation of SAS resources, including air transfers.
- 4. Ensure appropriate referral of people with all stroke events, including those with acute ongoing symptoms, acute but resolved symptoms and other stroke-like events.
- 5. Referral systems should prompt driving advice and secondary prevention prescription.
- 6. All patients referred to TIA services should be told not to drive for one month (as per DVLA recommendations) at the point of referral and advised on current regulations for resuming driving.

6. TIA Services

Many people who develop mild or transient symptoms which might represent a TIA or mild stroke do not require immediate admission to hospital but do need specialist assessment by a clinician experienced in stroke care, early access to investigations and same day initiation of treatment to reduce the risk of a disabling stroke.

TIA services aim to offer these functions flexibly and provide access to support to reduce long-term risks and optimise the person's physical, psychological and social outcomes.

These services may be delivered in a variety of settings including, but not limited to, specialist TIA outpatients' clinics. However, people with suspected TIA can also be supported effectively through the provision of services within ambulatory care units, stroke units, or through rapid inpatient ward reviews. A proportion of patients with TIA are seen in an Emergency Department. These models of care, so long as they are supported by stroke specialists and have early access to investigations, or backup from a TIA clinic, can provide excellent care which minimises the risk of further stroke.

The Scottish Stroke Care Audit does not fully capture or monitor routinely activity which takes place outside of TIA clinics as it has proven challenging to capture data in these more varied settings. This should be addressed to enable us to understand and compare all models of care for people with TIA.

The performance of TIA clinics is currently monitored by the Scottish Stroke Care Audit which measures the proportion of patients seen in the TIA clinics within 4 days of referral. Whilst the majority of services meet the standard of 80%, there remain opportunities for improvement and to address variation.

As the risk of recurrent stroke is higher in the first day or two following a TIA, the faster a person can be seen the better. Therefore, the Scottish Stroke Improvement Programme will work with services across Scotland to minimise delays.

At present, the Scottish Stroke Care Audit measures the referral time to TIA services, but there is an opportunity to look in more detail at the care for people who have experienced a TIA. Therefore, development of a TIA bundle including times to important investigations and treatments should be included within the audit.

6.1 Specialist assessment

Specialist assessment for people with suspected TIA helps to expedite additional imaging where this is necessary and ensure that a diagnosis and treatment plan is refined and tailored to the individual's needs. This should take place in a timely manner, as specified by relevant clinical guidelines.

Where in-person specialist assessment cannot always be rapidly available, TIA services should consider how targeted access to local or remote stroke specialists (for patients meeting agreed criteria) can minimise delay to time-sensitive interventions.

Due to the Covid-19 pandemic many NHS boards had started to incorporate virtual assessments using telephone and Near Me into their assessments. This more flexible approach has led to reduced waiting times for specialist input in some areas. It is important to ensure that where virtual assessments are performed, patients should have the same access to rapid investigations and immediate secondary prevention as those who are seen face-to-face.

6.2 Investigations

People with suspected TIA or minor ischaemic stroke require timely access to investigations to confirm a diagnosis and guide treatment.

High risk TIAs and patients with uncertain presentations may be assessed as inpatients, and so rapid access to necessary radiology and cardiac investigations should be available in both outpatient and inpatient settings. There should be a robust system in place to ensure that the results of radiology and cardiac investigation results are available rapidly and are flagged to the responsible clinicians.

Full details of access to investigations for people with suspected TIA or stroke is outlined in <u>Section 7.3: Access to imaging and other investigations.</u>

6.3 Treatment and care

Where necessary, people seen in TIA services should be able to rapidly access appropriate support from a Multi-Disciplinary Team including speech and language therapy, occupational therapy, clinical psychology, orthotics, ophthalmology and orthoptics.

Some patients seen in TIA services turn out not to have had a TIA or stroke. Alternative pathways should be available if input is required from another specialist service. There should also be a system for rapid feedback to referrers when a person would not benefit from attendance at a TIA service, and clear communication of an alternative pathway or approach.

For people who are identified as having had a TIA, treatment involves access to secondary prevention medication and advice. All NHS Boards should therefore have accessible pathways and secondary prevention guidelines for TIA patient management, which should be up-to-date and responsive to change in the evidence base. These should ensure that:

- For TIA (with full recovery) antiplatelet agents and a statin should be commenced immediately (as per local guidance, including any necessary investigations) pending specialist review, unless specialist review is immediate.
- Guidelines should recommend which secondary prevention medication to prescribe but should also have a plan for situations where medication should not be stopped (e.g., for some cases anticoagulants after TIA).
- Secondary preventative medications should be immediately available e.g., from ward stock, hospital pharmacy or written prescription to take straight to a 24/7 chemist.

People who have experienced a TIA or minor stroke may also require advice or onward referral to support them in their longer-term self-management. The following should be available from the TIA service:

- Referral to addiction support teams
- Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
- Recommendations to optimise physical activity and reduce sedentary behaviour, including referral to exercise services where appropriate
- Referral to Dietetics
- Vocational advice and support
- Recommendations to support emotional and psychological wellbeing including referral to psychological services where appropriate

Communication between health professionals following TIA assessment is important. There should be a rapid electronic communication system back to the referrer following assessment in a TIA service. If using a traditional dictated letter system, then the letter should be sent electronically and within 48 hours of the specialist assessment.

It is important that referrers are made aware of individual treatment targets:

- Remote blood pressure monitoring should be available where required e.g., FLORENCE programme or 24-hour ambulatory monitoring
- Selected patients may benefit from more aggressive lipid management aiming for lower LDL targets where appropriate, pathways should be in place for this e.g., a pharmacist led stroke lipid clinic, primary care follow up system.
- Furthermore, any request to referrer to make urgent prescribing changes or other key changes to management should be transmitted immediately.

Following discharge from TIA services, patients who have experienced TIA or minor stroke should receive lifelong follow-up in primary care and long-term conditions monitoring. This will require ongoing education to support primary care professionals with:

- Current best practice for longer-term care of TIA or stroke survivors
- Managing stroke in people with co-existing conditions

• Current guidance and pathways for referring a person back to stroke services

Follow up appointments for people who have experienced TIA should be available when needed, potentially through the TIA clinic or a stroke liaison nurse team.

6.4 Recommendations

- 1. People with suspected TIA should have specialist assessment by a clinician experienced in stroke care, early access to investigations and same day initiation of treatment to reduce the risk of further stroke.
- 2. Where in-person specialist review cannot always be rapidly available, TIA services should consider how to enable access to local or remote stroke specialists for patients meeting agreed criteria.
- 3. There should be appropriate pathways in place for onward referral of people who have had neither stroke nor TIA but require input from another specialist service.
- 4. All NHS Boards should have accessible pathways and secondary prevention guidelines for TIA patient management.
- 5. TIA services should support the following, where required:
 - Referral to addiction support teams
 - Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
 - Recommendations to optimise physical activity and reduce sedentary behaviour, including referral to exercise services where appropriate.
 - Referral to Dietetics
 - Recommendations to support emotional and psychological wellbeing including referral to psychological services where appropriate
 - Vocational advice and support
- 7. The Scottish Stroke Care Audit should develop a TIA bundle which takes account of the varied models of providing care for people with TIA.

7. Transfer to Hospital

Most patients with symptoms of acute stroke will be transferred to hospital by the Scottish Ambulance Service (SAS). In general, SAS transport patients with suspected hyperacute stroke to the nearest hospital which can provide thrombolysis (Acute Stroke Centre).

Transfer to hospital is a vital part of a progressive stroke pathway. There are important opportunities to:

- Improve pre-hospital diagnostic accuracy including assessment of eligibility for hyperacute treatments, enabling possible bypass of the local Acute Stroke Centre (sometimes referred to as a spoke hospital in the thrombectomy pathway) to a Comprehensive Stroke Centre (sometimes referred to as a thrombectomy hub).
- Provide receiving clinicians with information to enable quick decision making upon arrival at hospital.

7.1 Improving pre-hospital assessment

It is important to continue providing training and support to ambulance crews in the use of pre-hospital clinical assessment tools and to explore the use of more detailed tools or technologies which might improve diagnostic accuracy and triage for stroke, TIA and the identification of people potentially suitable for thrombolysis and thrombectomy.

Improving pre-hospital assessment of people who would benefit from hyperacute treatment will reduce time to treatment by ensuring that they can be quickly placed on the pathway for the most appropriate treatment.

It is also important that ambulance crews have the capacity to seek advice from stroke specialists to support with triage and diagnosis while a patient is being transferred. This can be provided via telestroke services. For example, there have been pilot projects indicating that providing ambulance crews with access to specialist support via a Professional to Professional audio and/or video call can enhance the pre hospital diagnostic accuracy and decision making with respect to TIA and stroke.

7.2 Pre-Alert

Ensuring that appropriate information is available to clinicians receiving the patient at the hospital enables quicker decision making and enables timely access to imaging and treatment upon arrival.

Pre-alert refers to the sharing of information about a patient with the hospital during transfer by an ambulance crew. Through our review process, hospital clinicians highlighted the vital importance of the pre-alert including patient identifiers such as the CHI number, name and date of birth. Despite this, the reviews identified that there is variation in appropriate pre-alerting of patients with stroke, and of the information included with the pre-alert.

At present, there is a lack of timely data available from NHS boards and sites, concerning the number of patients with suspected hyperacute stroke that are prealerted by SAS. This in turn means that there is no robust measure to ensure the correct patients are being taken to the most suitable hospital, and then placed on the most appropriate pathway. It is therefore important to have access to better information about pre-alerting across Scotland, to address variation and to improve pre-alerting in general.

7.3 Recommendations

- 1. To improve pre-hospital assessment ambulance crews should continue to be trained and supported in the use of pre-hospital clinical assessment tools.
- 2. The use of more detailed tools or technologies, which might improve diagnostic accuracy and triage for stroke, TIA and the identification of people potentially suitable for thrombolysis and thrombectomy, should be explored.
- 3. Telestroke systems should be available for use in ambulances and air transport to enable professional-to-professional calls to support ambulance crews in decision making regarding hyperacute stroke.
- 4. A single communication platform should facilitate voice, data and video communication between paramedics, ambulance control, stroke physicians in ASCs and CSCs, stroke nurses and interventional radiologists.
- 5. Communication of patient identifiers during pre-alert should be enabled to support timely decision making and improve time to treatment upon arrival at hospital.
- 6. A mechanism should be developed to provide routine feedback of confirmed diagnosis and treatment pathway to SAS to support staff development and improve performance and patient pathways.

8. Assessment and diagnostics

Early assessment and diagnosis are vital to ensuring that people can receive prompt and appropriate treatment, thus improving their chances of positive outcomes.

8.1 Interface between stroke services and emergency departments

Seamless joint working between stroke services and emergency departments is paramount for optimal patient care and outcomes in the acute stage of the stroke pathway.

