NHS SCOTLAND

Demand Optimisation in Laboratory Medicine

Phase III Report

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Riaghaltas na h-Alba
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Healthcare Science

Scottish Microbiology and Virology Network

HaTS
Haematology & Transfusion Scotland

Scottish Clinical Biochemistry Network
National Managed Diagnostic Network

Scottish Pathology Network (SPAN)

Genetics/Molecular Pathology consortia

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1 Foreword

The Scottish National Demand Optimisation Group (NDOG) continues to produce invaluable reports and recommendations which highlight proactive measures to reduce unwarranted variation in the delivery of healthcare. Laboratory testing continues to be a fundamental aspect of healthcare, and existing unwarranted variation and inappropriate diagnostic test requesting still exists in all NHS Boards in Scotland. In line with the ethos of Realistic Medicine, the NDOG have continued to work with colleagues across the wider healthcare community and in Scottish Government to address this unwarranted variation and contribute towards improved outcomes in patient care.

This report highlights the outcomes of the Phase III programme of work, including the refinement of the Atlas of Variation, extensive data collection work and wide-ranging Quality Improvement activity to address the unwarranted variation in laboratory diagnostic testing. Building on the momentum of Phase II work, it is particularly important to note the successful engagement and meaningful dialogue with the primary care community to inform improvement work.

The appropriate and targeted use of diagnostic testing and efficient use of scarce resources will be integral to the realisation of improved and optimised patient outcomes in NHS Scotland in the post-COVID-19 healthcare landscape. We fully endorse the work undertaken by the Scottish National Demand Optimisation Group to lead the drive towards appropriate test use and support ongoing engagement with the wider healthcare community, including close collaboration with laboratory and primary care colleagues. Given the impact that the COVID-19 pandemic has had on laboratory testing workflow, it is important that future Demand Optimisation work focuses on measuring such impact both during the pandemic and recovery phases – such valuable data can then be shared with remobilisation teams within the boards, but also Primary Care leads/strategists. I look forward to seeing the outcomes delivered as part of the Phase IV programme in the year ahead.

Catherine Ross
Chief Healthcare Science Officer
Scottish Government

Dr Gregor Smith
Interim Chief Medical Officer
Scottish Government

2 Executive Summary

Demand Optimisation is the process by which diagnostic test use is optimised to maximise clinical utility, which in turn optimises clinical care and drives more efficient use of associated scarce NHS resources.

In 2015, Scottish Government funded the establishment of the National Demand Optimisation Group, in line with deliverable three of the Healthcare Science National Delivery Plan "Driving Improvement; Delivering Results"[1]. Not only has the group been active in highlighting a variety of quality improvement activities associated with the promotion of appropriate laboratory test use, but has also led the design and delivery of an evidence based and strategic programme of work.

The group carried out its third Phase of operation during 2019 – 2020, concluding in May 2020. This document highlights the following key achievements in this Phase:

- The development of a Scottish Atlas of Variation for Laboratory tests that clearly demonstrates significant unwarranted variation in laboratory test use and availability. Phase III has further developed and refined the Atlas.
- Work with key individuals from primary care has informed development of the programme and the Atlas from the user's perspective and ensured meaningful dialogue can be established to lead to targeted improvement work.
- Pilot dashboard summary views have been created for both GP and Laboratory professional groups to interrogate and use as a basis to consider laboratory test use and availability.
- Data Collection to populate the Atlas has now stretched to cover three individual years (2017, 2018 and 2019). While manual collection of data remains the only option, this has been streamlined and has become routine work for NHS Board Laboratory Services. Data is now returned quarterly, meaning the impact of interventions and small tests of change can be observed more rapidly.
- NHS Board flash reports, focusing on requesting patterns for individual tests along with educational guidance on appropriate test use, were developed for some of the tests within the Atlas.
- A programme of quality improvement activity has continued, with work including:
    - Development of guidelines for a range of blood science tests
    - Discussion on the inclusion of samples for blood borne viruses, where the assumption is that the requesting rate may be too low in certain areas

[1] https://www.gov.scot/publications/driving-improvement-delivering-results-scottish-healthcare-science-national-delivery-plan-20152020/

- Work with colleagues in sexual health to explore optimised swab submission
- Optimising demand/workflow internally for a range of cellular pathology activity

Considerable stakeholder engagement around the work of the group continued throughout Phase III, notably with the Atlas of Variation, which has been very well received. A pilot within NHS Lothian Primary Care was planned for early 2020, with additional pilots planned for other areas later in the year.

The COVID-19 pandemic has had a major impact on the programme, which was largely paused in March 2020. Ongoing data collection, Atlas of Variation pilots and associated educational interventions, did not progress fully as planned.

In response to the changing healthcare landscape during the COVID-19 pandemic, focus of the programme transformed to monitor laboratory test use during the COVID-19 pandemic and recovery phases – this work has begun as Phase IV of the programme. It is anticipated that such data collection, analysis and subsequent dashboards can help identify healthcare gaps created during the pandemic and inform prioritisation decisions during remobilisation. In addition, identifying laboratory workflow issues, especially as remobilisation progresses, will enable laboratory resource pressures to be identified and addressed more easily.

