

# Virtual Capacity in Scotland: Findings from Interviews with Pathway Representatives and a Rapid Evidence Review



**HEALTH AND SOCIAL CARE**

<b>Acronyms .....</b>	<b>3</b>
<b>Definitions .....</b>	<b>4</b>
<b>Acknowledgements .....</b>	<b>6</b>
<b>Executive Summary .....</b>	<b>7</b>
<b>Background.....</b>	<b>9</b>
<b>Methodology .....</b>	<b>10</b>
Part 1: Qualitative Interviews .....	10
Part 2: Rapid Evidence Review .....	11
<b>Findings: Qualitative Interviews .....</b>	<b>13</b>
What is Virtual Capacity?.....	13
The Five Pathways .....	13
Hospital at Home .....	14
Heart failure .....	15
OPAT .....	16
Respiratory .....	17
COVID Remote Health Monitoring.....	18
Contexts.....	20
Outer contexts .....	20
Inner level contexts.....	23
Conclusion .....	25
<b>Findings: Rapid Evidence Review .....</b>	<b>26</b>
Summary .....	26
Question 1: Do Virtual Capacity services save bed days and/or save other hospital resources?.....	27
Hospital at Home .....	27
OPAT .....	27
Covid remote health monitoring (pulse oximetry) .....	28
Question 2: Do Virtual Capacity services reduce length of stay and enable earlier discharge? .....	29
Hospital at Home .....	29
OPAT .....	30
Respiratory .....	30
Covid remote health monitoring (pulse oximetry) .....	31
Question 3: Do Virtual Capacity services reduce the need for hospital readmissions and support admission avoidance? .....	32

Hospital at Home .....	32
OPAT .....	33
Heart Failure .....	34
Respiratory .....	34
Question 4: What is the patient experience of Virtual Capacity services? .....	37
Hospital at Home .....	37
OPAT .....	38
Respiratory .....	39
Heart Failure .....	39
Covid remote health monitoring (pulse oximetry) .....	39
<b>Conclusion .....</b>	<b>41</b>
Recommendations .....	42
<b>References .....</b>	<b>43</b>

# Acronyms

Chronic Obstructive Pulmonary Disease (COPD)

Health Boards (HBs)

Health Improvement Scotland (HIS)

Health Research Authority (HRA)

Health and Social Care Partnerships (HSCPs)

Hospital at Home (H@H)

Integration Authorities (IAs)

Length of stay (LoS)

National Research Ethics Service (NRES)

NHS Education for Scotland (NES)

National Early Warning Score (NEWS2)

Outpatient Parenteral Antimicrobial Therapy (OPAT)

Randomised control trial (RCT)

Virtual Capacity (VC)

## Definitions

**Bed days saved**<sup>1</sup> – the number of days receiving a VC service and not occupying an inpatient bed.

**Community Respiratory Response Teams** – Community Respiratory Response Teams provide treatment at home to patients with chronic respiratory conditions (e.g. COPD) who would traditionally require hospitalisation.

**Covid Remote Health Monitoring** – This was for individuals with Covid-19 who did not meet the threshold for hospitalisation, but who still required medical intervention. Covid Remote Health Pathways (RHPs) were piloted in Scotland and implemented from January 2021 as a new service enabling people diagnosed with Covid-19 to self-monitor their symptoms. The pathway was used to detect and manage early deterioration of patients, indicated by breathlessness and decreased oxygen saturation.

**Heart Failure Pathway** - The pathway was introduced to support heart failure patients through access to specialists to reduce the risk of hospitalisation and premature death by facilitating earlier heart failure therapy for patients newly diagnosed with the condition.

**Hospital at Home** – Hospital at Home is a short-term, targeted intervention providing a level of enhanced intermediate care in an individual's own home or homely setting as an alternative to acute hospital care. This has generally been used to describe the pathway provided to adults with a focus on older people in Scotland. However, Hospital at Home is now being used as an umbrella term to describe the activities provided by each of the pathways (in a similar way that the term Virtual Capacity has been used). We have retained the term Virtual Capacity in this report however to avoid confusion with the Hospital at Home pathway and in order to ensure consistency with the terminology used in the wider academic literature.

**Length of stay** – this includes length of hospital stay and length of treatment via a VC service.

**Readmissions** – readmissions to hospital from hospital level care. This can include being admitted to hospital from a VC service.

**OPAT** – Outpatient Parenteral Antimicrobial Therapy (OPAT) is a multidisciplinary clinical service which provides an alternative to hospital admission for patients with a range of infections which require treatment via intravenous or complex oral antimicrobials.

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<sup>1</sup> This section is not supposed to provide a nuanced understanding of the included terms, but instead to direct the reader on how they have been used in this report.

**Virtual Capacity** - traditional acute level care provided in alternative settings, such as in people's homes. VC aims to increase capacity, improve patient experience, and reduce the need to travel for care.

**Virtual Ward** - utilises technology to monitor patients remotely.

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# Executive Summary

Virtual Capacity (VC) enables traditional inpatient care and treatment to be provided in alternative settings, often in people's homes. This report aims to provide an understanding of how Virtual Capacity is operating in Scotland.

In part one, qualitative semi-structured interviews with pathway representatives were utilised to describe the development and scale of VC services, alongside barriers and facilitators to implementation. In part two, findings from a rapid evidence review examining the effectiveness of VC in alleviating pressure on hospitals are described as well findings related to how services are experienced by patients.

This report only focuses on evidence published between 2017 and 2022 and does not include evidence on safety or cost-effectiveness. The report also restricts its focus to the use of pulse oximeters for covid remote monitoring, and omits wider work being progressed through Connect Me and therefore only provides a partial view of how VC is operating in Scotland.

The interviews highlight the important role committed clinicians have played in VC, who have been central to driving change through local innovation. Other findings highlight the variable nature of implementation which has resulted in pathways being at various stages of development across Scotland. A national focus in the advent of COVID-19 has helped to accelerate change and has been accompanied by central funding, although sustainable funding was identified as being required as well as further expansion to address a lack of geographical equity with regards to access.

The effects of workforce issues on delivery were discussed by interviewees, including difficulties in recruiting adequately skilled staff. This was perceived as being impacted by wider funding structures. Participants also highlighted that changing embedded ways of working can be challenging and securing buy-in amongst strategic decision-makers is pertinent for successful implementation.

The rapid evidence review highlighted that people were satisfied with VC services and liked being in the comfort and familiarity of their own home. The reduced disruption to their everyday lives was valued, though some were less satisfied when travel was required for treatment, and concerns around safety were also noted (Echevarria et al., 2018; Gardner et al, 2019; Minton et al, 2017; Tonna et al, 2019).

The evidence review identified that VC services help to save hospital bed days by providing an alternative to an inpatient stay (Durojaiye et al, 2018; HIS, 2020; SAPG, 2022). The ability of VC to reduce hospital readmissions from hospital level care is however variable (Edmond et al, 2017; Pickstone and Lee, 2019; Tierney et al, 2021), though is often explained by wider contextual factors (e.g. the acuity of the population and availability of overnight care) (Shepperd et al, 2021).

Randomised Control Trial (RCT) evidence shows that VC services can reduce hospital length of stay (Singh et al, 2022; Echevarria et al, 2018). Length of



treatment (e.g. on a VC service vs inpatient stay) varies depending on the study however. Shepperd et al's (2021) RCT found a slight increased length of treatment for people receiving Hospital at Home, though it is unclear if this was statistically significant. Service evaluations (which are less robust than RCT's) do however report reduced length of treatment (Tierney et al, 2021).

# Background

Countries around the world are looking at ways of addressing increasing levels of demand on acute care services (Shepperd, 2016). Demographic changes, including an ageing population and increases in the population burden of disease, have significant implications for how care is delivered in Scotland (Scottish Government, 2021a).

The pandemic highlighted how innovations in community based approaches and technology can be harnessed within healthcare systems (Scottish Government, 2021b). One of the key new ways the NHS in Scotland is delivering more healthcare in the community and providing treatment closer to home is through “virtual capacity” (VC). This is where traditional acute level care is provided in alternative settings, which in many cases is in people’s homes (Scottish Government, 2022a).

These services aim to provide additional capacity by saving hospital bed days (Scottish Government, 2022b). The objectives of VC are to reduce the need for hospitalisation (admission avoidance) or length of stay in hospital (early supported discharge) by offering alternatives to inpatient care, improve patient experience, and reduce the need to travel for care (NHS Greater Glasgow and Clyde, 2022; NES, 2022).

Funding has been provided in recent years to develop and expand Virtual Capacity services across Scotland (Scottish Government, 2022a). At the start of 2022, there were 440 virtual beds, though the aim was to double this by the end of 2022 (Scottish Government, 2022b). Reducing avoidable travel also contributes to the wider net-zero agenda (NHS Scotland, 2022).

This research report aims to provide an understanding of what virtual capacity is and how it is currently operating in Scotland. It is split into two parts; firstly focusing on delivery, and secondly on outcomes. Part one provides an overview of the development and scale of VC in Scotland, as well as barriers and facilitators to implementation. Part two is a rapid evidence review of literature on the effectiveness of VC, alongside patient experience. Where evidence from Scotland is limited, the review will also consider similar initiatives across the UK<sup>2</sup> and abroad.