To minimise delays to assessment and treatment for people with stroke, emergency department services should include:

• Systems supporting pre-registered imaging requests from the stroke team clinicians.

- Staff competent in acute stroke management and familiar with thrombolysis and thrombectomy eligibility criteria and pre-transfer procedures, checklists and processes.
- Video links for optimal virtual communication between the emergency department and stroke teams, where required.
- Senior stroke decision maker and senior leadership involvement at the front door to minimise door-to-needle times for thrombolysis e.g., straight to CT protocols.
- Systems and resources agreed with SAS to minimise door in, door out times for patients eligible for thrombectomy.
- Goal of minimising inappropriate or futile transfers to the CSC for thrombectomy.
- "Straight to MRI protocols" for some strokes where this is the most appropriate imaging modality.
- Agreed stroke mimic pathways where non stroke patients are cared for out with the stroke service, when possible, enabling efficient use of stroke beds and workforce.

Performance and protocols should be audited, and cases reviewed.

8.2 Assessment of eligibility for hyperacute treatment

People with suspected acute stroke should be assessed immediately to determine the best approach to treatment. This is particularly important for identifying people who would benefit from specific hyperacute stroke treatments such as thrombolysis and/or thrombectomy.

Assessment for emergency hyperacute stroke treatments should be undertaken by a stroke specialist clinician without delay. In locations where that specialist clinician is not available on site then telestroke services should provide access to specialist assessment and decision making.

Telestroke involves the use of mobile technologies to provide audio and/or video calls between patients and local and remote healthcare professionals. It has a major role in improving access to hyperacute specialist care, decision making and the safe delivery of hyperacute treatments.

Electronic documentation for remote consultation outcomes (e.g., Clinical Portal) should be established. An audit trail of referrals, decisions and outcomes will help inform practice development and processes.

Telestroke can be used to support filtering and triage of referrals from remote sites into designated stroke units and reduce delays in time critical decisions, including on the delivery of appropriate treatments and identification of patients not suitable for specific interventions or transfer to another site.

Eligibility for thrombolysis should be guided by available clinical support tools. Further information on thrombolysis is included in <u>Section 8.1: Intravenous</u> <u>Thrombolysis</u>. Eligibility for thrombectomy should be guided by available clinical support tools. Patients who are identified as eligible for thrombectomy should be transferred to the relevant CSC for further assessment to confirm eligibility and to receive this intervention. They should then be admitted to a stroke unit to receive appropriate post intervention monitoring and care. Further detail on the core components of the delivery of thrombectomy are outlined in <u>Section 8.2: Thrombectomy</u>

The majority of patients with acute stroke will not be eligible for thrombolysis or thrombectomy. The key focus for these patients is ensuring access to the stroke bundle, including care within a designated stroke unit. Full information on this is included in <u>Section 9: Acute Stroke Care</u>.

8.3 Access to brain and vascular imaging and cardiac investigations

The role of diagnostic imaging and other investigations in stroke management is integral to achieving the best outcomes by supporting time critical decision making.

8.3.1 Brain imaging

For people with acute stroke Computed Tomography (CT) of the brain is a useful tool in detecting recent bleeding in and around the brain and can sometimes detect ischaemic changes present as a result of thrombotic stroke. CT Angiography (CTA) and CT Perfusion (CTP) are important in identifying large vessel occlusion, collateral circulation and salvageable tissue for reperfusion interventions. Magnetic Resonance Imaging (MRI) is particularly useful in detecting early or minor ischaemic changes, previous bleeding and can also be used to assess the blood vessels and salvageable brain tissue³.

Decision support systems based on Artificial Intelligence (AI) can provide clinicians and radiologists with very early access to the results of imaging, on laptops or even mobile phones. These platforms support them in the immediate interpretation of the images to confirm the diagnosis and identify a large vessel occlusion and thus speed up the appropriate decision making to refer a patient for hyperacute treatment or not^{4,5}.

However, it is important to recognise that AI is not a standalone decision-making technology and therefore, the process of using AI for decision support should be closely supported by radiology professionals. Formal reporting of images within 24 hours is important as a governance and learning tool.

The additional logistical link in delivering thrombectomy (patients are transferred to a CSC for this treatment) requires a clear plan between the ASC (spoke) and CSC (hub) regarding investigations to avoid duplication and minimise time to treatment. It also requires effective acquisition, transfer and interpretation of images between the ASC and CSCs.

There is also a need to ensure adequate imaging resources in ASCs and CSCs to cope with increasing numbers of patients needing assessments to determine

eligibility for thrombolysis or thrombectomy. Improved access to advanced imaging will maximise the number of patients who present on waking, or present late, to receive thrombolysis and/or thrombectomy⁶.

8.3.2 Vascular imaging

Imaging of the arteries and veins supplying the brain is not only important to determine suitability for thrombectomy but also guides the use of medication, interventional neuro radiology and surgery to reduce risks of stroke recurrence.

All ASCs and CSCs should have a pathway for carotid vascular imaging (using Carotid Doppler and/or CTA or MRA), enabling early identification of vascular pathology and rapid access to the vascular Multi-Disciplinary Team (MDT) to inform secondary prevention strategies where indicated.

- Carotid Ultrasound +/- CTA or MRA should be used for carotid imaging when required
- Where carotid stenosis is detected, there should be rapid access to a vascular MDT
- Carotid intervention should be performed within the standard time as recommended and monitored by the Scottish Stroke Care Audit – a Carotid Co-ordinator role may help this process

8.3.3 Cardiac investigations

Post-stroke cardiac investigations are important for identifying an underlying cardiac cause of stroke, such as AF or Patent Foramen Ovale (PFO). When judged to be required by the stroke specialist there should be early access to prolonged cardiac monitoring to detect paroxysmal AF. Prolonged cardiac monitoring should be carried out and reported within two weeks.

Cardiac rhythm monitoring systems should, where technically possible, have realtime reporting of paroxysmal AF with immediate notification of the service to allow verification of the diagnosis and, if appropriate, immediate anticoagulation. Where patients need anticoagulation, there should be a pathway in place for early anticoagulation with counselling and monitoring systems.

For patient work up for PFO, there should be 'soon' access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal echocardiography with a pathway in place ensuring that PFO closure is carried out within six months of the index stroke.

Monitoring of Boards' ability to perform cardiac investigations for people with stroke within these time frames will be via the Stroke Action Plan and Scottish Stroke Improvement Programme team.

8.4 Recommendations

- 1. People with suspected acute stroke should be assessed for hyperacute stroke treatments by a specialist clinician without delay.
- 2. Where telemedicine is used for the rapid assessment of people with suspected stroke, the system should include the option of a high-quality video link.
- 3. Staff providing care via telemedicine should be appropriately trained in hyperacute stroke assessment, the delivery of thrombolysis and the use of this approach and technology.
- 4. All stroke services should have access to CT, CTA, and CTP on a 24/7 basis whether the patient is an inpatient or outpatient.
- 5. Departments offering CT, CTA, CTP and MRI should have systems in place which ensure that patients with stroke or TIA are prioritised appropriately in order to enable rapid access to these time-sensitive investigations.
- 6. When the stroke specialist feels that brain imaging is required in patients attending the TIA service, there should be same day access to this. MRI will usually be the preferred imaging modality in TIA/minor stroke patients who require a brain scan.
- 7. Where the above investigations are not delivered within one location, stroke services should have a clear plan for a) assessing the gain in outcome if a transfer takes place, and b) enabling a transfer for investigations where the outcome would be improved.
- 8. Where AI is used to support interpretation of imaging and enable timely decisions around transfer for thrombectomy, formal reporting of all radiology investigations should take place the following working day after the investigation is conducted.
- 9. Each stroke service should have a pathway in place enabling same day access to MRI in instances where this would be the most appropriate imaging modality.
- 10. There should be nationally agreed imaging protocols to be followed by ASCs and CSCs for non-contrast CT, CT Angiography (CTA) and CT perfusion (CTP) to avoid duplication.

- 11. All stroke centres should have a clear pathway ensuring that carotid imaging and intervention is performed within the standard time as recommended and monitored by the Scottish Stroke Care Audit. A Carotid Co-ordinator role is recommended to support delivery of this pathway.
- 12. People who have experienced stroke should have access to cardiac investigations including:
 - Prolonged cardiac monitoring to identify paroxysmal AF (within two weeks)
 - Access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal echocardiography with a pathway in place ensuring that PFO closure is carried out within six months of the index stroke.
- 13. IT systems should be in place which highlight that the results of tests are available to the referring clinician. This enables prompt action to be taken on the results of the investigation.

9. Hyperacute Stroke Treatment

For some people, treatment of stroke within the first few hours can include treatments such as thrombolysis and thrombectomy. These are aimed at unblocking the artery. Both have the potential to greatly reduce the brain damage caused, and thus improve functional outcomes and probably survival.

Early blood pressure lowering, in some cases of intracerebral haemorrhage (ICH) may be beneficial and continues to be researched.

The earlier these treatments are given, the more chance the person will have of an improved outcome. Therefore, stroke services need to be configured to minimise any delays and maximise the proportion of patients suitable.

Patients receiving these treatments require more intensive observation and monitoring to minimise risks and identify complications early when they can be most effectively treated. Therefore, post intervention, they should be cared for in a stroke unit enabling close, non-invasive monitoring of physiological parameters to detect the early complications of treatment and of their stroke.

Assessment to determine eligibility for these treatments is outlined in <u>Section 7.2</u>: <u>Assessment of eligibility for hyperacute treatments</u>. This section will therefore focus on the logistics of delivering these treatments as quickly as possible once a patient has been identified as eligible.

9.1 Intravenous thrombolysis

Outcomes from ischaemic stroke treated with thrombolysis are time critical and can be improved by minimising the delay from stroke onset to thrombolysis treatment. There are a number of performance measures within the Scottish Stroke Care Audit relating to the delivery of thrombolysis, and performance measures for thrombectomy are in development.

Thrombolysis is carried out at 22 ASCs and 3 CSCs in Scotland. There is variation in the proportions of patients receiving thrombolysis and variation in door-to-needle time between hospitals.

In most hospitals offering thrombolysis the door-to-needle times are much shorter during normal working hours than at other times. However, in services where a stroke nurse is involved in "pulling" the patient through the pathway, or where specialist stroke doctors are available in person out of hours, door-to-needle times tend to be shorter overall, and the difference between in and out of hours is minimised. This reinforces the importance of adequate stroke specific staffing, including the important role played by stroke nurses⁷.

9.2 Thrombectomy

The most severe 10-20% of acute ischaemic strokes are due to a large vessel occlusion (LVO). Restoring blood flow with early thrombectomy, sometimes referred to as clot retrieval, significantly reduces dependency^{8,9}. In some cases, thrombolysis is given prior to the thrombectomy procedure.

Approximately 800 cases per annum in Scotland, 10% of all stroke presentations, could be treated by a 24/7, Scotland wide, thrombectomy service¹⁰.