To reflect the current status of the funded Phase IV COVID-19 pandemic monitoring project at the time of writing, an addendum has been added at the end of this report to reflect early progress with this work: **Lab Activity as a Metric for Pandemic Healthcare Trends** (see Section 11 Addendum).

With the return of conventional NHS services after the initial pandemic period is over, it is strongly recommended that the National Demand Optimisation work programme is re-commenced. The need for appropriate, targeted use of diagnostic tests will likely be even more important in the changed, new NHS of the future.

Unwarranted variation in the use and availability of laboratory tests will not be resolved rapidly and will require continual refinement and monitoring. It is vital that a National Demand Optimisation oversight is retained, both for the newly focused Phase IV pandemic monitoring programme and beyond, so that previous momentum and achievements can be built upon and the drive towards appropriate test use is supported to continue. Appropriate laboratory testing will be even more important in shaping prioritisation and driving recovery and remobilisation in a very changed healthcare landscape – ongoing funding of the programme is essential.

3 Introduction

3.1 Background

It has been widely accepted and demonstrated that there is considerable variation in the use of diagnostic tests across the NHS[2]. While some of this variation may be attributed to clinical and demographic differences, the degree of variation suggests an element of over/under-requesting, or unnecessary repeat testing. In addition, the lack of availability or awareness of certain tests within some NHS Boards will also limit their optimal use and thus further amplify any variation in use.

Demand Optimisation is defined as the process by which diagnostic test use is optimised to maximise clinical utility, which in turn optimises clinical care and drives more efficient use of associated scarce NHS resources.

The key areas to consider in targeting Demand Optimisation are:

- Minimising over-requesting and under-requesting, both of which can be damaging to patient care.
- Reducing unnecessary repeat requesting.
- Ensuring appropriate and useful test repertoires are universally available across all healthcare outlets.
- Standardisation of nomenclature/test coding to reduce unnecessary variation and allow automated data monitoring systems to extract laboratory test usage information in an efficient, consistent and timely manner.
- Internal standardisation of laboratory practice – to ensure the optimal processes, procedures and testing protocols are adhered to.

Optimisation of rational diagnostic testing may bring about more efficient use of resources within diagnostics, however it is the associated effect on patient care pathways that will ultimately be more valuable. Appropriate diagnostic test use drives appropriate and timely patient diagnoses which impact on subsequent patient flow and treatment and ultimately patient outcomes.

It is also vital to acknowledge that diagnostics and patient pathways interact in complex ways which may not be immediately evident. There may be occasions where sub-optimal tests are used to triage patients to different treatment pathways. It is vital therefore that Demand Optimisation takes a whole systems approach, with open communication and collaboration between laboratories and referring clinicians; to ensure the end to end management of patients using diagnostics is appropriate and optimises NHS resource and patient outcomes.

Demand Optimisation has become a focus programme within the Scottish Government's Healthcare Science National Delivery Plan (NDP). In 2015, the Scottish Government requested that a National Demand Optimisation Group (NDOG) be established to review the third deliverable of the NDP.

The first Phase of Demand Optimisation began in 2016 in order to review existing demand optimisation work, to deliver an improvement plan to optimise diagnostic testing for patients and to support the implementation of the National Clinical Strategy and Scottish Government's Healthcare Science NDP. The extensive report,

[2] https://www2.gov.scot/Resource/0047/00476785.pdf

providing a comprehensive overview of existing demand optimisation and demand management activity within structures across NHS Scotland, was published in 2017[3].

Following publication, diagnostic networks reformed their demand optimisation subgroups or directed their Steering Groups to progress implementation of the report and local arrangements were put in place in some NHS Board areas. However, there was no over-arching, cohesive national plan to progress the recommendations of the report.

The second Phase of Demand Optimisation began in February 2018 and focused on supporting the implementation of the key recommendations identified from the report. This included the regular collection of data that captures diagnostic test requesting activity, presenting it in an easy accessible format, and coordinating with laboratory network clinical leads to initiate and progress quality improvement initiatives. The second report detailing the prototype Atlas of Variation and the many existing quality improvement activities was published in 2019[4].

The development of the Atlas prototype and its potential in identifying unwarranted variation that could facilitate interventions to drive more optimal testing across NHS Scotland was welcomed universally. It was clear that there was a demand to maintain the momentum and implement improvement strategies locally and nationally.

3.2 Group Membership

The multidisciplinary National Demand Optimisation Group (NDOG) was formed to progress Phase I in 2015. During the subsequent life cycles there have been named stakeholder changes, yet there has always been representation from Scottish Government, National Services Scotland and the National Managed Diagnostic Networks. In addition, there has been representation from specific discipline laboratory groups (Biochemistry, Microbiology / Virology, Pathology, Haematology and Clinical Immunology) and from the Genetics / Molecular Pathology consortia. In Phase III, to coincide with the refinement of the Atlas for referring clinicians, there has been consistent representation from primary care. Full details of the group membership can be found in Appendix A.