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<sup>2</sup> As systematic reviews were identified in the literature searches and included in this report, it is acknowledged that these will contain studies outwith the UK

# Methodology

This section provides an overview of the methodology used in this report. Part one describes the qualitative interviews undertaken with pathway representatives and part two details the rapid evidence review process.

## Part 1: Qualitative Interviews

Qualitative interviews with staff working on key VC pathways were undertaken in order to better understand the nature and development of Virtual Capacity pathways in Scotland. The pathways are: Connect Me (which includes covid remote health monitoring which is focused on in this report), Hospital at Home, Heart Failure, OPAT, and Respiratory.

Two key research questions were developed to guide the interviews and are as follows:

1. How have the five VC pathways developed in Scotland?
2. What are the barriers to implementing VC in Scotland?

Semi-structured interviews were conducted with six representatives from the five pathways in March and April 2023. The participants who engaged in the interviews had detailed knowledge at a strategic level, as well as understanding of implementation within the respective pathways. Participants were also asked to review the content of the findings and provided additional information following the interviews via email. It should be noted that the interviews were not designed to be representative, but instead to provide an in depth understanding of the pathways from key experts in the area. Members of the Hospital at Home expert working group also provided feedback.

The Scottish Government social researcher ethics checklist and the Health Research Authority (HRA) decision tool were completed. This piece of work constitutes evaluation and therefore National Research Ethics Service (NRES) ethical approval was not required.

The interviews were conducted via Microsoft Teams and participants provided consent to these being recorded. The questions focused on the nature and development of the pathways to generate understanding of the Virtual Capacity landscape in Scotland. Questions also focused on barriers to implementation to elucidate what practical issues have impacted delivery.

The interviews were transcribed and thematically analysed. NVivo version 1.6.1 qualitative software was used to support coding. An inductive approach to coding was adopted and codes were subsequently deductively categorised as outer macro contexts, inner micro and meso contexts, outcomes, and innovation which relates to how VC and the pathways work. Due to the small number of participants, no

demographic information or details of participant roles is provided to ensure anonymity.

The findings section related to the interviews begins with a case study description of each pathway before providing an overview of the main themes that were identified during analysis. Some literature has also been incorporated into the pathway descriptions to triangulate the findings.

## **Part 2: Rapid Evidence Review**

This rapid evidence review examines whether VC services are effective at reducing the need for hospital admissions and lengths of stays (LoS), thereby enabling earlier discharge. It also examines how VC shapes patient experience. This review does not consider cost-effectiveness or safety as this was not within the scope of this research report. Furthermore, it focuses only the use of pulse oximeters for people with Covid-19, and not the wider Connect Me pathway.

The research questions that guided the evidence review were as follows:

1. Do VC services reduce numbers of bed days and/or other hospital resources?
2. Do VC services provide alternatives to hospital stay or reduce length of stay and enable earlier discharge?
3. Do VC services reduce readmissions and support admission avoidance?
4. How do patients experience VC services?

Two literature searches were conducted<sup>3</sup> on VC in the UK, and where available, specifically Scotland. The following databases were searched: Idox, KandE, Knowledge Network, Policy Commons, ProQuest, and Google Scholar. Search terms included:

- Virtual capacity
- Hospital at Home
- Outpatient parenteral antimicrobial therapy, OPAT, infectious diseases, antivirals
- Respiratory pathway, respiratory programme, respiratory care, respiratory service
- Covid remote monitoring
- Cardiology
- Geriatrics
- Anti-virals

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<sup>3</sup> These were conducted by the Scottish Government library service

- UK, Britain, England, Wales, Northern Ireland, Scotland

Peer reviewed and grey literature papers published between 2017 and 2022 were included if they reported primary or secondary qualitative or quantitative evidence on at least one of the research outcomes (hospital readmissions, length of stay, hospital resources/bed days, and patient experience). No language restrictions were placed on the search.

With regards to limitations, assessment of methodological rigor was not conducted since as this was not a systematic review, although strengths and limitations in the research are reflected upon throughout, and this should be considered when reading the findings. Additionally, it is possible that empirical evidence for these areas was not identified in the search terms utilised for this piece of work or within the time period selected. The evidence is also predominantly focused on Scotland and the rest of the UK, resulting in wider international literature being excluded. It should also be noted that there are variations in terminology and how outcomes are measured. Finally, this report had a narrow focus on the use of pulse oximeters for covid remote monitoring, and therefore omits wider work being progressed through Connect Me.

Almost 200 publications were identified as part of the search and an additional 30 sources were identified by the authors<sup>4</sup>. A review was also undertaken of literature available on the Healthcare Improvement Scotland (HIS) website. In total 233 studies were identified, with 42 meeting the inclusion criteria.

It should be noted that literature addressing the research questions was not always available for all five services. Table 1 shows the services which were covered by literature addressing each research question.

<b>Topic of research/Service</b>	<b>H@H</b>	<b>OPAT</b>	<b>Pulse oximetry for Covid</b>	<b>Cardiac services</b>	<b>Respiratory services</b>
<b>Readmissions</b>	<b>Y</b>	<b>Y</b>	<b>N</b>	<b>Y</b>	<b>Y</b>
<b>LoS</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>N</b>	<b>Y</b>
<b>Hospital resources/bed days</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>N</b>	<b>N</b>
<b>Patient experience</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>

<sup>4</sup> Gratitude to Professor Brian McKinstry (The University of Edinburgh) for providing additional papers on telemonitoring.

## Findings: Qualitative Interviews

This chapter presents the findings from qualitative semi-structured interviews with representatives from each of the pathways. It begins by defining Virtual Capacity, before providing descriptions of each of the pathways in Scotland. Following this, wider contextual factors which were identified as affecting implementation are discussed.

### What is Virtual Capacity?

Participants were firstly asked to provide a definition for Virtual Capacity. A number of key components were identified which included the provision of hospital level care in an alternative setting. This was identified as often being provided in people's homes or in the wider community, but can also include outpatient appointments to enable people to remain at home:

“it's [virtual capacity] creating additional space in which to manage patients who otherwise are required to remain in hospital. Not necessarily space but clinical services to manage those patients. So it's an alternative to hospitalisation.” [Participant, OPAT].

Participants highlighted that people using VC have acute level needs, making it distinct from community nursing and primary care:

“they are multimorbid, they are elderly [...] readmission at 30 days is particularly high for heart failure patients so a lot of this work is to reduce the readmission at 30 days” [Participant, Heart Failure]

“If you're not seeing at least 20% readmissions then you're probably not doing hospital at home right because you're probably taking the more long-term conditions so there should be that level of acuity” [Participant, Hospital at Home].

The role of VC in alleviating pressure on inpatient wards was highlighted. One participant, for example, noted: “to me it's about releasing capacity in acute beds” [Participant, Connect Me]. Others, including participants from the Hospital at Home, OPAT and Respiratory pathways focused on saving bed days, highlighting that their services had been successful in saving many bed days.

### The Five Pathways

Although models of care vary within and between the different pathways, participants highlighted key components that crosscut the pathways: specialist, multidisciplinary and acute level care. However, the covid remote monitoring self-

management pathway is the exception to this, which is explained in more depth below. The following section provides an overview of the five VC pathways, outlining their key aims, services, and how their development has progressed.

## Hospital at Home

Participants highlighted that hospital at home (H@H) provides hospital level, time-limited, care “that is equivalent to an inpatient setting” [Participant, Hospital at Home]. It is currently provided to adults with a focus on older people in Scotland, though there is no lower age limit.

Its key components were identified as: a secondary care specialist and “a multi-disciplinary team approach” that provides “urgent access to hospital-level diagnostics and acute interventions” [Participant, Hospital at Home]. It was noted that models of care and interventions offered vary across services to suit local need, although they should encompass the key tenets identified above.

The staff responsible for delivering hospital at home were identified as predominantly nursing staff and Advanced Nurse Practitioners (ANPs), with support from a doctor “whether that is a consultant, [or] whether that is a GP with specialist interest” [Participant, Hospital at Home].

It was highlighted that Hospital at Home differs from other VC services in that there is not an overarching approach to treatment, but instead it involves diagnosing, assessing, and treating patients whose treatment plan may not be known at the point of referral:

“[Hospital at Home provides] secondary care level intervention overseen by a responsible medical officer, in the similar way to you would have in a hospital, it’s just bringing that assessment and acute intervention to the home” [Participant, Hospital at Home, 1].

Hospital at Home has been running in Scotland for around 10 years. It originated in Lanarkshire and national implementation has been iterative, although over the last three years the pace of change has accelerated. There are currently Hospital at Home services in 11 NHS Boards and 21 HSCPs. There was a 53% increase in the use of H@H services between 2021/22 and 2022/23 (Healthcare Improvement Scotland (HIS, 2023).