Geographical modelling recommends three CSCs (sometimes called Thrombectomy hubs) serving 22 ASCs (sometimes referred to as spoke hospitals) where patients are first taken to their nearest ASC to be diagnosed, scanned, receive thrombolysis if appropriate, and then be transferred to a CSC for thrombectomy. This is known as the 'drip and ship model'¹¹.

There is a planned incremental development of services across the three CSCs (Queen Elizabeth University Hospital, Glasgow, Royal Infirmary of Edinburgh and Ninewells Hospital, Dundee) aiming for 24/7 availability across Scotland by 2023.

It will be important, as the service develops, that monitoring of referrals to the service is followed closely and accounted for in future service planning. This is because the number of people eligible for thrombectomy may increase due to advances in imaging, technology and research.

9.2.1 Transfer from ASC to CSC for thrombectomy

The transfer of patients between hospitals is an aspect of the thrombectomy pathway which can introduce delays to this time critical treatment. Therefore, it is important that safe, efficient and timely transfers take place.

An important aspect of transfer is ensuring agreed and robust communication processes and modalities for discussing cases between ASC, CSCs and the interventional neuro radiologists (INRs) /interventional radiologists (IRs) who will be

carrying out the procedure. It is vital that adequate infrastructure is in place for effective and reliable communications between all relevant teams and health boards.

Utilisation of electronic devices (using 4G/5G), capable of real time information sharing between the thrombectomy nurse escort (based at the ASC hospital), the ASC and CSC stroke physicians and INR/IR which integrate with patients' electronic health records would improve workflows and patient safety. Back-up systems (such as airwave radio systems) should be in place for when primary modes of communication fail or become unreliable due to connectivity or unplanned downtime.

The use of a mobile communication platform is currently being explored by the Thrombectomy Advisory Group (TAG)¹.

9.2.2 Repatriation

People who receive thrombectomy initially require intensive monitoring and support after the intervention in a stroke unit in the CSC until they are deemed to require less intensive care and are suitable for transfer to a stroke unit in the ASC. This is known as repatriation. Repatriation enables patients to receive as much of their care near their own home as possible. Prompt repatriation is vital to maintain flow and for CSCs to continue to take incoming referrals from ASCs.

It is important that there are shared protocols between CSCs, ASCs and the SAS for the delivery of agreed, safe and efficient repatriation. Decisions around repatriation after thrombectomy should be guided by the readiness for repatriation checklist, developed by TAG.

9.2.3 Interventional neuroradiology

Imaginative and flexible workforce solutions will be essential in a globally competitive employment market due to a shortage of specialist trained INRs. Incentivising rotas and job plans may be a partial solution if Scotland is to be an attractive workplace for specialist trained staff. Features of a sustainable interventional neuroradiology/radiology service for thrombectomy will include^{12,13,14}:

- A volume of work at CSCs that satisfies the agreed numbers for maintaining competency and training¹⁵ training may involve remote mentoring and simulation technology-based teaching.
- Credentialing, supported by interventional neuroradiologists (INRs), may be necessary to train sufficient operators to populate 24/7 rotas across Scotland and enable cover of non- stroke INR work e.g., aneurysm coiling.
- Workforce planning futureproofed for the anticipated increase in workload once a service has commenced and the inevitable effect of extending time windows for intervention as advancements in therapies emerge.

¹ The Thrombectomy Advisory Group is a national group tasked with overseeing the delivery of a national thrombectomy service in Scotland.

- Cognisance that 60% of potential cases will present out of hours work patterns, job plans and rotas will need to reflect this in order to provide equity of access and avoid the "weekend effect".
- Adoption of cutting-edge technological innovation including advancements in AI and neurointerventional robotic solutions.
- Opportunities to participate in research and teaching.

9.3 Management of intracerebral haemorrhage (ICH)

Strokes due to intracerebral haemorrhage (ICH) represented 12% of stroke admissions in Scotland in 2019. Mortality rates and disability remain disproportionately high within this group worldwide¹⁶.

A progressive stroke service should aim to improve outcomes for this group of patients. Hyperacute stroke services for ICH should include^{17,18,19,20}:

- Expert supportive care on a stroke unit, aiming for consistent and optimal care and close observation for signs of deterioration.
- Care that reflects emerging best evidence for reducing secondary brain injury
- Consideration of the adoption of care bundles to help consistency and reduce variation by standardising processes of care.
- Incorporate evidence-based interventions where available.
- Early communication with local or regional neurosurgical teams where the patient is at risk of developing hydrocephalus or other complications amenable to neurosurgical intervention.
- Rapid anticoagulant reversal protocols responsive to emerging evidence as up to 20% of ICH cases occur in patients taking anticoagulant medication.
- If required, the delivery of appropriate end of life care, consistent with the approach outlined in <u>Section 9.3: End of Life Care</u>, and the avoidance of harm and unintended limitations of care by ensuring timely senior level decision making regarding advanced care planning.

9.4 Recommendations

- 1. All patients eligible for thrombolysis should receive the intervention with the minimum delay. Therefore, there should be a sustained drive to improve door-to-needle times across Scotland.
- 2. Telestroke networks should be developed to support hospitals in achieving optimal thrombolysis treatment numbers and door-to-needle times.
- 3. There should be time efficient pathways and agreed processes for thrombectomy in place at all ASCs and CSCs to optimise patient outcomes and limit patient exclusions in those with ischaemic stroke due to LVO.

- 4. The provision of mobile communication platforms and adequate mobile technology will enable stroke physicians and INR/IRs to interpret hyperacute imaging remotely.
- 5. There should be nationally agreed pathway documentation, in digital and paper format, to facilitate movement of patients between NHS Boards and regions and to reduce duplication of imaging and investigations.
- 6. For patients referred for thrombectomy the door in, door out time in ASCs should be minimised.
- 7. Patients eligible for thrombectomy should be transferred to the CSC via the quickest and safest transport means available as determined by SAS.
- 8. Staff carrying out thrombectomies unsupervised should have completed recognised training and should perform a sufficient number of interventional procedures per annum to maintain their competencies.
- 9. The door-to-puncture time at thrombectomy hubs should be as short as is safely possible.
- 10. There should be agreed and sustainable rotas for anaesthetic staff, INRs/IRs, stroke physicians and theatre staff supporting the thrombectomy service.
- 11. There should be agreed, safe and efficient repatriation protocols in place between the CSCs and ASCs to ensure optimal patient flow.
- 12. There should be continuous review of the thrombectomy service model, processes of care and referral criteria as the evidence base grows. Regular multi-professional governance meetings should take place across Scotland with the intent of optimising learning for all involved in the process and embracing a culture of quality improvement.
- 13. Stroke services should have protocols for the monitoring, referral and urgent transfer of patients to regional neurosurgical centres.
- 14. A focus should be placed on improving outcomes for people with intracerebral haemorrhage. This may be achieved by the adoption of care bundles to help consistency and reduce variation by standardising processes of care.

10. Acute stroke care

10.1 Provision of 'the bundle' of care.

The majority of people who experience a stroke will not be eligible to receive hyperacute treatments such as thrombolysis or thrombectomy. The emphasis of care for the majority of stroke patients, is therefore to deliver the stroke bundle.

There are four components to the bundle:

- Swallow screen (100% within 4 hours of arrival, and before any food, fluids or oral medication is administered)²¹, we believe this reduces the risk of pneumonia, dehydration, malnutrition and death.
- Brain imaging (90% within 12 hours accepting that hyperacute patients require a scan as soon as possible after arrival), since confirmation of the stroke diagnosis and distinguishing strokes due to ischaemic and bleeding has wide-reaching effects on management from the earliest stages.
- Aspirin for those with ischaemic stroke (95% on day or admission or following day) – which is a very simple and almost universally applicable treatment which improves patients outcome.
- Admission to stroke unit (90% on day of admission or following day) which reliably provides a wide range of targeted interventions. This reduces the risks of complications, improves the patients' experience and is known to improve functional outcomes and reduce mortality.

In general, brain imaging and aspirin standards are met across Scotland. However, there remains significant challenges in swallow screen and access to stroke units. Consequently, the overall adherence to the stroke bundle performance remains low.

Where patients are at risk of post stroke complications (e.g., infection, venous thromboembolism, dehydration, malnutrition, pressure sores), and depending on the established aims of treatment, patients should receive evidence-based interventions such as parenteral fluids, early tube feeding, intermittent pneumatic compression and antibiotics. At present, delivery of these important aspects of stroke care is assessed through sprint audits within the Scottish Stroke Care Audit or local audits. These have demonstrated variable delivery. Such audits had to rely on review of paper or electronic health records which identifies issues in delivery only in retrospect.

TRAKcare, the electronic health record used across Scotland does not support the sort of data capture, extraction and analysis to provide real-time data on delivery of important aspects of stroke unit care. An improved approach is required where failures of delivery are identified in real time, when they can be rectified to avoid patient harm. However, IT systems which are available to do this for only certain aspects of care (e.g. delivery of the National Early Warning System (NEWS) of observations to avoid in hospital deterioration and cardiac arrest) are not currently

used to provide improvements in delivering specialty specific aspects of care, such as those in a stroke unit.

10.2 Access to stroke unit care

Stroke unit care is the central feature of a modern stroke service. As it can benefit most stroke patients, even those who also undergo hyperacute treatments, it is important that the important role of stroke unit care within hospitals is recognized and supported²².

Through engagement with the National Stroke Voices, we heard that receiving care in a stroke unit was important to people.

"My treatment was much better and much more focused when I was placed in the Stroke Unit" – National Stroke Voices participant.

Every stroke patient should receive the core service characteristics of stroke unit care²³ from initial assessment to discharge from hospital²⁴. Key features of a stroke unit in a progressive stroke pathway should include:

A geographically-defined unit

- A co-ordinated multi-disciplinary team that meets at least once a week for the exchange of information about in-patients with stroke.
- Information, advice and support for people with stroke and their family/carers.
- Management protocols for common problems, based upon the best available evidence.
- Close links and protocols for the transfer of care with other in-patient stroke services, early supported discharge teams and community services.
- Training for healthcare professionals in the specialty of stroke.
- The provision of holistic assessment of need for every patient which incorporates the views of patients and their families, which informs decisions about care.
- All interactions and interventions are carried out under a person-centred approach.

Although the core features are well described, services have sought to deliver stroke unit care in a variety of different ways. The size and configuration of stroke units depends on factors such as rurality and the other services and resources available within the local area.

Of the 22 ASCs, the seven smallest general hospitals in Scotland define stroke unit admission as entering the appropriate acute medical ward. While this means that the hospitals do not meet the first criteria of a geographically defined unit, they should meet all other criteria outlined above. In some instances, this may mean that remote stroke specialist support is required to provide early specialist assessments and a coordinated, regular multi-disciplinary team meeting. This is an appropriate response to maintaining local services, and reduced time to thrombolysis, for people with stroke in these areas.