The group representatives ensured that the work was cascaded through established formal and informal networks to lab users. Engagement with service users was sought throughout the development of the Atlas of Variation and accompanying education materials.

3.3 Governance of the NDOG

The Scottish Government Healthcare Science Officer commissioned the work, Scottish labs teams provided the expertise and NSS provided the resource and methodology to ensure improvements could be replicated and sustained.

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[3] https://www.gov.scot/publications/demand-optimisation-diagnostics/

[4] https://www.gov.scot/publications/demand-optimisation-laboratory-medicine-phase-ii-report/

The group function as a subgroup of the Diagnostic Steering Group (now Diagnostics in Scotland Strategic Group), reporting into Scottish Government via the Healthcare Science Officer (now via the Chief Healthcare Science Officer). As a new governance structure was developed in early 2020 (see Figure 1 below), the NDOG were represented in discussions.

The governance structure employed in the work was: -

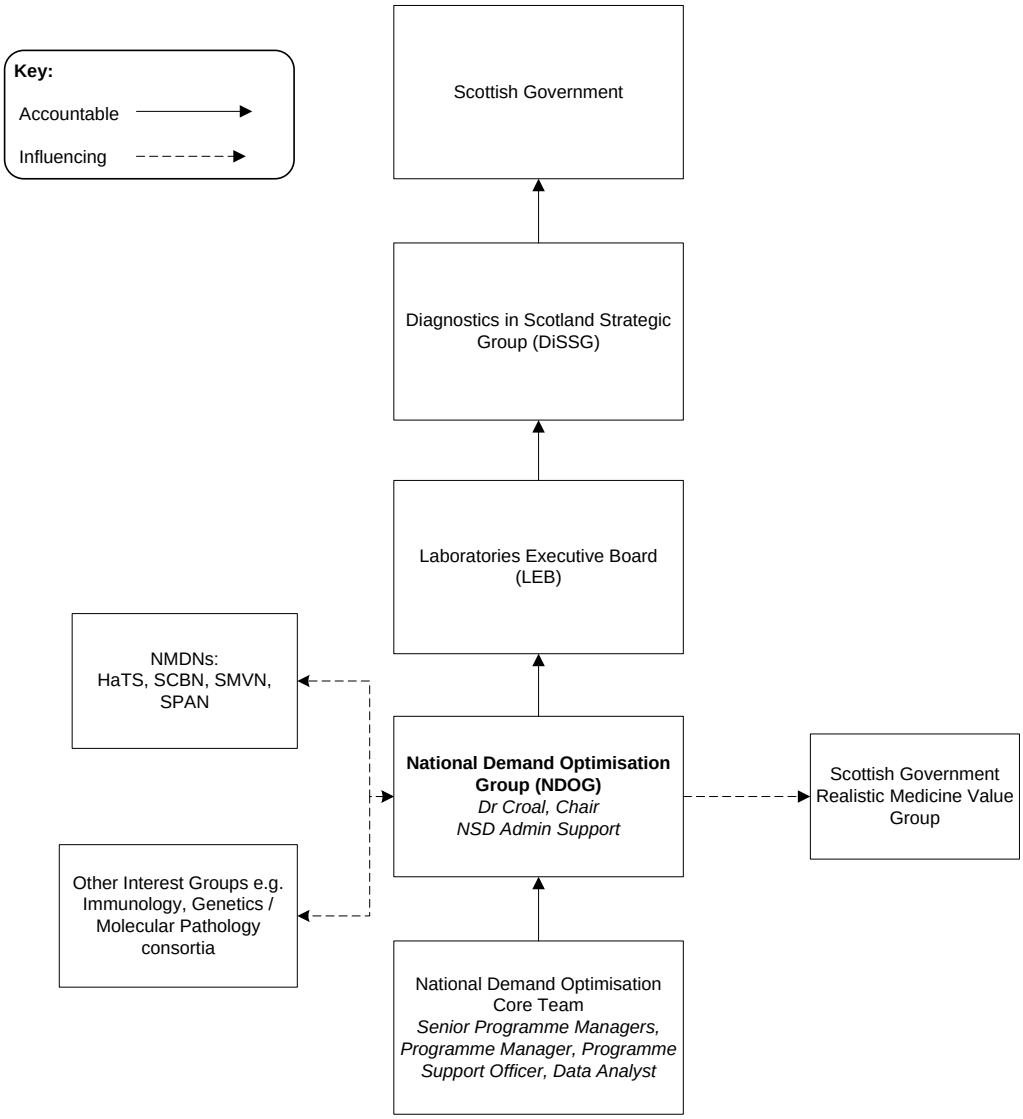


Figure 1 NDOG Governance structure

A dedicated website provided additional information and regular bulletins were issued to stakeholders to highlight the work of the NDOG.