Recent statistics from HIS (2023) show a 20% reduction in length of treatment via Hospital at Home services between 2021/22 and 2022/23. An expert working group member attributed this to a combination of staff becoming more confident in managing risk resulting in earlier discharge, more efficient processes and procedures, and the potential changes in patient acuity linked to more supported discharges from acute sites.

Participants highlighted that broadening the criteria to accommodate wider populations and specialties was the focus of future development. The aim being to

increase the number of people using services to ensure equity of access across Scotland:

“The key priority [...] is to increase the number of people that are able to access hospital at home level care [...] increase the established services capacity or throughput, ability to treat patients, but also to spread that geographically to treat patients in parts of Scotland where there were no hospital at home services.” [Participant, Hospital at Home].

## Heart failure

The Heart Failure pathway is a new pathway designed to support people with heart failure through four key services: 1) heart failure diagnostics; 2) inpatient heart failure reviews and early supported discharge; 3) ambulatory heart failure services; 4) remote monitoring.

Heart failure diagnostics aims to speed up the diagnosis process for people with heart failure to improve their prognosis. It was noted that people with heart failure are most commonly diagnosed at the point of presentation to acute care; the pathway is therefore designed to address this:

“our aim [...] is to get people diagnosed with heart failure quicker because what we know is if we diagnose people earlier on in their heart failure disease then their trajectory is much improved and their prognosis is much improved” [Participant, Heart Failure].

Although approaches vary, one model used in Greater Glasgow and Clyde that has been tested in a large clinical trial was described as follows:

“They got height, weight, ECG, blood pressure, echocardiogram, they were seen by a cardiology ANP [...]. And they were examined and given a diagnosis on the day. And they were treated on the day”. [Participant, Heart Failure].

Data on patients is entered onto a digital platform to improve information sharing across systems. The digital platform holds information on “key cardiac investigations, diagnosis and treatment” and is designed to “cut down on time to treat” by reducing the need to do “a manual trawl of notes” [Participant, Heart Failure]. This “markedly reduced the amount of clinic face to face cardiology appointments that were required”. The pathway is currently trying to nationally procure a heart failure digital diagnostics platform to further improve heart failure diagnostics and treatment.

Inpatient heart failure reviews and early supported discharge involve undertaking inpatient reviews with people with heart failure so that they can be referred to a specialist heart failure team. This is combined with virtual wards to support early discharge, and reduce hospital length of stay and readmissions:



“we can keep them on a virtual ward and know exactly where they are, go and visit them and keep an eye and make sure they’re not deteriorating from a heart failure point of view, which will reduce their hospital length of stay and ultimately readmission” [Participant, Heart Failure].

Ambulatory heart failure services were identified as aiming to reduce hospital length of stay by managing people as outpatients, providing required treatment, including IV diuretics, IV iron, and medication optimisation. Patients attend for treatment on a day case basis and are managed via a virtual ward.

Remote monitoring of heart failure is facilitated through the Connect Me service. Patients are provided with blood pressure monitors and weighing scales and use the Inhealthcare App for monitoring, which sends alerts to heart failure nurses when triggered by readings that indicate deterioration. This can be personalised to the individual to reflect their typical readings. This is used alongside a virtual ward to manage deterioration:

“quite often our heart failure patients run with very low blood pressure so if they were set at a standard pressure for example, they’d be alarming all the time. So, they can be very patient centred” [Participant, Heart Failure].

Two areas in Scotland currently have funding to deliver these services: Greater Glasgow and Clyde (GGC) and Forth Valley. GGC is further along in implementation and delivery, with most components of the service being delivered across the Health Board. The digital platform is being used in Forth Valley and funding has been secured to roll out the other components.

## OPAT

Outpatient Parenteral Antibiotic Therapy (OPAT) is an infection specialist led service providing IV and complex oral antimicrobial treatment in the community as an alternative to inpatient hospital treatment (Scottish Antimicrobial Prescribing Group (SAPG), 2022). OPAT supports early hospital discharge and admission avoidance “primarily, stopping people coming in, and getting people out as quickly as possible” [Participant, OPAT]. The focus is not on reducing readmission due to exacerbations of chronic conditions:

“this is not a chronic disease management strategy, so not about reducing re-admission due to exacerbation of the chronic disease. OPAT is all about managing acute infections which inevitably is about an alternative to hospital care” [Participant, OPAT].

It is infection specialist led and multidisciplinary in nature. The key aim of OPAT is to provide care that is “expert, and it is safe and effective, and well governed” [Participant, OPAT]. This is demonstrated in studies showing that OPAT is generally safe, effective, and acceptable for treating a range of infections (Barr *et al*, 2012; Gilchrist *et al*, 2022; Seaton, 2005).

OPAT is available for anyone over 16 in Scotland, though the average age of people receiving OPAT was identified as being on “average late 50s, early 60s” [Participant, OPAT]. There are currently very limited paediatric OPAT services in Scotland.

OPAT was first established in Tayside in the 1990s. There are currently services in both urban and rural areas, including Dumfries and Galloway, Grampian, Greater Glasgow and Clyde, Highland, Lanarkshire, Lothian, Fife, Forth Valley, Tayside, and the Western Isles. This expansion has resulted in an average of 250 people receiving OPAT per week in 2022 (Scottish Antimicrobial Prescribing Group (SAPG, 2022)).

Services are configured differently depending on local need and there are various models of OPAT. This includes teaching patients to prepare and administer antibiotics, including using pumps, receiving treatment in an OPAT clinic, the frequency of which will depend on the level of need, and community nurses treating people in their own homes.

A multidisciplinary team is responsible for delivery and can include infection specialists, nurse specialists, clinical pharmacists, and healthcare support workers. Referrals are made by GPs, hospital specialists, and relevant community professionals, including podiatrists.

Priorities for OPAT development are to ensure there is “the right governance, and the right guidance, and the right clinical practice in all of these services” [Participant, OPAT]. Having adequate workforce (skill mix and appropriate staffing) to meet population demands, and providing guidance to ensure consistency in practice and prevent the overuse of antibiotics due to rising antimicrobial resistance, was highlighted as priorities.

## Respiratory

The respiratory pathway was described as aiming to safely manage people with respiratory conditions who have had an acute event through the support of a community respiratory team. This includes support from a specialist multidisciplinary team, and the use of medications not provided by primary care. It was highlighted that services provide:

“an alternative to hospital admission because the respiratory team then take over their care and then manage them at home until they recover from their acute event” [Participant, Respiratory].

The pathway predominantly treats people with COPD, though the intention is to expand this to include a range of respiratory conditions such as lung disease, asthma, lung cancer, and interstitial lung disease (ILD).

It was highlighted that a broader approach covering multiple respiratory conditions was taken in response to the Covid-19 pandemic. Services were redesigned in GGC to provide an emergency seven-day response service, which ran for one year. Respiratory nurse specialist and community respiratory services were amalgamated to reduce readmissions to hospital.

Services within the pathway exist in areas with high deprivation due to incidence of COPD being correlated with deprivation. Community respiratory teams are currently running in Glasgow City HSCP, all HSCPs in Lothian, and in some parts of Fife, Tayside, Lanarkshire, Ayrshire and Arran, and Dumfries and Galloway. Services are at various stages of implementation. It was noted that Lothian has been running for around fifteen years, Glasgow for ten, Dumfries and Galloway for around six or seven, Ayrshire and Arran for two years, while Lanarkshire is a new service.

Staffing and service models were described as varying depending on whether they narrowly focus on reducing admissions or have a more holistic focus:

“Everyone kind of looks at things from a slightly different angle. The physios and the nurses deal with the acute issues with the presentation. And the idea is the occupational therapists and pharmacist will come in later on, and the dietician, to work with patient to prevent further admissions. So not just preventing that admission but preventing subsequent admissions as well. So its whether you have a model that is purely stopping admissions and just being a surrogate for ED or whether you have a more holistic care model which tries to provide more overall care for the population group.”  
[Participant, Respiratory].

Referrals are made from primary care to community respiratory teams, or through early supported discharge from hospital. The future ambitions for the respiratory pathway are to expand capacity to meet demand and broaden the scope of services, building this into referral pathways, through:

“7 day working. We could link in with flow navigation centres. So people phone NHS 24, that gets diverted to the community teams rather than going through the weekend process” [Participant, Respiratory].

## **COVID Remote Health Monitoring**

Covid remote health monitoring is part of the Connect Me service. Although a number of Connect Me services have been developed, this report is specifically focused on remote health monitoring for Covid-19. There are two strands within covid remote monitoring: clinically managed and self-management pathways. Covid remote monitoring was initially set up as a pilot in 2020 with a wider launch in January 2021. The service aimed to support early identification of deteriorating symptoms relating to Covid-19 including breathlessness and silent hypoxia (a rapid deterioration in oxygen levels). It was highlighted that:

“This was to try and offset that [deterioration] and to support patients where they weren’t displaying severe symptoms at the time. They could be managed at home, they chose to be at home and it was giving them the information they needed” [Participant, Connect Me].

If required, clinicians were able to check symptoms, such as oxygen levels, on the system and arrange a follow up call if concerned. Automated alerts were provided, and patients could use the system via telephone call, SMS, or an online app. This service was mainly used in Lanarkshire, Highland, and Grampian.