The Scottish Stroke Care Audit 'bundle' reflects access to stroke unit care and shows that this is currently variable between health boards and sites. There are marked variations in the size of stroke units, their staffing levels (medical, nursing, allied health professionals, clinical and neuropsychologists and social work staff) and the training of those staff.

While every stroke patient should have access to stroke unit care as defined above, in some instances, patients may require more intensive care. This is the case for those who undergo thrombectomy. In such instances, those people should receive care within a stroke unit which can also provide:

- Specialist staffing and technology that provide close clinical and continuous physiological monitoring for all, and especially those at higher risk of early deterioration or complications.
- Seamless working with intensive care units and high dependency units where required.
- Continuous access to a consultant with expertise in stroke medicine, with consultant review seven days per week.
- Immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the hyperacute management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

These features are often available within a hyperacute stroke unit (HASU) where patients often stay for just the first couple of days, or a hyperacute bay within a stroke unit.

All stroke services should have protocols for the monitoring, referral and urgent transfer of patients, where there is a risk of patients requiring neurosurgical intervention, to regional neurosurgical centres.

Systems of joint working should be developed to establish broadly agreed referral criteria for carefully selected cases, e.g., those patients who might benefit from decompressive hemicraniectomy for malignant middle cerebral artery (MCA) syndrome.

As outlined in the introduction of this paper, supporting shared decision making helps to ensure treatments are delivered which are most likely to deliver the outcome valued by the patient and/or family. This remains important in the acute and hyperacute phases and is likely to be optimised by early involvement of senior clinicians with access to systems to share tailored information with patients and their family.

10.3 End of Life Care

About one in 20 people with acute stroke will be receiving end-of-life care within 72 hours of onset, and one in seven people with acute stroke will die in hospital²⁵.

Therefore, providing high quality end-of-life care should be a core activity for the multi-disciplinary stroke team. The key aim is to appropriately and holistically manage distress associated with the end-of-life experience for the person and the family/carers, in line with guideline advice²⁶.

Patients with severe stroke resulting in a high risk of death or poor functional outcome, should be involved at an early stage in shared decision making about the aims of treatments including cardiopulmonary resuscitation, critical care, hemicraniectomy, and treatments to reduce the risk of serious complications. Where the patient lacks capacity then next of kin or advocate should be involved.

Advanced care planning should take place for those people who may survive the acute stroke with limited life expectancy, to facilitate timely referral to specialist palliative care services, where required²⁷.

10.4 Recommendations

- 1. Patients with acute stroke should have their clinical status monitored closely and managed according to clinical guidelines.
- 2. Stroke services should deliver the stroke bundle, meeting the Scottish Stroke Care Audit Standards for:
 - Swallow screen
 - Brain imaging
 - Provision of aspirin for those with ischaemic stroke
 - Admission to stroke unit
- 3. Healthcare professionals responsible for the assessment and management of patients with acute stroke should be trained in how to position and mobilise patients in a way that is safe and consistent with clinical guidelines.
- 4. Acute stroke patients should be managed in a stroke unit that meets the core requirements outlined in Section 9.2.
- 5. A stroke unit should have continuous access to a consultant with expertise in stroke medicine, with consultant review 5 days per week.
- 6. Staff working in stroke units should have completed the necessary training as outlined in the national educational template and should follow standardised management protocols for the assessment & management of acute stroke according to clinical guidelines.
- 7. Staff working in stroke units should have access to IT systems which optimise the reliability of assessments and treatment delivery.

- 8. People with rehabilitation needs should be assessed by a therapist and ongoing management planned according to clinical guidelines and in line with the progressive vision of rehabilitation outlined in Section 10.
- 9. Services providing acute and ongoing care for people with stroke should provide high quality end-of-life care for those who need it, including advanced care planning and timely access to specialist palliative care if required.
- 10. All stroke services should have protocols for the monitoring, referral and urgent transfer of patients, where there is a risk of patients requiring neurosurgical intervention, to regional neurosurgical centres.
- 11. In addition, for patients who require closer monitoring:
 - A so called hyperacute stroke unit or area which is providing close monitoring of patients post thrombectomy should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week.
 - These units should in addition have immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

11. Rehabilitation and long-term support

11.1 Stroke Rehabilitation

People who have had a stroke should have access to high quality, evidence-based, person-centred stroke rehabilitation which reflects their needs and preferences. Stroke rehabilitation aims to optimise function, reduce disability, promote independence and work alongside people and their families to achieve meaningful outcomes²⁸. It helps people to be as independent as possible in everyday activities and enables participation in education, work, recreation and meaningful life roles. An inter-disciplinary team approach to stroke rehabilitation is essential, with the individual and their family or carers at the centre and given the opportunity to see the right professional at the right time to support their needs.

The United Nations has set out the right of people with disabilities to have access to rehabilitation to achieve participation and inclusion in all aspects of life²⁹. The World Health Organisation Rehabilitation in Health Framework highlights a tiered approach to rehabilitation which should be community based and focussed on the needs of the population³⁰.

Access to rehabilitation should be equally available to those in urban and remote and rural areas and across socio-demographic areas, using technology to deliver when appropriate.

Stroke rehabilitation should be based on a holistic biopsychosocial approach which seeks to understand the interactions of a diverse range of factors in a person's presentation (i.e. biological, psychological and social factors). This is essential for defining the aims of rehabilitation and to ensure that interventions are appropriate for, and meet the needs and preferences of, the individual. This shared understanding promotes interdisciplinary working between health and social care professionals to support effective and efficient stroke rehabilitation services³¹.

The foundations of a progressive stroke rehabilitation service are underpinned by a holistic rehabilitation model³² and appropriate service infrastructure, leadership and expertise, as depicted in the infographic below. This model outlines the requirements of holistic patient assessment, interventions where individuals and practitioners work towards agreed goals, the importance of appropriate evaluation and an underpinning rehabilitation infrastructure that supports the provision of co-ordinated care.

Holistic Model of Stroke Rehabilitation (Williams, Hamilton & Evans, 2021)



The core elements of rehabilitation include person-centred care, the setting of personal goals, and supported self-management. Personalised and evidence based therapeutic interventions delivered by stroke specialists should be offered to support recovery, adaptation to new functional status, and to support self-management and longer-term health and wellbeing.

11.1.1 Key principles of stroke rehabilitation

Person-centred - Person-centred care is about treating people as individuals and working with them to develop the knowledge skills and confidence to manage and make decisions about their own health and social care needs. Rehabilitation should be personalised, co-ordinated and enabling, and above all ensure that people are treated with dignity, compassion and respect³³. Person-centred rehabilitation considers the person's needs, capacity, preferences, wishes, values, lifestyle, environment, family and social circumstances. The rehabilitation team works in partnership with them to understand their priorities and to develop solutions.

Personal goals - Goal setting is the process by which the person with stroke (and their family or carers if they wish) and members of the stroke team identify individual goals which are meaningful, challenging and have personal value³⁴.

Supported Self-management - A person-centred approach in which the individual is empowered and has ownership over the management of their life and condition.

Co-ordinated Services- Areas in which Managed Clinical Networks (MCN's) operate with clear clinical and operational leadership are more able to connect services via clear service pathways. Stroke rehabilitation services should co-ordinate across clinical and service pathways and be tailored to individual needs based on a range of personal, environmental and social factors.

Rehabilitation team - Expertise from an interdisciplinary team who work in partnership with the person who has had a stroke and who collectively tailor rehabilitation input towards the person's goals. Where appropriate, this partnership should include family and carers.

Clinical Leadership - Clinical and service leadership should be provided by senior allied health professionals, medical, psychology and nursing staff, ensuring an equal focus on hospital and community rehabilitation pathways.

Appropriate care setting - In-patient rehabilitation is required for people with complex physical, cognitive, psychological and/or social needs, who could not be supported in a community setting. Rehabilitation of stroke patients in hospital should occur in an integrated stroke unit (a mixed acute and rehabilitation ward) or a specialist rehabilitation area. Early supported discharge (ESD) and community stroke

rehabilitation services should be offered in a community setting whenever that best meets the needs and wishes of the patient.

Evaluation - Data on service delivery, patient outcomes and experiences should be collected systematically³⁵. Outcome measures used should be standardised, valid and reliable³⁶ as well as being focused on what matters to patients^{37,38}. The effectiveness of progressive stroke rehabilitation services will be reviewed via the Scottish Stroke Improvement Programme utilising rehabilitation data from the Scottish Stroke Care Audit and by at least one annual review.

11.1.2 Stroke Rehabilitation Service Provision

Stroke rehabilitation services should include inpatient rehabilitation, ESD and community stroke or neuro rehabilitation teams who work closely to ensure services are delivered in the most appropriate setting for each person's needs. This relies on having the right infrastructures in place, including sufficient access to rehabilitation professionals and close links with social care and the voluntary sector as part of an MCN.

Rehabilitation for people with stroke in all settings should ensure:

- That people receive a holistic assessment to determine their rehabilitation needs as quickly as possible.
- That the delivery of rehabilitation takes place in the most appropriate setting and at the right time for that person's needs.

To achieve this, stroke rehabilitation plans should be agreed and initiated in the acute phase and be available, according to need, along the entire stroke pathway.

The duration of stroke rehabilitation services should be led by the needs of the person who has had a stroke and be defined by their goals and should not be time limited. A clear life-long pathway for people to be able to re-engage with stroke rehabilitation services and to re-access specialist support should be available to patients and families³⁹.

It is important that families and carers are included in rehabilitation planning and goal setting, if agreed by the person who has had the stroke. If agreed, then carers should be

- Included in assessments to identify needs.
- Provided with tailored information about stroke and the caring role.
- Provided with advice, access to emotional support to adjust to their caring role and maintain their wellbeing.
- Signposted to peer support to reduce the impact of loneliness and social isolation if required.

Evidence supports increased frequency and intensity of therapy especially in the first six months post-stroke which can improve recovery rate and outcome. Provision of greater amounts of stroke therapy is associated with higher therapy and nursing staffing levels, a weekend therapy service and specialist stroke rehabilitation teams⁴⁰. Stroke rehabilitation services should therefore be available as required across the pathway seven days per week at an appropriate intensity with appropriate workforce skill mix.

Factors which impede the amount of therapy provision include time spent in information exchange and administration. Patient focussed reorganisation of working practices including shared documentation, and individual patient therapy timetabling is recommended to enable therapy provision in line with clinical guideline recommendations⁴¹.

11.1.3 The Rehabilitation Team

Stroke rehabilitation services must include regular access to an inter-disciplinary team who work in a co-ordinated manner and collaborate towards common goals.