4 Aims

The NDOG Phase III programme of work was funded and the Steering Group was scheduled to meet four times across 2019/2020.

The agreed main aims of the group during Phase III are summarised below: -

Atlas of Variation development -

- Build upon the existing data collected in Phase II and collect for the calendar year of 2018.
- Explore alternative options to streamline data collection for populating the Atlas.

Engagement -

- Engage with referring clinicians to further refine the Atlas of Variation.
- Engage with referring clinicians to promote a cultural shift in managing requesting patterns.
- Expand stakeholder engagement by coordinating quality improvement champions at a local level to support change.

Quality Improvement -

- Monitor and report on QI programmes being delivered.
- Undertake internal demand optimisation within laboratories to review and standardise methodologies.
- Implement interventions where unwarranted variation can be identified.
- Continue engaging with clinical networks at a national, regional and local level to develop and implement requesting guidelines which could be referenced at a board level.

Endorsement -

- Promote the capabilities of the Atlas of Variation within the GP community.
- Promote the demand optimisation and the realistic medicine agenda at conferences, in reports to professional bodies and in newsletters.

5 NDOG Output

This section details the overall activity and output of the NDOG in relation to the aims stated above. The NDOG programme was unfortunately paused early in 2020 due to developing impact of COVID-19, hence the scope of the programme has been limited with some objectives not fully met. Despite this, the full NDOG met on three occasions through 2019/20, with further regular meetings of a smaller NDOG core group throughout the period. During this time the Atlas was further refined and concepts around the identified activities and pilot work from Phase II were progressed.

5.1 Atlas of Variation for Diagnostic Laboratories

5.1.1 Background

The NHS England Diagnostic Atlas of Variation was first published in November 2013 and focused primarily on diagnostic tests from Laboratory Medicine. The Atlas demonstrated significant variation in many diagnostic requesting patterns which could not wholly be explained by differences in patient populations, by demography or by disease prevalence/incidence. It was expected that a similar observation in variation would be replicated across NHS Scotland.

Phase I Demand Optimisation reported a limited pilot of data extraction was possible and that similar variation was observed to that across NHS England previously. During Phase II of Demand Optimisation a list of tests was identified by the representatives of specialty focused networks and laboratory disciplines. The criteria for including a test was based on identifying the ones where unwarranted variation in requesting within and across boards was suspected or was deemed important, rather than the most common tests carried out. Data was initially collected from all NHS health boards for the 2017 calendar year for selected tests from primary and secondary care, and combined with additional demographic information. Data for 2018 was subsequently added in Phase III, with 2019 data under collection.

Using Tableau software, a prototype Atlas for Scottish Laboratories was produced and developed extensively throughout Phases II and III. The Atlas comprised of a number of summary dashboards that provided snapshots of laboratory requesting activity and allowed comparisons between NHS Boards and the GP practices within.

5.1.2 Detailed development and data extraction

The interactive dashboards were devised to provide laboratory and health professionals with a variety of ways to identify requesting variation, align to appropriate test use and to provide a starting point from which to develop targeted interventions aimed at reducing unwarranted variation. The importance of facilitating targeted interventions to drive optimal testing was clear but was in turn dependent on building on existing data collected and further refining the Atlas dashboards views for referring clinicians.

At the end of Phase II, the Atlas held data for the calendar year of 2017. It was agreed that building upon the existing data with data from the calendar year of 2018 was imperative for continuation into Phase III (see Appendix B for list of tests). A significant challenge remained around further data collection given the absence of

automated real time extraction directly from Laboratory Information Management Systems (LIMS). A national procurement process for a common LIMS with a linked standardisation work stream is in progress, however it is unlikely this will be available for several years due to the scope of the development. As such, the extraction remains an arduous manual process undertaken by laboratory managers. To reduce the burden on individuals it was agreed that a tally of the yearly requesting would be acceptable rather than monthly breakdowns.

The data was extracted from the LIMS by executing a standard query and populating an Excel spreadsheet for further analysis. In total, test request data from practices across Scotland was collated for 2018 and added to the Atlas. As previously, data was adjusted per 1000 population unless otherwise stated. Comparative variation in requesting for each test between GP practices was displayed using simple bar charts, with variation across health boards displayed using box and whiskers plots.

During Phase III, the impact on colleagues' time for data collection was more evident. Data collection to populate the Atlas is pivotal for the programme and as such it was imperative that the process was as efficient and easy as possible. A meeting with the laboratory managers responsible for data collection was organised to identify any steps that could be put in place to further simplify the process. This led to the following recommendations:

- Data may be sent in the format that is extracted from the system with minimal/no requirement from the lab managers to adapt to fit in to a prescribed spreadsheet.
- Clear definitions of what to collect for each test to ensure all NHS Boards collect the same set of tests.
- One request for collection of all tests for all disciplines/specialties rather than individual requests per discipline.
- Monthly collections per financial quarter was acceptable as some health boards have or in the process of acquiring automated scheduling facility. A schedule of upcoming requesting dates would be advantageous.