The self-management pathway was set up at pace in January 2022 to roll out the availability of pulse oximeters to help people with Covid-19 to safely stay at home. Patients were assessed by a clinician, and if deemed suitable for the service, issued with a pack and invited to register with the national call centre for two weeks of remote monitoring. Over 15,000 packs were distributed to clinical teams and included a pulse oximeter and guidance for use. This pathway did not offer any clinical oversight and people were required to call 111 or 999 depending on the nature of their symptoms (Alexander, 2021).

Packs were offered to all GP practices in Scotland, alongside out of hours GP services, respiratory services, the Scottish Ambulance Service, and some maternity services. Alexander (2021) highlights that between January and August 2021, 149 people used the service in NHS Boards in Lanarkshire, Grampian, Highland, Western Isles, Forth Valley, and Orkney.

The Connect Me representative explained that the omicron variant did not have the same respiratory impacts resulting in significantly less need than anticipated. Around 350 pulse oximeters were used and the self-management pathway has now ended, though the clinically managed pathway is still running, and the remaining pulse oximeters are available for respiratory and NEWS2 (National Early Warning Score) pathways.

As part of the national contract for the underlying Inhealthcare App, available to all Health Boards, a key focus for the Connect Me team has been the scale up of remote blood pressure monitoring. To date, over 75,000 people have registered on the hypertension pathway. It was highlighted that:

“Evidence has shown people who use telemonitoring maintain optimum blood pressure longer than those who may only attend for annual reviews”  
[Participant, Connect Me].

As part of the wider Hospital at Home programme, work is currently underway to develop a Vital Signs pathway. This will provide short term remote monitoring of blood pressure, SpO2 [oxygen saturation], heart rate, respiration and temperature, along with an option to calculate a NEWS2 early warning score.

## Contexts

Macro (health system and wider structures), meso (organisational), and micro (individual) contexts shape implementation processes and outcomes (Harvey and Kitson, 2016). As such, the interviews examined barriers to implementation to elucidate what factors could be addressed to increase the chances of successful uptake. Core barriers to successful implementation and delivery are presented here alongside the mechanisms that helped to support delivery.

### Outer contexts

Macro level, or outer contexts, are those within the wider health system and the wider structures surrounding the system (Harvey and Kitson, 2016). Participants specifically focused on how funding structures, workforce, and Covid-19 shaped delivery.

### National Prioritisation and covid

In recent years there has been a national interest in VC. Prior to this, implementation was variable, and reflected the interests and endeavours of local clinicians. Participants highlighted that national policy interest, leadership, and funding has altered the pace of change, and has been an important catalyst that has helped to accelerate service development:

“the support from Scottish Government for hospital at home has been obviously really key [...] I think the leadership from the Scottish Government has been a key enabler” [Participant, Hospital at Home, 2].

The Covid-19 pandemic was perceived to drive national interest. The covid remote health monitoring pathway was set up because “there was a concern that it [Covid-19] would overwhelm services” [Participant, Connect Me] and new ways of working were sought to help prevent the spread of infection:

“Covid was a major factor because everybody’s looking for [...] different ways of managing admissions, and shielding patients, stopping them having to come into hospitals [...] it kind of made everybody realise that you can’t just keep doing things the same way. You have to be a bit more agile and flexible in the way we manage patient pathways” [Participant, OPAT].

### Funding structures

The national focus on VC was accompanied by central funding. Participants reflected that this enabled the recruitment of additional workforce to deliver services:

“we’ve used that [funding] to employ new nurses and a healthcare support worker. Got some consultant session[s] which we didn’t have before. And funding for a pharmacist” [Participant, OPAT].

However, participants talked about the need for further funding for expansion to ensure equity of access across the country. The Respiratory pathway for example, was described as being currently at capacity, and in need of additional funding to expand the workforce to increase service provision and meet demand. The potential to provide extra capacity to meet demand on the wider health system was reflected upon:

“we’re currently turning people away, on both a national level and local level, we’re turning away and we’re not expanding the service as much as we can. We’re holding back on implementing elements which could have a dramatic impact on ED, would have a dramatic impact on flow navigation centres because we don’t have the resources to do it.” [Participant, respiratory].

The intersection of the funding landscape and VC’s position in the wider health system was discussed. Whilst some national funding has been made available, participants noted that local funding provided directly through Health Boards (HBs) or Health and Social Care Partnerships (HSCPs) is also required<sup>5</sup>:

“because it’s acute care but it’s delivered in the community, so for certain parts of the workforce, partnership might fund it because it’s community, but for some services, the consultant-input might be Board funds and even though there was government funding, each year that wasn’t enough to fund a whole service” [Participant, Hospital at Home].

Another participant talked about how one off, non-recurrent funding can result in risk aversion from HB’s, who can be reluctant to fund services that may not have sustained central funding:

“the Boards won’t give recurrent funding because they, the risk might be too much. So who does the risk lie with? Should it lie with the Scottish Government, or should it lie with the Boards? And the Boards are like, but we don’t know if the Scottish Government will give us the money the following year.” [Participant, Heart Failure].

Despite requiring additional funding to develop services, participants were conscious of challenges with the current economic climate, reflecting: “money is tight just now” [Respiratory], “the major issue is funding obviously” [OPAT], and “there’s no spare cash at the moment” [Participant, Heart Failure].

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<sup>5</sup> This was not the case for Covid Remote Monitoring who were funded through the Scottish Government

## Workforce challenges

Participants reflected that workforce issues impacted the delivery of VC. Some pathways secured funding but were struggling to recruit and retain the required staff to deliver services:

“a lot of times they plan a workforce that they can’t recruit and so they need to rethink it. There’s a lot of staff turnover, it’s like service development at the moment, a lot of staff turnover.” [Participant, Hospital at Home].

The wider context was reflected upon, with VC complementing acute services, rather than replacing inpatient beds. As a result, increased numbers are required from the same pool of staff:

“Hospital at Home doesn’t mean you’re shutting anything else; you’re not shutting wards or anything like that because Hospital at Home exists” [Participant, Hospital at Home, 2].

Recruitment challenges were perceived to be exacerbated by the way that funding systems are structured. The non-recurrent nature of the funding means that posts are often advertised as fixed term contracts or secondments, which acts as a barrier to recruiting talented, skilled staff:

“because of the funding availability, then often contracts tend to be short term or fixed term at the very least and [...] you’ve also not always got contracts which are that appealing, so it’s tricky to attract people. [Participant, Hospital at Home].

Difficulties recruiting staff members was also linked to limited access to training and development. Implementation of the Heart Failure pathway, for example, has been delayed by a shortage of trained cardiac physiologists and Clinical Nurse Specialists (CNSs), who play an important role in diagnosing and treating heart failure:

“we’re somewhat off having enough people trained to such a level to deliver all this properly. Although we are getting there and we’re in a much better position than we were three/four years ago” [Participant, Heart Failure].

This was perceived to be a consequence of a commitment to provide 500 Advanced Nurse Practitioners (ANP’s) by 2021, which resulted in funding and training being directed to ANP’s instead of CNSs. Although it was noted that this has now been addressed, posts are often being undertaken as training posts.

Another participant reflected that employing people on a trainee basis resulted in services not running at full capacity:

“they might undertake the training while they’re in the role, so it’s challenging for a service to reach its full potential quickly, as people are then undertaking

training and they can't take on the level of responsibility that they can when they've completed that" [Participant, Hospital at Home].

## Inner level contexts

Inner level micro (local/individual) and meso (organisational) contexts impact the success of delivery (Rycroft-Malone et al, 2013; Harvey and Kitson, 2015). The following section focuses on culture and buy-in, local innovators and engaged communities, and access and equity.

### Culture and buy-in

Participants talked about the importance of culture in shaping implementation progress, and the difficulties involved in changing embedded ways of working. Transferring people to hospital when an acute need is identified is the norm and changing engrained clinical practices and referral pathways can be difficult:

“one of the hardest things they did when setting up the service was getting the Consultant to trust that they could look after their patient. And you're changing that culture, and think her words exactly were ‘...fixing the patient 100%, to just making sure they're alright to be at home’, so that's been a real challenge as well.” [Participant, Hospital at Home].

As well as culture impacting on people delivering services, the importance of having engagement of those in leadership positions was also mentioned. Business cases must be produced to secure funding, however, the success of this is impacted by having adequate buy-in and being considered a priority by Board's. This was reinforced by the Heart failure representative who said: “if you're not on the Boards priorities [...] then the business case isn't going to go through”.