The inpatient stroke rehabilitation team should include stroke specialists in medicine, nursing, occupational therapy, physiotherapy, speech and language therapy, and dietetics. It should also ensure timely access to other specialist clinical services as required, such as orthotics, pharmacy, orthoptics, and social work. The psychological, emotional and cognitive effects of stroke should be understood and supported by the whole team. Specialist input from clinical psychology and neuropsychology should also be part of the core team and service provision throughout the patient journey from acute to longer term.

ESD and community stroke/neuro rehabilitation teams should include occupational therapy, physiotherapy, speech and language therapy, nursing and neuro/psychology, with easy access to other professionals as required.

Rehabilitation and recovery should be embedded within all aspects of stroke rehabilitation by all team members on a 24/7 basis. Teams should work to engage people in as much therapeutic activity (including specialist therapy interventions and self-practice) as required at a frequency and intensity that enables them to reach their rehabilitation goals.

The stroke rehabilitation environment should facilitate patient engagement in a range of physical, cognitive and social activities out with formal therapy time. This can be supported by staff, carers and volunteers. This whole system approach to stroke rehabilitation should be promoted to improve recovery and rehabilitation outcomes⁴².

11.1.4 Rehabilitation settings

Inpatient stroke rehabilitation is required for those who have complex physical, cognitive and psychological needs which are unable to be managed in a community setting.

Community stroke rehabilitation can be offered by a range of services including ESD and community stroke/neuro rehabilitation teams, with varying intensity for up to seven days per week depending on the individual's needs.

All hospital in-patients with stroke who have mild to moderate disability should have the opportunity for early supported discharge⁴³ which enables rehabilitation to commence in their home environment within one working day of hospital discharge and at an intensity and frequency that would be provided if they remained in hospital. To enable this, strong links are required between the inpatient and community rehabilitation teams^{44,45}.

Regardless of the health board in which the patient receives acute stroke care, it is important that rehabilitation is provided in their local area. This should be facilitated by effective communication and clear referral pathways between health boards.

To ensure equitable access to ongoing support and self-management resources, all those who have had a stroke or TIA should be provided with high quality, tailored information at the point of discharge from outpatient clinic, emergency department or hospital and be followed up as soon after discharge as possible and thereafter, as indicated by the individual's needs, by a community stroke nurse or other stroke specialist healthcare professional to provide further specialist advice and support.

Everyone with residual difficulties following a stroke on discharge from hospital should be provided with a documented plan for community rehabilitation and self-management support.

In addition, everyone who has experienced a stroke should receive a review by a stroke specialist health care professional within six months of their event.

11.1.5 Key interventions delivered by a progressive stroke rehabilitation service

Many aspects of stroke rehabilitation require a tiered approach whereby aspects of care are the responsibility of the whole interdisciplinary team with specialists within the team focusing on more complex presentations. Each stroke rehabilitation network should have clearly defined pathways about how these services are provided.

Activities of Daily Living

Activities of daily living (ADL) include personal activities, e.g., washing and dressing; domestic activities, e.g., cooking and housework, and extended activities, e.g., work, driving and leisure. People experiencing difficulty with ADLs should be seen by an occupational therapist for assessment and the implementation of a personalised intervention programme. Evidence supports continued ADL training from occupational therapy and interventions can include direct training in an activity, training in adapted methods of performing an activity and the training in the use of adaptive equipment, assistive technology and environmental adaptation to maintain independence⁴⁶.

Arm function

Rehabilitation interventions that comprise intensive, graded practice of tasks and activities that focus on an individual's goals have been shown to be effective⁴⁷.

Progressive arm rehabilitation, usually provided by occupational therapists and physiotherapists, comprises comprehensive assessment, person-centred goal setting and the provision of a structured, goal-orientated programme of intensive practice. This may include assistive technologies (e.g., functional electrical stimulation, mirror-box therapy and virtual reality⁴⁸) as well as involving their affected arm in activities of daily living as much as possible in order to increase the intensity of meaningful practice and to improve outcomes.

Bowel and Bladder rehabilitation

Bladder and bowel dysfunction (including urinary incontinence, faecal incontinence, constipation and nocturia) are common and can be persistent following stroke but are amenable to rehabilitation intervention. Progressive rehabilitation will feature structured assessment by a nurse to identify the type of bladder/bowel dysfunction, agreement of individual goals and a programme of mainly behavioural interventions targeted to the type of dysfunction, to support active recovery of bladder/bowel function and use of the toilet. Regular review of the rehabilitation programme and avoidance of containment approaches (including indwelling catheters) are key to recovery of independent bladder/bowel functioning and toilet use⁴⁹.

Balance, walking and mobility

Problems with balance, walking and mobility are likely to increase the risk of falls, deconditioning, becoming housebound and social isolation. People who have had a stroke should have their mobilisation needs assessed and once medically stable, they should be assisted to mobilise, overseen by a physiotherapist. Walking training should be task specific and include a cardiovascular component. Treadmill training with or without body weight support can improve walking and should be available for those who are able to walk independently⁵⁰. For those who are not able to walk independently⁵¹ and this technology should be made available. Early access to orthotic assessment for the provision of an ankle foot orthosis (AFO) should be available, with reassessment when necessary, in order to facilitate walking and prevent falls. Functional electrical stimulation (FES) should be available to facilitate gait and prevent falls in those with persistent mild lower limb weakness.

Communication

Post-stroke communication disorders occur frequently. Aphasia and dysarthria each affect around a third of people following a stroke. People who are identified as having a communication disorder after a stroke should be assessed by a speech and language therapist and provided with an individualised rehabilitation programme using evidence-based interventions⁵² to reduce the impairment and/or support functional improvement and long-term adaptation. Such interventions may include

group work, computer-based therapy, assistive technology and conversation partner training⁵³.

Cognition

Cognitive impairment is common following a stroke and can have a significant impact on social recovery and re-integration with overall poorer rehabilitation outcomes. Services should have a documented pathway for the identification and assessment of cognitive problems. Cognitive rehabilitation should be integrated into the broader rehabilitation programme and goals should include cognitive rehabilitation interventions with the aim of restoring, compensating or adapting for reduced cognitive ability.

Driving

A documented pathway should be available to advise on national and local services for further assessment and advice about resuming driving or alternative mobility options. Stroke service should ensure that driver status and intention to return to driving should be ascertained and advice and tailored information is made available.

Fatigue

Fatigue is commonly reported following stroke and can impact on longer term recovery and wellbeing. A range of physical and mental factors may contribute to fatigue and a documented pathway for the identification and assessment of fatigue and its impact on activity and participation should be available. Rehabilitation programmes should include strategies to anticipate and manage fatigue as well as education for patients and families/carers.

Pain management

Pain following stroke can be due to several causes including neuropathic pain, musculoskeletal pain and shoulder pain and subluxation. Each element requires specialised assessment and a range of evidence-based interventions which should be available in documented pathway.

Physical activity, exercise and fitness training

Physical activity, exercise and fitness training should be provided through partnerships between health and exercise professionals, the third sector and local authority services. Exercise and fitness training should begin, as appropriate, in hospital and continue in the community⁵⁴. It should be provided by therapists or exercise professionals who have evidence of stroke specific knowledge and skills to adapt and tailor exercise programmes for people after stroke.

Physical activity should also be encouraged. Many people who have had a stroke experience barriers to becoming more active and sedentary behaviour tends to persist after stroke^{55,56}. Evidence-based counselling strategies are effective to
encourage stroke survivors to engage and maintain physical activity after stroke⁵⁷ and these should be provided as required along the entire stroke pathway.

Posture and movement – spasticity services

Stroke services should implement a systematic approach to identify all those who need specialist spasticity assessment and treatment. Stroke services should also implement a documented programme for prevention and management, including self-management, of post stroke spasticity. All those who need it will have access to a specialist spasticity service which may include Botulinum toxin injections, electromyography (EMG) or ultrasound guided approach, appropriate clinical expertise to deliver, and co-ordinated multidisciplinary community follow up including occupational therapy, orthotics and physiotherapy.

Positioning and seating

Following stroke, many people will find it challenging to control their position when in bed and when sitting in a chair. Effective positioning and seating is essential for reducing the risk of aspiration, falls, skin breakdown, and contracture development in addition to providing maximum comfort and supporting participation in ADL. All staff from statutory and voluntary sector organisations and carers involved along the whole pathway should be aware of correct positioning. People with stroke, their carers, and all services should have access to clinicians with training in postural management. Appropriate beds, specialist chairs and positioning equipment should be available from inpatient and community rehabilitation services when required.

Psychological Care (cognitive and emotional)

In the aftermath of stroke, patients and families experience a wide range of psychological, cognitive and emotional difficulties which impact profoundly on function and rehabilitation.

Stroke services should implement a documented programme for promoting awareness of, screening for and treatment of psychological consequences of stroke, led by a specialist clinical/neuropsychologist as detailed in the National Model of Psychological care for stroke⁵⁸. Psychological care should be available to all patients in line with local delivery plans.

Relationships and sexuality

Sexuality includes physical and psychosocial aspects of intimacy. Approximately 50% of individuals experience sexual dysfunction following stroke⁵⁹, however it is not commonly included as part of a rehabilitation programme⁶⁰. Services to address these aspects of life after stroke are variable and professional education is lacking. Education with regards to sexuality following stroke should be provided to the stroke rehabilitation team and specialised support should be made available to those who require it.

Swallowing

Post-stroke swallowing difficulties (dysphagia) are common and can persist longterm. Management of such difficulties should be led by a dysphagia specialist, such as a trained speech and language therapist (SLT), and should include evidencebased rehabilitation and restorative strategies which aim to improve oropharyngeal function. Management of swallowing difficulties will additionally include compensatory strategies, swallowing manoeuvres, sensory modification and texture modification of food and fluids as appropriate. All interventions should take into consideration the factors which may limit ability to participate, such as physical and cognitive impairment, as well as encompass shared decision-making and a shared responsibility for management of risk. There should be access to instrumental assessments such as videofluoroscopy and flexible endoscopic evaluation of swallowing (FEES) to determine the specific rehabilitation programme/management approach. There should also be pathways for people with long-term dysphagia to reaccess services for review.

Technology and tele rehabilitation

Stroke rehabilitation services should include the use of robotics and software programmes which support rehabilitation interventions as appropriate.

Vision

Comprehensive assessment and rehabilitation services should be provided to all those with visual problems due to their stroke including:

- Comprehensive visual screening completed before discharge.
- Direct referral to appropriate professionals for assessment of suspected visual problems.
- Follow up to determine the level of spontaneous recovery of visual problems.
- Provision of treatment and rehabilitation, tailored to the specific visual problems by the most suitable profession in that locality (this may vary across NHS and Social Care areas).
- Provision of tailored information and clear explanation of visual problems, and their possible impact, at each possible opportunity.
- Ensuring individuals have knowledge of, and access to, relevant low vision services initiating direct referral if required⁶¹.