Following feedback and amendment, data collection for 3 quarters of 2019 was also collected from six NHS Boards, covering 87% of all practices in Scotland with an additional four health boards providing data for the fourth quarter of 2019 and the first quarter of 2020.

5.1.3 Atlas dashboards

Throughout all Phases of the Demand Optimisation programme there has been significant engagement in the generation and development of the Atlas dashboards. In Phase III, there was increased engagement with primary care (see Appendix C for a full list of meetings) as the intention was for the Atlas to be piloted with referring clinicians within one NHS Board for utility and suitability in highlighting test variation. Using the simplicity of existing antibiotic prescribing feedback as a standard, the GP Atlas dashboards were refined to two specific dashboard views:

- GP practice variation of all tests
- GP comparator view, comparing practice with peer groups, cluster, NHS Board, region and Scottish average

GP specific variation of all tests

Upon opening the Atlas, the first dashboard includes a plot demonstrating the five highest and 5 lowest test requests (for the chosen practice compared to the health board average; Figure 2). This is not the highest or lowest number of requested tests but rather the 10 tests that the requesting pattern for the practice is least like their NHS Board average. Hovering over the blue bar of each test will bring up key information such as the national, board and GP practice average and a link to current guidelines if available. The option to view all the current 70+ tests included is available using the outlier filter mode.

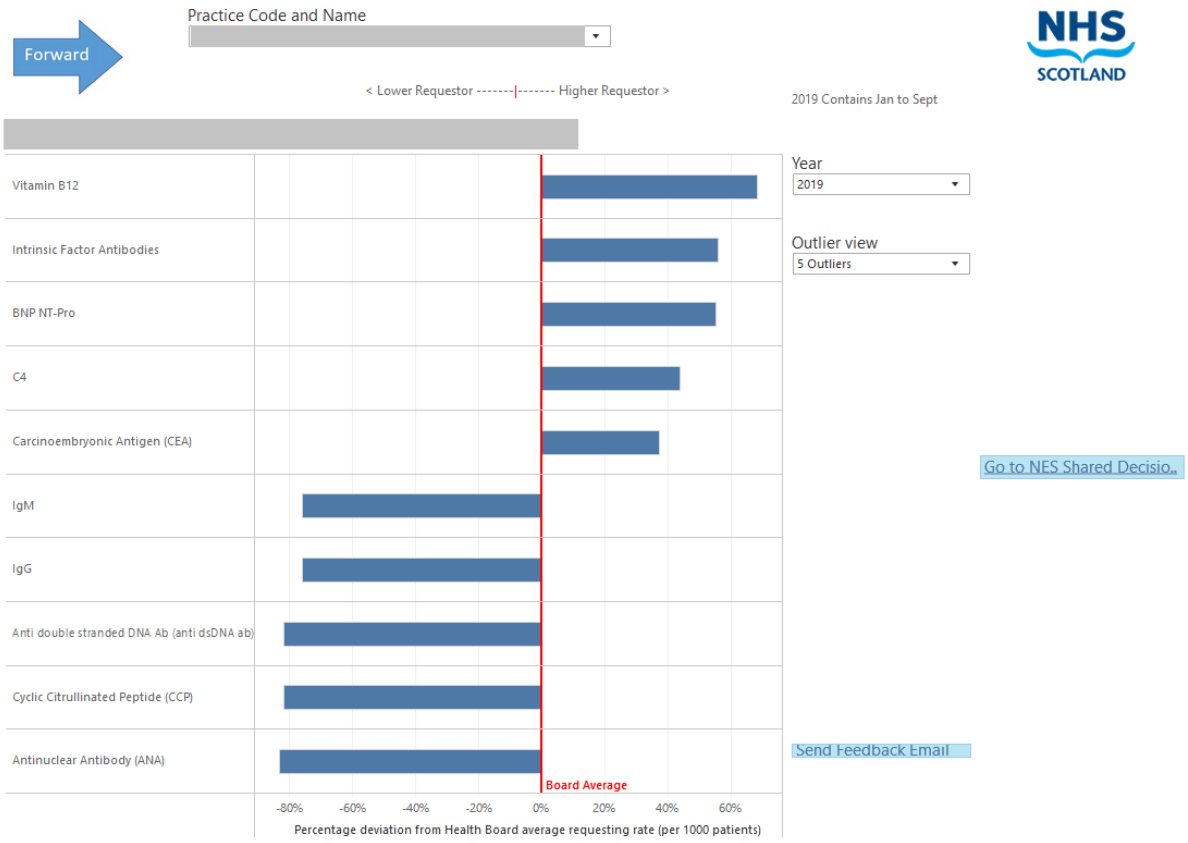


Figure 2 GP specific variation of tests dashboard view

The specific practice can be selected either by using the GP practice name or practice code using the filter at the top and a link to IMS is provided for comments, feedback or support. Furthermore, there is a link to NES shared decision making for additional resources.