Whilst participants reflected on person-centred care being the key driver for VC, it was noted that strategic decision-makers are often interested in cost savings. As highlighted, VC is designed to be an alternative, complementary service, as opposed to being intended to replace acute beds. However, a culture focused on addressing short term immediate needs was perceived to hinder the ability to invest in alternative options for sustainability in the longer term:

“the health service has been preoccupied with firefighting [...] opening up winter beds and increasing capacity [...] So, that's the biggest barrier is the kind of, the process, the mentality within the health service. I've had many many meetings over the years where the manager's just put up their hands and say there's no money. There's no money to invest.” [Participant, OPAT]

### Local innovators and engaged communities

The development of VC in Scotland has happened “completely naturally or organically” [Participant, Hospital at Home] according to a number of participants,



being shaped by local innovators and a “network of enthusiastic” clinicians [Participant, Heart Failure]. Participants talked about the positive impact that committed clinicians have had in progressing VC, creating and testing new ways of working, building evidence, sharing learning and best practice, and communicating and raising awareness of its benefits. This includes collecting data on the effectiveness of VC, such as how many bed days it saves:

“all our OPAT leads around Scotland are voluntarily collecting the data [...] it does serve as a sort of stimulus for more development” [Participant, OPAT].

When the national pathways commenced, there was already an existing community of dedicated practitioners to influence and drive the agenda for change. Participants talked about how the qualities of individual ‘enthusiasts’ has provided a strong foundation to progress the rollout of VC in Scotland:

“because of their personality, they’re innovators. Because they did it without a national drive to do it, so they got it [...] They want to kind of explain its benefits, they’re quite evangelical about its benefits” [Participant, Hospital at Home].

## **Access and Equity**

The fragmented nature of implementation has resulted in significant variation in the numbers and locations of VC services, as reflected in the pathway descriptions. Participants highlighted the need for greater equity of access, particularly in relation to geographical spread and socioeconomic status, and emphasised the need for further funding to expand:

“It needs a bit more investment and ultimately it needs to become business as usual... if you’re denying somebody a service because of where they live, that’s not really right.” [Participant, OPAT].

The ways in which VC intersects with socioeconomic status was highlighted. Some of the pathways had a specific focus on supporting people from lower socioeconomic backgrounds. For example, covid remote health monitoring aimed to provide equity of access to pulse oximeters for people who could not afford to buy their own device. Furthermore, COPD services are located in areas with higher levels of socioeconomic deprivation:

“COPD is a condition of deprivation so in Glasgow if you live in a deprived area, you are seven times more likely to get the condition than if you live in the most affluent quintiles. So, incidence of COPD is associated with deprivation” [Participant, Respiratory].

However, other pathways reflected that those from higher socioeconomic groups may be more likely to access services due to the inverse care law<sup>6</sup>. The OPAT representative, for example, noted that referrer bias and transportation costs can act as a barrier to equity of access, though highlighted steps that were being taken to address this:

“we’re all trying to make sure that transport to and from the hospital is free. But sometimes, for example, at weekends it can be difficult, and people can’t afford to, or nobody’s got a car, not well enough to use public transport and can’t afford a taxi. So that’s an issue as well but we’re all trying to address that because the whole issue of access and equity is all on our minds”.

Another participant noted that equality impact assessments are conducted locally to try and mitigate against this, building in processes from the outset to ensure that services are available in areas with mixed socio-economic indices to prevent further inequities. They said: “it would be very easy to end up actually creating an even wider gap, so each service does an impact assessment and considers those things” [Participant, Hospital at Home].

## Conclusion

The interviews provide an overview of what VC is and how the pathways have developed. Virtual Capacity was identified as providing acute level care outwith inpatient wards, supporting people with acute level needs, and alleviating pressure on hospitals by providing a complementary service.

Until recently, implementation had been driven by local innovators who have established new ways of working, shared learning, and garnered support and evidence. As a result, the availability of services is variable and there is a lack of equity of access to VC across the country.

The recent national focus has helped to accelerate change, with funding being made available to expand services, although questions remain about the sustainability of funding. Workforce issues have also impacted delivery, with some pathways experiencing difficulties recruiting adequately skilled staff.

Participants underlined the need for sustainable funding to develop the pace and scale of change, as well as a culture that fosters new ways of working, a skilled workforce, and buy-in from strategic decision-makers and other key stakeholders.

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<sup>6</sup> This is where ‘the availability of good medical care tends to vary inversely with the need for it in the population served’ (Marmot, 2018:1)

# Findings: Rapid Evidence Review

The following section presents a synthesis of the wider literature on VC, with a particular focus on four key outcomes:

- 1) Bed days saved
- 2) Length of stay (e.g. length of treatment in hospital and community settings)
- 3) Hospital readmissions/avoidance
- 4) Patient experience

## Summary

- There is encouraging evidence for the use of VC in Scotland, particularly in relation to patient experience. Patient satisfaction is high, with people valuing the comfort and familiarity of their home environment, though satisfaction was lower when travel was required for treatment and some people expressed concerns around safety.
- VC services can save hospital bed days by providing an alternative to inpatient care.
- There is mixed evidence on hospital readmissions. Hospital at Home services had mixed evidence, though this may be explained by the levels of need of the population, and cardiac and respiratory services led to admission avoidance. Systematic reviews of studies on OPAT from the UK, Europe, and North America were inconclusive, some of which included comparisons with usual care.
- There are differences in how length of stay is defined and measured, denoting length of treatment via a VC service and as an inpatient. There is evidence that VC services can help to reduce hospital length of stay.
- There are gaps in the literature which warrant further research. Not all pathways had evidence on all four outcomes and whilst some studies specifically focused on Scotland, systematic reviews included studies from the UK, Europe, and North America. Furthermore, some of the findings are based on only one study, so caution needs to be exercised when drawing firm conclusions.
- This report does not undertake an assessment of methodological rigour as it was not a systematic review. Whilst limitations are reflected upon throughout, this caveat should be taken into account when interpreting the findings.

## Question 1: Do Virtual Capacity services save bed days and/or save other hospital resources?

### **Hospital at Home**

Hospital at Home or similar services in Scotland have saved hospital bed days.

### **OPAT**

OPAT has been found to save bed days in Scotland and throughout the UK

### **Pulse oximetry for Covid**

The evidence on COVID-19 monitoring via pulse oximetry saving hospital resources is inconclusive.

This section focuses on published data on bed days saved as well as evidence on other hospital resources being saved.

### **Hospital at Home**

A survey by the Scottish Government was administered to all Health Boards to identify which NHS Boards were offering a Hospital at Home service and where this was not offered, what alternative treatments were in place (HIS, 2020). A total of 25 out of the 31 integrated authorities (IA's) responded, with 10 IA's stating that they had a Hospital at Home type system in place and 14 stating that they had alternative provisions in place. Although there was limited data on the type or number of patients admitted to Hospital at Home (or alternative services) and the total number of hospital bed days saved<sup>7</sup>, it was identified that bed days had been saved in IA's with Hospital at Home in place. For example, it was reported that Lanarkshire's Hospital at Home service admitted over 2,000 people in 2018, saving over 14,000 bed days. Likewise, City of Edinburgh Hospital at Home admitted 693 patients in 2018/19, saving over 2,500 bed days, and West Lothian Hospital at Home admitted 763 patients in 2018/10, saving over 3,000 bed days. Overall, this data suggests there is the potential to reduce bed days in Scotland via Hospital at Home, however there is variation in how the data is collected.

### **OPAT**

Inpatient bed days have been saved due to the increasing use of OPAT in Scotland. Between January and August 2022, the number of inpatient days avoided per week was 1,453, and approximately 45,031 in total during this period, with further increases in OPAT clinical activity in Scotland expected (SAPG, 2022).

Findings from the BSAC National Outcomes Registry showed that bed days had been saved across the entire UK as a result of OPAT. A total of 57 organisations from across the UK submitted data and reported that 442,280 treatment days had been provided via OPAT (Gilchrist *et al*, 2022).

<sup>7</sup> Please note that it is not clear as to how 'bed days saved' have been defined within this survey

## Covid remote health monitoring (pulse oximetry)

One of the reviews examined by McKinstry, Alboksmaty et al. (2022), showed that pulse oximetry for covid monitoring had potential to save hospital resources, though the authors found no explicit evidence that it was more effective than other remote monitoring interventions. Of the other studies looking at the use of pulse oximetry considered by McKinstry (2022), two did not support, or only provided extremely limited support to, the continued use of pulse oximetry to monitor Covid (Beaney et al., 2022; Lee et al., 2022).

Alexander (2021) also highlights that patients reported not needing to access healthcare resources as much and suggests that these results *could* indicate a positive effect on healthcare resources, but notes that there is no direct evidence of this.

### Summary

The literature demonstrates that Hospital at Home and OPAT services save bed days, whilst the evidence on COVID-19 monitoring via pulse oximetry saving resources is inconclusive. No evidence was found specifically on respiratory services.

## Question 2: Do Virtual Capacity services reduce length of stay and enable earlier discharge?

### **Hospital at Home**

Evidence from a large RCT in the UK shows that Hospital at Home can support earlier discharge from hospital (Singh et al, 2022), though length of treatment can be slightly longer for people receiving Hospital at Home (in the home/community setting) compared to inpatients (Shepperd et al, 2021).

### **OPAT**

There was only very limited evidence which suggested that length of OPAT treatment for adults was over double the duration of OPAT for children in entries to the National Outcomes Registry System.