Vocational rehabilitation

Stroke rehabilitation services should identify work status and offer advice, signposting and referral for specialised return to work support as appropriate. A documented pathway should identify local and regional access to specialised vocational rehabilitation services.

11.2 Supported Self-Management and Longer-term support

Supported self-management and longer-term care & support should be an integral element of stroke rehabilitation pathway⁶² and should be provided in partnership with health, social care and the voluntary sector.

Supported self-management is a core component of person-centred care and is an interdisciplinary approach which supports people to develop skills, knowledge, and confidence to manage the impact of stroke and to maintain an ability to engage in meaningful activities and life roles.

Not everyone who experiences a stroke or TIA will have ongoing rehabilitation needs identified at the time of their discharge. However, feedback from people with lived experience was that often, this meant that there was a missed opportunity to identify routes to access support.

Everyone who experiences a stroke or TIA should receive tailored information provision and be signposted to community-based support and advice. It is important that people who have had a stroke or TIA are provided with the necessary skills, resources and support to continue self-management in the longer term along with management of other long-term conditions they may have⁶³.

There is considerable variation across the country in the longer-term support for people who have had a stroke. This may comprise nurse or other healthcare professional follow up, peer support groups and exercise classes. In some places these aspects of care are provided directly by NHS stroke services, in others they are commissioned from charities including Chest Heart and Stroke Scotland (CHSS) and the Stroke Association.

Primary care services are the main source of medical care for stroke survivors in the longer-term after their stroke. It is common practice that routine annual reviews for people with stroke take place alongside reviews of other long-term conditions. In addition, people who have had a stroke identify health issues that arise and contact primary care services for assessment.

Primary and secondary care services should communicate effectively to enable the provision of patient-centred care, for example primary care may identify a further rehabilitation need and refer the person back to the community rehabilitation team.

People with lived experience of stroke highlighted that a key issue was the lack of a 'joined up' approach, and outlined how important it would be to have a person who could support them by signposting to advice and support services, and act as a point of return for when issues arose further down the line in their journey.

"One of the big aspects is going to be having someone who is responsible for ensuring that the service is joined up. I think that's what's missing" – National Stroke Voices participant.

It is therefore important that people who experience stroke are provided with clear and easily accessible contact information once discharged from community services, enabling the provision of continued advice, support and signposting. A clear life-long pathway for people to be able to re-engage with stroke services and re-access specialist support should be available to patients and families⁶⁴.

To ensure equitable access to ongoing support and self-management resources every person who has had a stroke should be contacted by a community stroke nurse or other appropriate stroke professional as soon as possible following their discharge from outpatient clinic, emergency department or hospital to provide review and an opportunity to access specialist advice and support⁶⁵.

11.3 Recommendations

- 1. Stroke rehabilitation services should be underpinned by a holistic rehabilitation model, appropriate service infrastructure, clinical leadership and expertise.
- 2. Stroke rehabilitation in all settings should be person-centred and optimise outcomes with evidence-based interventions, enabling appropriate long-term support and self-management.
- 3. Rehabilitation should be a process that begins as soon as a stroke is diagnosed and continues as long as required. The duration of stroke rehabilitation should be needs led and not time limited.
- 4. An early holistic assessment of a person's rehabilitation needs should be provided by specialist stroke teams and a personalised, documented rehabilitation and self-management plan agreed with the person who has had a stroke and, if they wish, their family/carers.
- 5. Stroke rehabilitation services must include a specialised and coordinated team who work in an interdisciplinary manner and collaborate towards common, person-centred goals.
- 6. The psychological, emotional, cognitive effects of stroke should be understood and supported by the whole team. Specialist input from clinical psychology and neuropsychology should be part of the core team and service provision throughout the patient journey from acute to longer term.
- 7. Evidence based stroke rehabilitation services should be available in inpatient and community settings seven days per week at an appropriate intensity, with an appropriate workforce skill mix.

- 8. Each stroke rehabilitation network should have clearly defined pathways about how key stroke rehabilitation interventions and services are provided.
- 9. Stroke rehabilitation services should be provided as part of a managed clinical network which includes inpatient rehabilitation services, ESD and community stroke or neuro rehabilitation teams who work closely with social care and the voluntary sector to ensure services are delivered in the most appropriate setting for each person's needs and ensure equity of service provision across all geographical and socio demographic areas.
- 10. Inpatient stroke rehabilitation is required for those who have complex physical, cognitive and psychological needs which are unable to be managed in a community setting.
- 11. Community stroke rehabilitation can be offered by a range of services with a range of intensities according to individual needs, including Early Supported Discharge and community stroke / neuro rehabilitation teams.
- 12. Clinical and service leadership should be provided by senior allied health professionals, medical, nursing and neuropsychology staff, ensuring an equal focus on hospital and community rehabilitation pathways
- 13. Every person who has had a stroke should be followed up by a community stroke nurse or other appropriate healthcare professional, as soon as possible following discharge from hospital and thereafter, as indicated by the individual's needs, ideally in their own home.
- 14. A clear lifelong pathway for people to re-engage with stroke rehabilitation services and re-access specialist support should be available to patients and families
- 15. A formal review should also be carried out for everyone who has experienced a stroke, six months post event, to provide another opportunity to access specialist advice and support, regardless of the rehabilitation needs identified at the time of their discharge from hospital.
- 16. People who have had a stroke should be signposted to relevant resources and support to continue self-management in the longer term along with management of other long-term conditions they may have.
- 17. Demonstration of a person-centred approach should be evaluated via the approach used by stroke rehabilitation services to deliver activities which are deemed to be central to person centred care e.g., regular holistic assessment of need; goal setting; supported self-management and family/carer involvement, as well as the patient experience of these activities and the

treatment and communication they experience with the professionals working with them.

12. Workforce

The quality of stroke services provided is hugely dependent on the availability of knowledgeable, skilled and experienced healthcare professionals. This is influenced by access to high quality education and supported learning, and staff turnover.

Stroke services should provide specialist medical, nursing, allied health professional neuropsychology, and other rehabilitation staffing levels matching the Royal College of Physicians ⁶⁶ and British Association of Stroke Physicians Guidelines⁶⁷.

It is recognised that there is significant attrition of stroke trained staff from acute stroke rotas and services and retention of trained staff remains a challenge for future service provision. It is imperative that burnout risk is minimised in a speciality with unpredictable intensity and requiring complex decision making. To support this, it will be necessary to:

- Ensure that working patterns and staffing levels, especially for healthcare staff contributing to out of hours care, are sustainable to attract and retain staff.
- Consider novel remuneration rates for unsociable hours which may save on external locum costs for rota gaps.
- Ensure that there are adequate levels of support staff and access to IT to optimise the efficiency of clinical staff and optimise patient facing time.

Through the review process for this document, staffing available to deliver equitable rehabilitation services was raised as a concern, with particular reference to limited access to psychology & neuropsychology services across the country.

The rehabilitation workforce challenges mean that in practice, few stroke rehabilitation services are able to offer a seven-day service with appropriate intensity. To be able to provide a progressive stroke rehabilitation service these workforce challenges should be addressed.

12.1.1 Education and training

Stroke services should have an education programme for all staff providing acute, hyperacute stroke care and rehabilitation.

There is currently a national education template which outlines the training required for staff involved in the care of stroke patients. It is important that all NHS boards enable staff involved in delivery stroke care to undertake the education outlined by this template. Dedicated trainers can support this.

- All professional groups potentially dealing with hyperacute patients should have been trained in core stroke competencies, STAT+, STARS Advanced Modules and Hyperacute stroke treatment decision making for clinicians.
- Stroke physicians and radiologists should have up to date training in advanced imaging for stroke.
- Training should be supported by rolling educational plans with blended learning, web based and simulation-based training.
- Training should include a focus on supporting staff with having difficult conversations.
- Regular national educational sessions will support shared learning amongst professional groups.
- Education development framework with clear career progression opportunities important for retaining staff.
- Mentoring for junior staff, opportunities to rotate into other parts of the stroke pathway or undertake secondments and gain wider knowledge and appreciation of their role within the entire system.

To support health boards to deliver effective training and education, at a national level, there will be a continued:

- Investment in developing and maintaining interactive online training which can be accessed at the convenience of the learner.
- Delivery of live training sessions which can be delivered remotely via an appropriate online platform (e.g., MS Teams) to a large live audience across many NHS Boards, and also be recorded for others to access later.
- Coordinated national training programmes tailored to each group of healthcare staff involved in stroke services.

NHS Boards should keep records of the staff working within stroke services, their training needs and training received. When new staff join a stroke service their training needs should be identified and a plan made to meet those needs promptly.

13. Glossary

ACTATS (Acute CTA for Thrombectomy in Stroke): An online training package aimed at stroke clinicians and radiologists to help them interpret CT (see computerized tomography) & CTA (see computed tomography angiography) in the context of thrombectomy.

Acute Stroke Centre: A hospital which has staffing and facilities to acute assess acute stroke patients, carry out an early CT brain scan and deliver thrombolysis. They will also have a stroke unit, or equivalent facility for ongoing care of stroke patients.

AF: Atrial Fibrillation is an irregular and often very rapid heart rhythm (arrhythmia) that can lead to blood clots in the heart. AF increases the risk of stroke.

AFO: Ankle Foot Orthoses are external biomechanical devices utilized on lower limbs to stabilize the joints, improve the gait and physical functioning of the affected lower limb.

AI: Artificial intelligence: In the context of stroke services this term refers to digital systems which provide a rapid interpretation of brain imaging, and communication of the images and its interpretation to those involved in delivering time sensitive stroke treatments.

Aneurysm coiling: a procedure performed to block blood flow into an aneurysm (a weakened area in the wall of an artery).

Aphasia: a disorder of language which can affect speech, reading and writing. It's usually caused by damage to the left side of the brain.

Botulinum toxin injections: Botulinum toxin can help to relax overactive muscles for a short period of time. During this time a therapy programme can be implemented to stretch shortened muscles and stiff joints. This may help improve function e.g., walking or grip, or could help care staff manage personal hygiene.

Carotid endarterectomy: An operation to remove the narrowing in a carotid artery to reduce the risk of future stroke.

Carotid Ultrasound: Carotid ultrasound is an imaging test that uses high-frequency sound waves to create pictures of the inside of carotid arteries. It is used to identify patients who may benefit from carotid endarterectomy or angioplasty and stenting

CHI number: Community Health Index number is a unique patient identifier used across Scotland. The first 6 digits include the patient's date of birth.

CSC: A Comprehensive Stroke Centre is a hospital which in addition to the facilities of the ASC can also provide thrombectomy and neurosurgery with associated critical care support.

CT: A computerized tomography (CT) scan combines a series of X-ray images taken from different angles around your body and uses computer processing to create cross-sectional images (slices) of the inside of the body.

CTA: Computed tomography angiography (CTA) uses an injection of contrast material into your blood vessels and CT scanning to help diagnose and evaluate blood vessel disease or related conditions.