This dashboard allows the user to easily identify the key tests where requesting patterns of the practice are least like the requesting pattern of their NHS Board overall. This can only be used as an indicator to direct the user to narrow their search from the list of tests. Clicking on the specific test on the dashboard provides more detailed information for this test in the GP comparator view.

GP comparator view

Clicking on a specific test in the previous dashboard brings up the GP comparator view, which provides greater detail for the test in question (Figure 3). A GP practice line chart plots the selected practice requests per 1000 patients (blue) over the previous 3 years. Feedback from primary care indicated that a number of different comparison options would further enhance the data when reviewing their practice requesting pattern. As such, the plot includes the average requesting pattern of the practice's associated cluster (turquoise), its peer group (green), NHS Board (lilac) and national average (red). In addition, an information box across the top of the screen (blue fill) includes the GP practice list size, the number in the peer group and the Scottish Index of Multiple Deprivation 16 Score Decile (SIMD16 decile score).

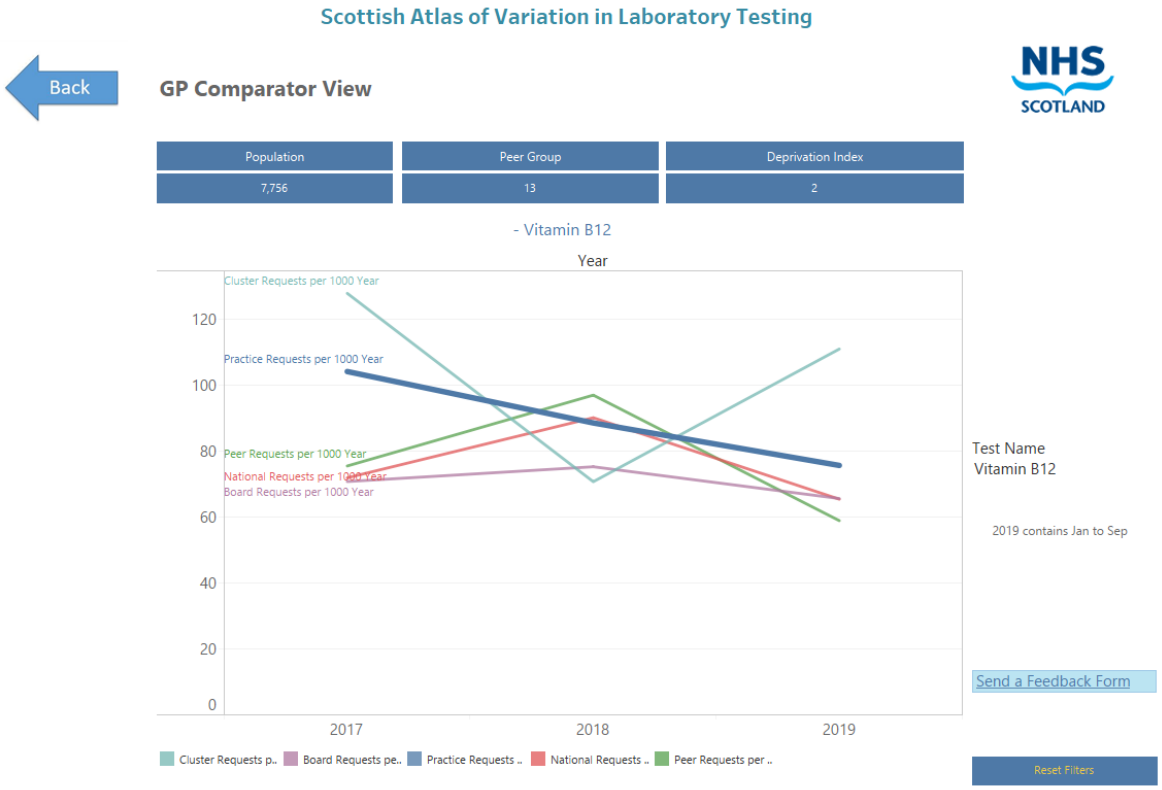


Figure 3 GP practice comparator view

The GP comparator view demonstrates the test requesting patterns of a GP practice versus a variety of peer, regional and national benchmarks. While not specifically identifying inappropriate requesting per se, the tool highlights possible test areas for review. Additional educational materials, regional and/or national guidelines and specific user knowledge of the patient population and demographics are pertinent to draw conclusions.

5.1.4 Access

Following user feedback, it was agreed that for maximum ease and usability, online access to the Atlas should be open. However, there was uncertainty on whether in some small practices where very few tests are requested it was possible to determine the individual patients. To eliminate this, the raw number of all tests that were 5 or below and all those collected in future would be hidden with only the tests that are greater than 5 displayed.

A Data Protection Impact Assessment (DPIA) Screening was then carried out to identify any further issues. However, it was deemed that any information governance risk was negligible and so the programme was given permission to upload the Atlas online with no additional password protection.