### **Respiratory services**

Treatment at home for COPD reported a statistically significant reduction in LoS

### **Pulse oximetry for Covid**

There are encouraging findings for the use of pulse oximetry to reduce LoS.

Length of stay is measured in different ways in the literature. This refers to both the length of treatment via a VC service and also the length of hospital stay prior to referral to a VC service. So, length of stay here refers to length of treatment in both hospital and community settings.

### **Hospital at Home**

There are differences in the quality of evidence on Hospital at Home. The largest RCT on Hospital at Home in the UK included an evaluation of length of treatment (for inpatients and people receiving Hospital at Home) and length of hospital stay for older people. The study was conducted with 1055 participants across nine hospital and community sites in the UK, including Scotland (Shepperd et al., 2021). Participants were randomised to receive usual inpatient care or comprehensive geriatric assessment via Hospital at Home. Participants had similar baseline characteristics. Shepperd et al's (2021) work measured length of stay as the length of time an individual received treatment, including through Hospital at Home. It was reported that patients allocated to Hospital at Home had on average 6.89 Hospital at Home days compared to those receiving inpatient care who spent an average of 5.25 days in hospital (although the statistical significance and/or effect size of this difference is not reported).

The same study also reported that Hospital at Home reduces length of stay in hospital (Singh et al, 2022). Comparisons were made between hospital length of stay for inpatients and those receiving a Hospital at Home service. The authors

concluded that receiving Hospital at Home resulted in three fewer days in hospital at one month follow up, though this reduced to one day at six month follow up (Singh et al, 2022).

A service audit exploring the effectiveness of caring for older people at home in Northern Ireland (similar to Hospital at Home in Scotland) found that length of treatment was significantly reduced in acute care at home, with an average of 4 days compared to 14 days observed in hospital care in a ward for older people (Tierney et al., 2021).

Other implementation evidence focuses on whether length of stay in hospital is reduced through early discharge to a Hospital at Home service. Pearson et al. (2017) report on a Hospital at Home programme in Devon for frail people aged 80 and over. The authors note that the outcomes of the quality improvement project “appear unremarkable” (Pearson et al., 2017, p. 391), as length of stay did not change. However, financial pressures, reduced community resources, and poor interagency working are important contextual factors that may have impacted delivery.

Edmond et al’s (2017) work additionally showed that the average length of stay in hospital for those initially accepted onto a Hospital at Home treatment for hip fracture was less compared to those that did not receive Hospital at Home treatment. However, as time progressed the difference in length of stay between those who did and did not receive Hospital at Home treatment for hip fractures declined. The authors noted that a potential explanation for this was the number of patients requiring treatment for hip fractures was rising but this was not being matched by a rise in Hospital at Home services.

Recent statistics from HIS (2023) also show that the length of treatment from a Hospital at Home service reduces over time. There was a 20% reduction in the length of treatment on a Hospital at Home service between April 2021/22 and March 2022/23 2022 across Scotland.

## OPAT

Whilst no studies were found to compare the length of OPAT treatment and inpatient length of stay, Gilchrist *et al* (2022) examined length of OPAT treatment amongst adults and children included in the BSAC National Outcomes Registry between 2015 and 2019. They reported that the mean OPAT treatment for adults was 16.67 days, whilst this was 7.66 days for children (Gilchrist *et al*, 2022). This was due to adults having more complex pathologies, more co-morbidities, and more prosthetic infections compared to children.

## Respiratory

A UK based study comparing the effectiveness of a Hospital at Home treatment<sup>8</sup> to usual care for COPD reported encouraging findings for the use of Hospital at Home treatment in relation to length of stay (Echevarria et al. 2018). It was reported that

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<sup>8</sup> This was not specifically for older people.

there was a statistically significant reduction in length of hospital stay over a 90 day period for the Hospital at Home treatment when compared to usual care (median number of days: 1 vs. 5).

### **Covid remote health monitoring (pulse oximetry)**

There are encouraging findings for the use of pulse oximetry to reduce LoS. Dirikgil et al. (2021) found that telemonitoring interventions which included pulse oximetry were both safe and effective at reducing short-stay admissions (those under 24 hours).

Research on virtual wards established at University Hospitals Leicester NHS Trust to accelerate hospital discharge for people admitted with Covid-19 also reports reduced length of stay (Swift et al. 2022). Eligible patients were required to possess a smartphone, tablet, or laptop and submit daily readings from a thermometer and pulse oximeter. Their results were compared with readings from clinically similar patients before the establishment of the virtual ward. Before the establishment of the virtual ward, average LoS for inpatients was 5.5 days; average length of stay for virtual-ward patients was 3.3 days. This represents a 40% reduction in bed days, although without further statistical analysis, it is not possible to gauge the true significance or size of this difference. Additionally, half of the authors of the paper are employed by the company which owns the software used for sharing data between patients and clinicians, thereby presenting a potential conflict of interest. The findings are nonetheless encouraging for the use of pulse oximetry for Covid patients to reduce length of stay and save inpatient bed days.

#### **Summary**

VC services can reduce hospital length of stay. Length of treatment (e.g. on a VC service) varies depending on the study. Shepperd et al's (2021) RCT reported a slight increased length of treatment for people receiving Hospital at Home, though statistical significance was not reported.



### Question 3: Do Virtual Capacity services reduce the need for hospital readmissions and support admission avoidance?

#### **Hospital at Home**

There is mixed evidence on the impact on Hospital at Home treatment on hospital readmissions, as well as variations in the quality of evidence. A RCT found that patients in the UK treated under Hospital at Home initiatives sometimes had a higher risk of hospital readmission than inpatients at one month follow up, but not at six months (Shepperd et al., 2021). Service evaluations are conflicting, either showing no differences in readmissions (Edmond et al. 2017), higher rates of readmissions at 30 days, 3-month and 6-month follow-up (Tierney et al, 2021) or conversely had a 'demonstratable effect'<sup>9</sup> on admission avoidance (Pickstone and Lee, 2019). However, it should be noted that service evaluations are less robust than RCT evidence.

#### **OPAT**

A lack of evidence was found that met the inclusion criteria for this review. The available evidence is limited due to comparing populations with different clinical characteristics, not reporting statistical significance, or not including comparators. However, as the interviews highlighted, the primary aim of OPAT is not to reduce hospital readmissions but instead to provide safe, effective treatment.

#### **Cardiac services**

A systematic review found that virtual wards can reduce heart failure related readmissions for patients with heart failure. Studies on heart failure found significant reductions in readmission rates for people using sensors (Cowie et al, 2022; Daww et al., 2022).

#### **Respiratory services**

Published statistics from Scotland show that at-home respiratory treatment has led to admission avoidance. VC-type treatment for COPD suggests that such interventions reduce hospital readmissions (MacGillivray & Gray, 2019; Sharpe et al., 2021).

This section focuses on whether VC services reduce readmissions to hospital level care. Hospital level care applies regardless of whether this is provided as an inpatient or in the community, including at home. Evidence for the ability of VC services to reduce readmissions is mixed.

#### **Hospital at Home**

An increased risk of readmission or transfer to hospital for participants in the Hospital at Home group at one month was reported by Shepperd et al's (2021) large robust UK based RCT. A 32% relative increase (which was statistically significant) was reported, but this was not maintained at six-month follow-up

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<sup>9</sup> No statistical significance is reported here and no control groups were included

(Shepperd et al., 2021). This difference may be attributable to limited availability of overnight care for the Hospital at Home group and demonstrates the acuity of the population, with sufficient need for hospital based care (Shepperd et al., 2021).

The remaining evidence comes from service evaluations. One service evaluation of a Hospital at Home type initiative in Northern Ireland found that patients using the service had higher readmission rates at 30 days, 3-month and 6-month follow-up (Tierney et al, 2021). Tierney and colleagues (2021) reported that people who received care at home were 'frailer, more dependent and immobile nursing home residents' (p2985) which potentially explained the higher admission rates observed. Despite this, length of stay was shorter, patients were less likely to require domiciliary care or rehabilitation on discharge from the service. This indicates that wider outcomes are positive for older adults using Hospital at Home services.

However, Hospital at Home increasing hospital readmissions was not supported by another service evaluation of two Hospital at Home services for individuals with hip fractures. Edmond et al. (2017)<sup>10</sup> found no differences between those who did and did not participate in the programme for admission to hospital within 30 days of discharge.

Pickstone and Lee's (2019) service evaluation examined whether Hospital at Home reduced emergency department (ED) admissions over a 3-month period in autumn/winter 2016. The authors reported that the Hospital at Home service helped 397 people avoid ED attendance who would otherwise have attended. This amounts to around 38% of patients referred to the service. The authors conclude that there is a demonstrable effect on ED attendance from the Hospital at Home service, although this is still very small (total ED attendances over the study period were 119,718). Limitations to the study include that there are no robust comparison data for the types of conditions patients were presenting with.

## OPAT

The interviews in part 1 highlighted that OPAT aims to provide alternative, safe, effective treatment for infections through admission avoidance and early supported discharge. The primary aim is therefore not to reduce readmissions. In many of the studies, patients were found to be allocated to OPAT or inpatient care depending on clinical characteristics. It is therefore likely that differences (e.g., severity of infection) exist between these two groups meaning that the following conclusions should be interpreted with caution.