CTP: Computed tomographic perfusion (CTP) imaging is an advanced modality that can aid in diagnosis, management, and prognosis of acute stroke patients by clarifying acute cerebral physiology.

Decompressive hemicraniectomy: A surgical treatment for cerebral oedema (when the brain swells, causing an increase in pressure). Has been performed for several different pathologies, including malignant middle cerebral artery syndrome, one of the most widely recognized large vessel strokes.

Door In, Door Out time: The delay between a patient's arrival at an Acute Stroke Centre (ASC) and their departure from that hospital to go to a Comprehensive Stroke Centre (CSC) for thrombectomy.

DTN: Door-to-Needle Time is the delay between arrival at a hospital and the administration of a bolus of thrombolysis medication.

Dysarthria: Slurred speech caused by disturbance of muscular control.

Dysphagia: Medical term for swallowing difficulties.

Endovascular therapy: Minimally invasive procedures that are done inside the blood vessels.

ESD: Early supported discharge services comprise a stroke specific interdisciplinary team and sufficient care staff to allow hospital admitted stroke patients to be discharged home earlier than otherwise to continue their rehabilitation in the community

Flexible endoscopic evaluation of swallowing (FEES): FEES is a procedure designed to assess swallowing function through visualization of the pharyngeal and laryngeal (throat) structures.

FLORENCE: Flo or Florence is a simple telehealth system that uses text messages to support patients to manage their high blood pressure and related aspects of health.

FES: Functional Electrical Stimulation is a treatment that uses small electrical charges to produce muscle activity or a muscle contraction.

Hydrocephalus: a build-up of fluid around the brain, which increases pressure and can cause brain damage.

Integrated Joint Boards: Bodies that lead the planning of health and social care services. IJB's commissions the local authority and health board to deliver services in line with a strategic plan.

Interdisciplinary team: a group of professionals from a range of disciplines who work in a coordinated manner toward the same goal for the patient

Intermittent pneumatic compression comprises sleeves wrapped around the legs which are inflated regularly to squeeze the legs, increasing blood flow to reduce the risk of blood clots in the legs).

Interventional Neuroradiologists: doctors who specialise in minimally invasive treatment of neurovascular disease including thrombectomy

Interventional Radiologists: Doctors who performs image guided procedures, fully interpret the imaging required to guide and monitor response of those procedures, as well as provides the pre and post procedural care for those patients receiving procedures including thrombectomy.

LDL: **Low density lipoprotein** (LDL) cholesterol is often referred to as "bad cholesterol" because too much is unhealthy.

Large Vessel Occlusion a blockage in one of the major arteries of the brain which may be opened up with thrombectomy.

Managed Clinical Networks: linked groups of health professionals and organisations from primary, secondary and tertiary care, working in a co-ordinated manner to ensure equitable provision of clinically effective services throughout Scotland.

MRA: Magnetic resonance angiography (MRA) uses a powerful magnetic field, radio waves and a computer to evaluate blood vessels and help identify abnormalities.

MRI: Magnetic resonance imaging (MRI) is a type of scan that uses strong magnetic fields and radio waves to produce detailed images of the inside of the body.

Musculoskeletal pain is pain which affects the muscles, ligaments, tendons, and bones.

Mirror-box therapy: a rehabilitation therapy in which a mirror is placed between the arms or legs so that the image of a moving non-affected limb gives the illusion of normal movement in the affected limb.

Multi-disciplinary team: a group of professionals from one or more clinical disciplines who together make decisions regarding recommended treatment of individual

Near Me: A secure form of video consulting approved for use by the Scottish Government and NHS Scotland.

Neuropathic pain: Neuropathic pain is often described as a shooting or burning pain. It often is the result of nerve damage or a malfunctioning nervous system.

Neurosurgery: Specialty concerned with the diagnosis and treatment of patients with injury to, or diseases/disorders of the brain, spinal cord and spinal column, and peripheral nerves within all parts of the body.

Nocturia: The medical term for excessive urination at night.

Orthoptics: Allied health professionals who specialise in the diagnosis and nonsurgical management of eye problems that affect eye movement and the development of vision.

Orthotics: Allied health professionals who make and fit braces and splints (orthoses) for people who need added support for body parts that have been weakened by injury, disease, or disorders of the nerves, muscles, or bones.

Patent Foramen Ovale: A hole in the heart that didn't close the way it should after

Post stroke spasticity: Following stroke, muscles may become stiff, tighten up and resist stretching. This is called spasticity.

SCI Gateway: Scottish Care Information (SCI) Gateway is a national system that integrates primary and secondary care systems using highly secure Internet technology. SCI Gateway enables GPs to access SCI services on-line.

Scottish Stroke Care Audit: An audit coordinated by Public Health Scotland. Measures the performance of stroke services against national standards

STAT+, STARS Advanced Modules: Professional training:

STAT+: Stroke and Transient Ischaemic Attack (TIA) Assessment Training (STAT) and STAT+. Training incorporates simulated scenarios to improve the emergency response to stroke and TIA.

STARS: Stroke Training and Awareness Resources. An e-learning resource providing a learning tool for health and social care staff to enable them to become more knowledgeable and skilful in the area of stroke care.

Stroke: Occurs when the blood supply to part of the brain is interrupted and brain cells are starved of oxygen. **Ischaemic strokes** occur when a blood clot blocks the flow of blood. A **haemorrhagic stroke** can happen when blood from an artery begins bleeding into the brain after a blood vessel bursts.

Subluxation: Shoulder subluxation happens when the upper arm bone, called the humerus, becomes partially dislocated from the shoulder socket. This condition starts when the muscles around the shoulder become weak or paralyzed after stroke.

Telestroke: A service which uses telephone, video conferencing and access to Picture Archiving and Communication System (PACS) to allow clinicians to remotely assess patients to enable the clinician to advise on management.

Thrombectomy: The physical removal of a thrombus (clot) which is blocking an artery causing a stroke.

Thrombolysis: The use of medicine which dissolves blood clots and restores blood flow to the brain.

Transient Ischaemic Attack (TIA): A temporary disruption in the blood supply to part of the brain. The symptoms last only minutes or hours.

TRAKCare: An electronic health record management system which is available in all NHS Boards.

Treadmill training: Used to aid walking rehabilitation with or without the use of body weight support

Transthoracic echocardiogram: The most common type of echocardiogram, which provides a moving image of the internal parts of the heart using ultrasound.

Transoesophageal Echocardiography: A type of echocardiogram where a small probe is passed down the throat into the gullet and stomach.

Transcranial Doppler: A test that uses sound waves to detect medical problems that affect blood flow in the brain.

Triage: The assignment of degrees of urgency to illnesses to decide the order of treatment of a large number of patients.

Vascular surgery: Vascular surgeons are trained in the diagnosis and management of conditions affecting the circulation, including disease of the arteries, veins and lymphatic vessels.

Venous thromboembolism: Blood clots that can develop in the deep veins in the legs or pelvis and can travel to the lungs to cause pulmonary embolism.

Videofluoroscopy: Assesses swallowing ability. It takes place in the X-ray department and provides a moving image of swallowing in real time.

14. Acknowledgements

This document has been delivered through contributions of a number of individuals during the Covid-19 pandemic. We are grateful for their support and contributions and pay special thanks to;

Scottish Government

Katrina Brennan MBE Professor Martin Dennis Thérèse Lebedis OBE Neil Muir Dr Fiona Wright Susan Wallace Kylie Barclay John Wilson

National Stroke Voices Lived Experience Group.

Thrombectomy Advisory Group

Sub Group advisors (Pre- Hospital, TIA, Hyperacute, stroke unit, rehabilitation and long-term support)

Craig Henderson Dr Stephen Makin Karen Garrott Dr Alison Brooks Dr Gareth Clegg Prof Mark Barber Sandi Haines Dr Gethin Williams Dr Neil Hunter Dr Helen Slavin Dr Gareth Blayney Dr John Reid Dr Ronnie Burns Dr Luke Yates Dr Matt Lambert Dr Mary Joan Macleod Dr Tracey Baird Elizabeth Barrie Dr Anthony Byrne Linda Campbell **Christine Carter** Dr Vera Cvoro **Prof Peter Langhorne**

Dr Christine McAlpine Keri-Ann Van-Nuil Dr Richard O'Brien Anne Armstrong **Dr Fiona Brodie** Professor Jo Booth **Gillian Crighton** Gillian Capriotti Andrea Cail Dr Emma Coutts Dr Charlie Chung Dr Alastair Cozens Dr Jackie Hamilton Dr Christine Hazelton Lesley Kane Dr Lisa Kidd Dr Ashish Macaden Dr Alex Pollock **Dr Lesley Scobbie** Mark Smith Prof. Frederike van Wijck Dr Luke Williams

¹ Public Health Scotland, (2021), *Scottish Stroke statistics - Year ending 31 March 2020*, available at <u>https://publichealthscotland.scot/publications/scottish-stroke-statistics/scottish-stroke-statistics-year-ending-31-march-2020/</u>, accessed 1st November 2021.

² Royal College of Physicians, (2016), *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition, available at https://www.strokeaudit.org/Guideline/Full-Guideline.aspx, accessed 1st November 2021.

³ Ajay Bhalla, Mehool Patel, Jonathan Birns, (2021), An update on hyper-acute management of ischaemic stroke, *Clinical Medicine*, 21 (3) pp 215-221

⁴ Hassan AE, Ringheanu VM, Rabah RR, et al, (2020). Early experience utilizing artificial intelligence shows significant reduction in transfer times and length of stay in a hub and spoke model, *Interventional Neuroradiology*, 26(5): pp 615-622.

⁵ Murray NM, Unberath M, Hager GD, et al (2020), Artificial intelligence to diagnose ischemic stroke and identify large vessel occlusions: A systematic review, *Journal of NeuroInterventional Surgery*, 2020, 12(2): pp 156-164.

⁶ Thomalla G, Boutitie F, Ma H, et al, (2020), Intravenous alteplase for stroke with unknown time of onset guided by advanced imaging: systematic review and meta-analysis of individual patient data, *Lancet,* Nov 14; 396(10262): pp 1574-1584.

⁷ McDermott M ,Skolarus LE ,Burke JF, (2019), A systematic review and meta-analysis of interventions to increase stroke thrombolysis, *BMC Neurology*, May 3;19(1): pp 86

⁸ Mortimer A, Lenthall R, Wiggam I, et al, (2021), To support safe provision of mechanical thrombectomy services for patients with acute ischaemic stroke: 2021 consensus guidance from BASP, BSNR, ICSWP, NACCS, and UKNG, *Clinical Radiology*, 76(2).

⁹ NICE,(2019), Stroke and transient ischaemic attack in over 16s: diagnosis and initial management NICE guideline: NG128, available at

https://www.nice.org.uk/guidance/ng128/chapter/Recommendations#thrombectomy-for-people-withacute-ischaemic-stroke, accessed 25th October 2021.