5.1.5 Educational material

It was identified early in the programme that the Atlas is a valuable tool in highlighting unwarranted variation. However, as a standalone tool it lacks the educational support to facilitate and promote appropriate test use. Providing educational guidance in accompaniment to feedback of laboratory test requesting in not a novel concept. NHS Grampian piloted providing educational feedback with laboratory test requesting rates as part of a randomised controlled trial in 2006[5]; this practice has now become routine with tailored feedback documents detailing requesting rates for laboratory tests sent to all GP practices across NHS Grampian every 2 months. More recently, antibiotic prescribing data is also now routinely sent to all GP practices presenting their antibody use in comparison to their NHS Board and across Scotland, with educational material highlighting the prescribing guidelines. This provides the GPs with all the tools to view their own practice and the resources to review their requesting/prescribing patterns.

To produce the supporting educational information, there was substantial collaboration with key representatives from the laboratory networks and primary care. Discussions concluded that the best format would be a one page ‘flash report’ for each test that included the specific practice’s comparative requesting patterns, followed by key indicators on when to test and when not to test, with additional links to further resources. The educational material/guidance would ideally be devised on a national basis but would allow regional or board variation if required.

Interrogation of the interactive Atlas highlighted 3 tests that showed clear variation, namely thyroid function tests (TFTs), vitamin D and HbA1c. The first set of flash reports were produced, an example of the TFTs report can be observed in Appendix D.

Sending flash reports directly to every GP will ensure that referrers are given the option to receive specific educational material in their preferred manner and encourage users to access the Atlas to review their variation rates for their practice. However, implementing an electronic automated distribution system has its challenges and needs further exploration to be fully achievable. As an initial step, flash reports are being produced on an NHS Board basis to include a graph at the

[5] Thomas et al. The Lancet 2006; 367: 1990-1996

top showing the Scotland average and that NHS Board's average for the test in questions over a set time period. There will be links into the practice views.

6 Engagement

Throughout Phase III of the programme, opportunities have been taken to talk about the programme and demonstrate the Atlas to a number of stakeholders including clinicians, laboratory managers, referring clinicians and Scottish Government (see Appendix C for a full list of engagement). This has provided opportunities to demonstrate the GP versions of the Atlas and listen to feedback, helping to shape the content and views of the Atlas, ensuring that it meets stakeholders' needs and is developed into a useful tool both for service users and laboratories. It has also created the opportunity to begin to use/pilot the Atlas.

NHS Lothian have a primary care lab interface group that brings GPs together with laboratory medicine professionals. The programme was given the opportunity to present to them in January 2020. The session was attended by over 300 GPs and provided an opportunity for them to sign up as early adopters of the Atlas. Many GPs were keen to see this work progress, with the inclusion of more up to date data identified as a priority for them (see Appendix E for Twitter feedback following the event). A subsequent planned rollout of Atlas access with educational support was planned for early 2020.

The programme was also offered the opportunity to present the Atlas to the Primary Care Advisory (PAC) group, which comprised of GPs/Associate Medical Directors and Scottish Government. There was universal agreement that everyone should be able to see each practice's data and a lot of keen interest from a number of referring clinicians across the NHS Boards for access to begin reviewing their own practice data. Additional feedback was welcomed and helped to further refine the Atlas dashboards.

Throughout the programme there have been regular updates with the Diagnostic Networks and the Atlas was showcased at the HaTS launch and a number of network education events (see Appendix C).

The Atlas and the Demand Optimisation programme have also been promoted at regular national events including the NHS Scotland event, Association for Clinical Biochemistry and Laboratory Medicine (ACB) focus event, and at roadshows in several NHS Boards. This has had the benefit of further promoting the capabilities of the Atlas to a wide audience and ensuring the objectives of the programme are disseminated.

7 Impact of the COVID-19 Pandemic

As with every other area of the NHS, and the country as a whole, the effect of COVID-19 has had an impact on the Demand Optimisation programme. As the COVID-19 threat increased, all health professionals were instructed to set aside all non-essential work that was not COVID-19 related and use all their resources to concentrate on the pandemic. As such, programmes like the Demand Optimisation programme have in effect been largely paused.

Anecdotally, the shift of focus of healthcare towards the pandemic has resulted in dramatic effects on laboratory test use with many NHS Boards reporting reductions of around 75% in overall test use due to overall under activity in more routine clinical services. This will clearly have significant impact on any longitudinal observations on test requesting trends during this time period and likely into the near future. These deviations may make the effectiveness of demand optimisation intervention more difficult to assess fully.

Therefore, a number of planned objectives within Phase III have been left unfulfilled. Whilst all referrers who had requested access are now users, any direct interaction with GPs and the subsequent piloting of the Atlas in NHS Lothian has been put on hold. In addition, the future events where the Atlas may be showcased (and have accepted abstracts) e.g. NHS Scotland Event, ACB focus conference, Scottish Clinical Immunology Group (SCIG) have been postponed and, in many cases, with no rescheduled dates. This will undoubtedly impact on the significant traction the Atlas has recently gained with primary care, especially during Phase III.