A 2021 review by the SHTG (2021) synthesized the published evidence on OPAT from three systematic reviews which included studies from the UK, Europe, and North America. As reported by SHTG (2021), one systematic review compared OPAT with inpatient antimicrobial therapy (Mitchell et al., 2017). Of the studies measuring hospital readmission, the results of OPAT in comparison to inpatient care were inconclusive. A second systematic review compared the efficacy of

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<sup>10</sup> Whilst the evaluation over a 27-year period was not specifically for older adults, the mean age of participants was 77.2 years and 79.2 years respectively for the two included services. As such the results have been included here.

OPAT with hospital-based parenteral antimicrobial therapy in children aged 16 and under (Bryant & Katz, 2018). The results were either not reported or not found to be statistically significant.

Other studies lack comparative data. For example, Sriskandarajah et al. (2018) conducted a systematic review evaluating OPAT in three age groups (mixed age, over the age of 60 and children < 18 years) and included observational studies only. Hospital readmission rates ranged from 1% to 14.3% in the mixed age group, 2.6% to 14.2% in adults over the age of 60, and 3.8% to 26% in children under 18 years (Sriskandarajah et al., 2018). Similarly, a study evaluating the use of OPAT for a specific infection (i.e., necrotising otitis externa) reported that nine out of 46 included cases (i.e., 19.6%) had unplanned readmission within 30 days after stopping OPAT. The absence of comparative data, however, makes it difficult to draw conclusions (Durojaiye et al., 2022).

## Heart Failure

A systematic review exploring the impact of virtual wards on readmission rates found a reduction in heart failure related readmissions for patients with heart failure, though this was not reduced for all-cause readmissions (Uminski, 2018).

Further evidence is based on the use of sensors, though these are not currently being used in Scotland. Evidence supporting the effectiveness of a pulmonary artery pressure sensor in UK patients was reported with a reduction in the number of heart failure hospitalisations 12 months after the implant (pre-implant = 165 to post-implant = 12). This resulted in a significant reduction in risk for heart failure hospitalisations of 82% (Cowie et al., 2022).

A separate study evaluated a pulmonary artery pressure sensor in a European multicentre cohort and included UK patients (Duaw et al., 2022). A comparison of the total number of heart failure hospitalisations pre- and post-implantation at 3, 6 and 12 months showed that the number of these hospitalisations significantly reduced at 6- and 12-months post-implantation only. The number of first heart failure hospitalisations were also significantly reduced at 6- and 12-month post-implantation.

## Respiratory

Studies on the ability of VC services to reduce hospital readmissions for people with respiratory conditions are promising. VC-type treatment for COPD suggests that such interventions reduce hospital readmissions (MacGillivray & Gray, 2019; Sharpe et al., 2021).

Evidence supporting the use of remote care for primary-diagnosis COPD comes from the establishment of a Community Respiratory Team (CRT) in North West Glasgow (Carlsson et al., 2020; Levin et al., 2021). The CRT was established in 2013, and as of 2015 there was a 33.7% relative reduction in emergency admissions with COPD as a primary diagnosis in North West Glasgow compared to

2011. Control data from North East and South Glasgow (where there were no CRTs), did not show any decrease in emergency readmissions with COPD as a primary diagnosis over the same period. The service did not appear to have any effect where COPD was a secondary diagnosis.

Similarly, research from Turner et al. (2022) reported low hospital readmissions for those referred to the Greater Glasgow and Clyde NHS Trust Community Respiratory Response Team (CRRT). Patients were triaged based on the severity of their needs and received consultations via phone, video calls, and home visits from a multidisciplinary team. Low rates of hospital admissions were evident amongst those referred to the CRRT (12%). The authors conclude that there was a 'significant decrease in the trend in COPD EAs' in Greater Glasgow and Clyde compared to the rest of Scotland<sup>11</sup>, which was used as a control.

In their systematic review of research into reducing readmissions for COPD patients, Sharpe et al. (2021) observed a trend towards reduced all-cause admissions following at-home treatment. Multi-modal (e.g. self-management education, follow-up appointments, medication support and remote monitoring) and broader system-level treatments (e.g. advice on smoking cessation, self-management education, and medication support; telemonitoring; and initial treatment in a specialised respiratory hospital) also reduced COPD-related admissions. Sharpe et al. (2021) caution, however, that much of the evidence supported improved 30-day admission outcomes, rather than longer-term outcomes.

Rickards et al. (2021) also report on data collected from 103 COPD patients. This was not a RCT, but the results demonstrated that the community respiratory team could safely manage patients in their homes, including those whose arterial oxygen levels would normally indicate hospitalisation. The respiratory service helped patients safely avoid hospital readmission and provided early supported discharge.

However, 90 day readmission rates were found to be similar in a UK based study which compared a Hospital at Home treatment to usual care for COPD (Echevarria et al., 2018). It should be noted that a low-risk sample, as indicated by DECAF scores (a strong predictor of COPD inpatient mortality), were specifically recruited for this study which offers a possible explanation for the lack of difference between conditions for readmission rates.

While several of the studies above addressed COPD specifically, the Improving Adult Respiratory Care Together (ImpACT+) project, based in South Derbyshire, was implemented in 2018 to address all respiratory diseases. Support was provided from a multidisciplinary team and included virtual place based consultant led clinics and a telephone helpline. Subramanian et al. (2018) found that the service brought about a 6% decline in non-elective readmissions for all respiratory diseases, and a 9% reduction in emergency department readmissions for asthma.

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<sup>11</sup> The rest of Scotland excluded Fife, Lothian, and Tayside

Cox et al. (2017) report on a case-note review of a service for COPD patients in Lincolnshire. The Acute Respiratory Assessment Service led by specialist nurses was designed to avoid hospital readmissions for patients with a COPD diagnosis experiencing acute exacerbation. Case notes from 128 patients referred to the service from April 2014 to March 2015 were reviewed. Out of the 128 patients, only 5 were admitted to hospital due to respiratory issues. This is a very positive outcome, particularly given that on initial review, 21 patients were hypoxemic and would have needed to be admitted to hospital for further assessment, in line with NICE guidelines, if they did not have access to treatment from a respiratory nurse specialist. The authors also note that it is possible that educating patients in self-management could have supported the reduction in readmission rates.

### **Summary**

There is variation in the extent to which VC reduced readmissions to hospital across the four identified areas. VC reduced COPD readmissions for people using community respiratory response teams in Greater Glasgow and Clyde (Carlsson et al., 2020; Levin et al., 2021; Turner et al., 2022). There is also positive evidence for people with heart failure. Systematic Reviews show that Virtual Wards and the use of sensors reduce readmissions (Uminski, 2018; Cowie et al., 2022; Duaw et al., 2022). Evidence on Hospital at Home is mixed, and may be impacted by a lack of overnight care and the clinical needs of the population. Included studies on OPAT published within the inclusion timeframe allocated people to OPAT or inpatient care depending on clinical characteristics, and therefore should be interpreted with caution.

## Question 4: What is the patient experience of Virtual Capacity services?

### **Hospital at Home**

Evidence from the UK (Sheppard et al. 2021; Mäkelä et al. 2020) suggests that patient satisfaction is generally higher for those being treated at home compared to inpatients.

### **OPAT**

Evidence shows that patient satisfaction may vary by factors such as age group and also identified both strengths and weaknesses to the at-home OPAT treatment they received.

### **Pulse oximetry for Covid**

Evidence from Scotland suggests that patients are reassured by self-monitoring their Covid symptoms (Alexander, 2021).

### **Cardiac services**

Patient experience of cardiac services reported improvements in quality of life, although this was not statistically significant (Cowie et al. 2022).

### **Respiratory services**

Evidence from England suggests that patients report a positive experience from receiving treatment at home for respiratory conditions.

Norman et al. (2023) conducted a systematic review of virtual capacity services including Hospital at Home, virtual wards, and remote monitoring for people with respiratory conditions, heart failure, Covid-19 and frailty. They report that patient satisfaction “may be slightly higher” in patients treated by Hospital at Home than inpatients (Norman et al, 2023, p6).

### **Hospital at Home**

There has been broadly positive feedback from patients who have received Hospital at Home. In their randomised controlled trial, Sheppard et al. (2021) reported that patient satisfaction scores were found to be higher across various outcomes (e.g. being involved with decision making and the length of time waiting for care to begin) in patients who received Hospital at Home at one-month follow-up compared to patients admitted to hospital. In the same study, Singh et al (2022) reported that 74 patients randomised to receive inpatient care subsequently moved to the Hospital at Home group. Reasons for this included patients choosing Hospital at Home care, demonstrating a preference for home based care.