¹⁰McMeekin P, White P, James MA, et al, (2017), Estimating the number of UK stroke patients eligible for endovascular thrombectomy, *European Stroke Journal*, Dec;2(4): pp319-326.

¹¹ Zhang L, Ogungbemi A, Trippier S, et al, (2021), Hub-and-spoke model for thrombectomy service in UK NHS practice. *Clinical Medicine Journal*, Jan;21(1): pp e26-e31.

¹² British Society of Interventional Radiology and The Royal College of Radiologists, (2019), *Provision of Interventional Radiology: Second Edition*, London, The Royal College of Radiologists, available at https://www.rcr.ac.uk/system/files/publication/field_publication, The Royal College of Radiologists, available at https://www.rcr.ac.uk/system/files/publication/field_publication_files/bfcr198-provision-interventional-radiology-services-second-ed.pdf, accessed 25th October 2021.

¹³ <u>https://bsnr.org.uk/_userfiles/pages/files/bsnrtrainingresponsetomtevidencefinal23116.pdf</u>

¹⁴ Mortimer A, Lenthall R, Wiggam I, et al, (2021), To support safe provision of mechanical thrombectomy services for patients with acute ischaemic stroke: 2021 consensus guidance from BASP, BSNR, ICSWP, NACCS, and UKNG, *Clinical Radiology*, 76(2).

¹⁵ Kim BM, Baek JH, Heo JH, et al, (2019), Effect of Cumulative Case Volume on Procedural and Clinical Outcomes in Endovascular Thrombectomy, *Stroke*, May; 50(5): pp1178-1183.

¹⁶ Feigin VL, Krishnamurthi RV, Parmar P, et al, (2015), Update on the global burden of ischemic and hemorrhagic stroke in 1990-2013: the GBD 2013 study, *Neuroepidemiology*, 45: pp161–76.

¹⁷ Canadian Stroke Best Practices, (2020), Emergency Management of Intracerebral Hemorrhage: 7th Edition – 2020 UPDATE, available at <u>https://www.strokebestpractices.ca/recommendations/management-of-intracerebral-hemorrhage/emergency-management-of-intracerebral-hemorrhage</u>, accessed 15th November 2021.

¹⁸ Hemphill JC, Greenberg SM, Anderson CS, et al, (2015), Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American heart Association/American stroke association, *Stroke*, Volume 46, No7: pp2032–60

¹⁹ Parry-Jones AR, Sammut-Powell C, Paroutoglou K, et al, (2019), An intracerebral hemorrhage care bundle is associated with lower case fatality, *Annals of Neurology*, 86 (4): pp495–503

²⁰ Parry-Jones AR, Moullaali TJ, Ziai WC, (2020), Treatment of intracerebral hemorrhage: From specific interventions to bundles of care, *International Journal of Stroke*, 15(9): pp945-953.

²¹ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

²² Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

²³ Langhorne P, Ramachandra S, (2020), Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke: network meta-analysis, *Cochrane Database of Systematic Reviews*, 4(4):CD000197

²⁴ Busingye D, Kilkenny MF, Purvis T, et al, (2018), Is length of time in a stroke unit associated with better outcomes for patients with stroke in Australia? An observational study, *BMJ Open*, 12;8(11):e022536

²⁵ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

²⁶ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

²⁷ NHS Quality Improvement Scotland, (2010), Best Practice Statement: End of life care following acute stroke, available at <u>Best Practice Statement End of life care following acute stroke.pdf</u> (scot.nhs.uk), accessed 15th November 2021.

²⁸ Wright J, Zeeman H, Biezaitis V, et al, (2016), Holistic Practice in Traumatic Brain Injury Rehabilitation: Perspectives of Health Practitioners, *PLOS ONE*, 11(6): e0156826.

²⁹ United Nations, Convention on the Rights of Persons with Disabilities and Optional Protocol, available at <u>https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html#Fulltext</u>, accessed 1st November 2021.

³⁰ World Health Organisation, (2019), Rehabilitation in health systems: guide for action, available at <u>https://www.who.int/publications/i/item/9789241515986</u>, accessed 15th November 2021.

³¹ Wade DT & Halligan PW, (2017), The biopsychosocial model of illness: a model whose time has come, Clinical Rehabilitation, Vol. 31(8) 995–1004

³² Williams, L., Hamilton, J. & Evans, J.J. (2021) A holistic model of stroke rehabilitation (Unpublished document)

³³ The Health Foundation, Person-centred care made simple: What everyone should know about person-centred care, January 2016, available at https://www.health.org.uk/publications/person-centred-care-made-simple, accessed 24th January 2021

³⁴ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

³⁵ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

³⁶ Kwakkel G, van Peppen R, Wagenaar RC, et al, (2004), Effects of augmented exercise therapy time after stroke a metaanalysis, *Stroke*, 35(11): pp2529–2539

³⁷ Duncan-Millar D, van Wijck F, Pollock A, Ali M, (2021), International consensus recommendations for outcome measurement in post-stroke arm rehabilitation trials, *European Journal of Physical and Rehabilitation Medicine*, 57(1): pp61-68.

³⁸ Duncan-Millar J, van Wijck F, Pollock A, Ali M. Outcome measures in post-stroke arm rehabilitation trials: do existing measures capture outcomes that are important to stroke survivors, carers, and clinicians? Clinical Rehabilitation 2019, Vol. 33(4) 737 –749. DOI: 10.1177/0269215518823248

³⁹ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁴⁰ Gittins M, Vail A, Bowen A, et al on behalf of the SSNAP collaboration, (2020), Factors influencing the amount of therapy received during inpatient stroke care: an analysis of data from the UK Sentinel Stroke National Audit Programme, *Clinical Rehabilitation*, Volume: 34 issue: 7, page(s): 981-991

⁴¹ Clarke DJ, Burton LJ, Tyson SF et al, (2018), Why do stroke survivors not receive recommended amounts of active therapy? Findings from the ReAcT study, a mixed-methods case-study evaluation in eight stroke units, *Clinical Rehabilitation*, Vol. 32(8) pp1119 - 1132

⁴² Clarke D, Gombert-Waldron K, Honey S, et al, (2021), Co-designing organisational improvements and interventions to increase inpatient activity in four stroke units in England : a mixed-methods process evaluation using normalisation process theory. *BMJ Open*, 11(1):e042723

⁴³ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁴⁴ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁴⁵ Langhorne P, Baylan S, (2017, Early supported discharge services for people with acute stroke, *Cochrane Database of Systematic Reviews*, Issue 7. Art. No: CD000443.

⁴⁶ Legg LA, Lewis SR, Schofield-Robinson OJ et al, (2017), Occupational Therapy for adults with problems in activities of daily living after stroke. *Cochrane Database of Systematic Reviews*, Issue 7, Article No: CD003316

⁴⁷ Bosomworth H, Rodgers H, Shaw L, (2020), Evaluation of the enhanced upper limb therapy programme within the Robot-Assisted Training for the Upper Limb after Stroke trial: descriptive analysis of intervention fidelity, goal selection and goal achievement, *Clinical Rehabilitation*, 35(1): pp119-134

⁴⁸ Pollock A, Baer G, Campbell P, et al, (2014), Physical rehabilitation approaches for the recovery of function and mobility following stroke, *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001920.

⁴⁹ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁵⁰ Mehrholz J, Thomas S, Elsner B, (2017), Treadmill training and body weight support for walking after stroke. *Cochrane Database of Systematic Reviews*, Issue 8. Art. No.: CD002840

⁵¹ Mehrholz J, Thomas S, Elsner B, (2017), Treadmill training and body weight support for walking after stroke. *Cochrane Database of Systematic Reviews*, Issue 8. Art. No.: CD002840

⁵² Brady MC, Kelly H, Godwin J, Enderby P, et al, 2016. Speech and language therapy for aphasia following stroke. *Cochrane Database of Systematic Reviews*, Issue 6, Art. No: CD000425.

⁵³ UK Government, Guidance: Assistive technology: definition and safe use, Updated 28 October 2021, available at <u>Assistive technology: definition and safe use - GOV.UK (www.gov.uk)</u>, accessed 15th November 2021.

⁵⁴ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁵⁵ Tieges, Z. et al, (2015), Sedentary behavior in the first year after stroke: a longitudinal cohort study with objective measures. *Archives of Physical Medicine and Rehabilitation*, 96(1), pp15-23

⁵⁶ Fini NA, Holland AE, Keating J, et al, (2017), How physically active are people following stroke? systematic review and quantitative synthesis, *Physical Therapy*, 97: pp707–717

⁵⁷ Pollock A, Baer G, Campbell P et al, (2014), Physical rehabilitation approaches for the recovery of function and mobility following stroke, *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001920

⁵⁸ National Model of Psychological Care in Stroke (Scotland) (NMPCS) in *Improving Psychological Care in Stroke Service: A National Model for Scotland, October 2020*, Scottish Stroke Psychology Forum.

⁵⁹ Stratton, H., Sansom, J., Brown-Major, A et al, (2020). Interventions for sexual dysfunction following stroke, *Cochrane Database of Systematic Reviews*, Issue 5. Art. No.: CD011189

⁶⁰ Winstein, C.J., et al (2016). Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke, 47(6), e98-169

⁶¹ Pollock, A, Hazelton, C., Rowe, F et al, (2019), Interventions for visual field defects in people with stroke, *Cochrane Database of Systematic Reviews*, Issue 5, Art. No.: CD008388

⁶² Kidd L, Booth J, Lawrence M, & Rowat A (2020) Implementing Supported Self-Management in Community-Based Stroke Care: A Secondary Analysis of Nurses' Perspectives. Journal of Clinical Medicine. 9(4):985. <u>https://doi.org/10.3390/jcm9040985</u>

⁶³ Kidd L, Booth J, Lawrence M, & Rowat A (2020) Implementing Supported Self-Management in Community-Based Stroke Care: A Secondary Analysis of Nurses' Perspectives. Journal of Clinical Medicine. 9(4):985. <u>https://doi.org/10.3390/jcm9040985</u>

⁶⁴ Norrving B, Barrick J, Davalos A, et al, on behalf of the Action Plan for Stroke in Europe Working Group (2018), Action Plan for Stroke in Europe 2018–2030, *European Stroke Journal*, Vol. 3(4) pp309–336.

⁶⁵ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁶⁶ Royal College of Physicians, *National clinical guideline for stroke*, Prepared by the Intercollegiate Stroke Working Party, Fifth Edition 2016, available at <u>https://www.strokeaudit.org/Guideline/Full-Guideline.aspx</u>, accessed 22nd October 2021.

⁶⁷ British Association of Stroke Physicians, (2019), Meeting the Future Consultant Workforce Challenges: Stroke Medicine, available at <u>BASP-Stroke-Medicine-Workforce-Requirements-Report-</u><u>FINAL.pdf</u>, accessed 23rd October 2021.