Further patient satisfaction is evidenced in a qualitative study with patients and their carers. Semi-structured interviews explored experiences of care at home in comparison to inpatient hospital care. Mäkelä et al. (2020) found that some older

people who received Hospital at Home reported being able to continue with their day-to-day activities while unwell. This enabled people to maintain their usual routine within their own home and facilitated independence. A familiar setting was also reported to be beneficial to patients who experienced confusion, but only if it was combined with family supervision. Managing risks in the home and organising social resources, including family members and wider networks of support, was also highlighted as being important (Mäkelä et al, 2020)

Whilst Gardner et al. (2019) support the potential for improved alignment with daily routines, concerns around safety and a lack of rapid access to clinicians overnight were also highlighted. Furthermore, a lack of patient and carer involvement in assessment processes across both hospital and Hospital at Home settings was reported (Gardner et al, 2019; Mäkelä et al, 2020).

## OPAT

A patient feedback survey was part of the 10-year retrospective analysis by Durojaiye et al. (2018). Satisfaction and acceptance of the OPAT service was high. For instance, 99% of the respondents rated the service as 'very good or excellent', 98% would choose OPAT again for future treatment and 97% felt that the treatment 'met their expectations'.

There are different ways that OPAT can be provided, including through self-administration. A small scale qualitative study utilising semi-structured interviews focussed on perceptions of self-administration as part of the OPAT service. The interviews were conducted with adults receiving OPAT in Scotland, but who did not self-administer (Tonna et al, 2019). Several facilitators to self-administration were identified. These included quality of life being improved (e.g., ability to return to work), having the skills to self-administer OPAT at home, and staff providing support and reassurance. Despite this, barriers were also identified to self-administration. These included not knowing that self-administration was an option, believing that it is safer for OPAT (i.e. IV medications) to be delivered in the hospital environment, and concerns about self-administration in case of difficulties.

Further qualitative research highlights variation in views regarding different OPAT models. A qualitative analysis explored experiences of OPAT through 28 semi-structured interviews and a focus group with adults on short and long-term IV antimicrobial treatment (Minton et al, 2017; Twiddy et al. 2018). Differences in preference regarding OPAT models were apparent between older and younger participants (Minton et al, 2017; Twiddy et al. 2018). While nurses visiting the patients' home was viewed as more preferable for older adults, younger patients preferred attending outpatient clinics for short-term treatment.

Participants indicated that the different models of OPAT (outpatient clinic, nurse attending the home and self-administering OPAT at home) had their own strengths and weaknesses (Minton et al, 2017; Twiddy et al. 2018). Benefits of OPAT included avoiding hospital admission, less interference with everyday life (e.g., work) and being able to be treated at home. The option to ask questions and follow-



up once treatment had concluded and having clear communication with the OPAT team was also considered important by patients (Twiddy et al. 2018).

Weaknesses related to transportation (Minton et al, 2017). Travelling via public transport was perceived as difficult and high parking fees were also a barrier. Furthermore, patients who required a cannula or port reported being worried about the impact this would have on their day-to-day life. For example, patients who took public transport with the visibility of a cannula feared being judged by others.

## **Respiratory**

Patients in England receiving treatment at home for respiratory conditions described a positive experience (Cox et al., 2017). More specifically, Cox et al. (2017) reported that all patients who completed a satisfaction questionnaire stated they were “extremely likely” to recommend the service. Survey responses also indicated that patients were very satisfied with the service, valued being included in their care and were given information about their care and treatment.

The use of a Hospital at Home service for COPD was also positively received with 90% of patients across both settings (i.e., Hospital at Home and usual inpatient care) stating that they would prefer a Hospital at Home service for future COPD treatment (Echevarria et al., 2018). The facilitators and barriers to a Hospital at Home service for COPD have also been identified in a qualitative study in Northeast England (Dismore et al., 2019). Positives for the service included: being relaxed in their own home and being able to have more mobility, for instance moving their oxygen equipment, viewing recovery as quicker at home, better diet and sleep, and home being more convenient for family and friends (e.g., travel and limited visiting hours in hospital). Barriers to providing the Hospital at Home service for COPD were identified from people who provided reasons for not participating in the study, which included being worried about being home alone when ill and concerns for their privacy.

## **Heart Failure**

Cowie et al. (2022) reported improved quality of life at 12 month follow up in an evaluation of people with a pulmonary artery pressure sensor in the UK. However, it should be noted that this was not statistically significant.

## **Covid remote health monitoring (pulse oximetry)**

Data on Covid Remote Health Pathways (RHPs) demonstrates high patient satisfaction levels. An evaluation of data collected from NHS Highland and NHS Lanarkshire during the RHP pilot found that patients were reassured by self-monitoring.<sup>12</sup> (McKinstry et al., 2021). Furthermore, out of 39 participants who completed an experience survey, the majority felt positive about remote monitoring

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<sup>12</sup> Alexander (2021) and McKinstry et al. (2021) also report on clinician experience of the pathway, which – like that of patients – was positive. Understanding clinician experience across all the VC pathways could be a focus for future work.



(liked it or felt it was “OK”) and found it easy to use. Participants found it reassuring, reported spending less time travelling to and attending appointments , and most stated that they would use the service again (Alexander, 2021).

These positive results were also reflected in an evaluation of a new Covid RHP launched in 2022 (Alexander, 2022). The pathway utilised pulse oximetry measurements and a National Contact Centre to support patient onboarding, with symptoms being monitored by SMS or telephone. Although numbers of patients involved were small in both 2021 and 2022, and while survey respondents were self-selecting, the results are nonetheless encouraging.

Further evidence regarding the use of home monitoring for Covid-19 is synthesised in two systematic reviews. McKinstry (2022) concludes that patient experience of these interventions is universally positive. It is important to highlight however that this refers to remote monitoring in the whole, which includes use of apps, SMS, and telephone services as well as pulse oximetry monitoring.

### **Summary**

There is evidence that patients tend to be broadly satisfied with VC provision. Qualitative evidence demonstrates that patients valued being in the comfort and familiarity of their own home, and the reduced disruption to daily routines. Patients were at times less satisfied in relation to safety concerns and having to travel for treatment. Differences in preferences over different VC models were also evident.

# Conclusion

This report provides insight into how VC is operating in Scotland. The interviews highlight the important roles local innovators have played, although this bottom-up approach has resulted in variable implementation and a lack of equity of access across Scotland.

Participants reflected that the recent national focus has helped to accelerate service development. With the advent of the Covid-19 pandemic came a need to find alternative ways of providing hospital level care outwith the acute setting. National funding has enabled expansion, though questions remain about funding sustainability, which also has wider consequences for the workforce. Participants underlined the need for sustainable funding to develop the pace and scale of change, as well as a culture that fosters new ways of working, a skilled workforce, and buy-in from strategic decision-makers and other key stakeholders.

The evidence review examined literature on the effectiveness of VC and patient experience. Overall, there is encouraging evidence for the implementation of VC across the UK. However, VC is still developing and more empirical evidence is required to understand if it works and in what circumstances.

There is evidence from the literature review that patients are broadly satisfied with VC services. Patients valued receiving care and treatment in the comfort and familiarity of their own home environment, alongside the reduced disruption to their everyday lives and routines. Safety, and issues related to transportation method and cost, were however cited as concerns.

VC services were noted to have the potential to alleviate pressure on hospitals, though the extent of this varies according to what outcomes are being measured and the associated pathway in question. Hospital at Home and OPAT save hospital bed days in Scotland, whilst research on monitoring Covid-19 via pulse oximetry is inconclusive and no published evidence was found for respiratory services.

The literature demonstrates that cardiac and respiratory VC services reduce hospital readmissions. However, systematic review evidence of OPAT services in the UK, Europe, and North America is inconclusive, although it should be noted that OPAT is designed to cure infections as opposed to explicitly reduce readmissions. Furthermore, RCT evidence reported increased readmissions from hospital level care for those receiving Hospital at Home at one month follow up, but not at six months, whilst service evaluations reported mixed findings. This may be explained by a lack of available overnight care and the clinical needs of people using Hospital at Home services. This was reflected in the interviews, with it being noted that readmissions are common for people using Hospital at Home services, due to high acuity, as opposed to the intervention itself.

The ability of VC to reduce length of stay depends on what is being measured. VC services were effective at reducing length of treatment for respiratory conditions

and COVID-19. Evidence from a large RCT in the UK shows that Hospital at Home can support earlier discharge from hospital (Singh et al, 2022). However, length of treatment can be slightly longer for people receiving Hospital at Home (in the home/community setting) compared to inpatients, though statistical significance was not reported (Shepperd et al, 2021).

## Recommendations

The priorities we recommend moving forward are:

- Further research to evaluate what works for whom and in what circumstances for VC in Scotland.
- Consistency in how effectiveness is defined and measured across the pathways to allow comparisons to be made quickly and on a regular basis.
- Consideration of other metrics to evaluate the pathways (i.e. what outcomes do patients and their relatives/carers perceive as important?).
- Further research to explore the extent, nature, and impact of inequities in access to VC.
- An economic evaluation of the financial costs of virtual capacity to understand if treating people at home rather than hospital is economically beneficial.
- Given the shift in treatment from the hospital to the home setting, an evaluation of the impact and experiences of informal carers/families.
- An evidence review of international evidence on VC that includes safety as an outcome measure.

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