The magnitude of the COVID-19 situation also affected engagement with laboratories. Routine data collection had been established and so some laboratories have continued to provide data returns; however, this was halted in several NHS Boards. In addition, as regular specialist network meetings were postponed, the data interrogation and expert view on production of educational material roles were significantly reduced.

Quality Improvement work was a key part of Phase III, however national networks and specialist groups did not have the capacity to report on the many great Quality Improvement initiatives undertaken throughout the country and there is no currently available outcome data to report. A list of the QI work underway is listed in Appendix F.

The return of conventional NHS services at this point presents an opportunity to optimise demand as testing increases again. It is strongly recommended that National Demand Optimisation work is re-commenced in preparation for this. The need for appropriate, targeted use of diagnostic tests will likely be even more important for the NHS in the near future.

In response to the changing healthcare landscape during the COVID-19 pandemic, focus of the programme transformed to monitor laboratory test use during the COVID-19 pandemic and recovery phases – this work has begun as Phase IV of the programme. It is anticipated that such data collection, analysis and subsequent dashboards can help identify healthcare gaps created during the pandemic and inform prioritisation decisions during remobilisation. In addition, identifying laboratory

workflow issues, especially as remobilisation progresses, will enable laboratory resource pressures to be identified and addressed more easily.

To reflect the current status of this funded Phase IV COVID-19 pandemic monitoring project at the time of writing, an addendum has been added at the end of this report to reflect early progress with this work: **Lab Activity as a Metric for Pandemic Healthcare Trends** (see Section 11 Addendum).

Unwarranted variation in the use and availability of laboratory tests will not be resolved rapidly and will require continual refinement and monitoring. It is vital that a National Demand Optimisation oversight is retained, both for the newly focused Phase IV pandemic monitoring programme and beyond, so that previous momentum and achievements can be built upon and the drive towards appropriate test use is supported to continue. Appropriate laboratory testing will be even more important in shaping prioritisation and driving recovery and remobilisation in a very changed healthcare landscape – ongoing funding of the programme is essential.

8 Conclusions

Demand Optimisation of laboratory testing remains vitally important so that test use and availability is appropriate in the Scottish NHS. This will help ensure scarce resource is not wasted and patient outcomes are optimised.

The development of a Scottish Atlas of Variation for Laboratory tests has been a major achievement. It clearly demonstrates significant unwarranted variation in laboratory test use and availability. Phase III has further developed and refined the Atlas, with pilot dashboard summary views developed for both GP and Laboratory professional groups to interrogate and use as a basis to consider test use and availability.

Data Collection to populate the Atlas has now stretched to cover 3 individual years (2017, 2018 and 2019). While manual collection of data remains the only current option, this has been streamlined and has become routine for some NHS Board Laboratory Services. Laboratory IT support needs strengthened across the health boards to enable data collection to continue, especially given the increased demand during the pandemic for such personnel. Snapshot reports, focusing on requesting patterns for individual tests along with educational guidance on appropriate test use, have also been developed for some of the tests within the Atlas.

Considerable stakeholder engagement around the work of the group is ongoing, notably with the Atlas of Variation, which has been very well received.

The COVID-19 pandemic has had a major impact on the programme, which was largely paused in March 2020. Ongoing data collection, Atlas of Variation pilots and associated educational interventions did not progress fully as planned and outcome data following interventions are not currently available to share.

The focus of the programme has therefore shifted to monitor laboratory test use during the COVID-19 pandemic and recovery phases – this has begun as Phase IV of the programme. It is anticipated that such data collection, analysis and subsequent dashboards can help identify healthcare gaps created during the pandemic and inform prioritisation decisions during remobilisation. In addition, identifying laboratory workflow issues, especially as remobilisation progresses, will enable laboratory resource pressures to be identified and addressed more easily.

9 Recommendations

Unwarranted variation in the use and availability of laboratory tests remains an important issue. It is vital that national Demand Optimisation oversight is retained throughout Phase IV and beyond, so that previous momentum and achievements can be built upon and the drive towards appropriate test use is supported to continue.

The COVID-19 pandemic has had a significant impact on the programme. With the return of conventional NHS services at this point, including the re-introduction of more regular testing, it is strongly recommended that the Demand Optimisation work is prioritised to continue. The need for appropriate, targeted use of diagnostic tests will likely be even more important in the post pandemic Scottish NHS of the future.

The following recommendations are made: -

1. A National Oversight for Demand Optimisation of Laboratory testing is retained, further promoted and supported in all NHS Boards.

2. Data collection of laboratory test requesting and use continues as a priority in all NHS Boards; it is pivotal to the identification of unwarranted variation and it allows the effectiveness of interventions aimed at promoting appropriate testing to be addressed. It is therefore essential that appropriate dedicated resource for IT support is immediately identified and utilised within the NHS Boards where data extraction is currently a challenge.

3. Interactive dashboards within the Atlas of Variation and the production of regular focussed reports need to be further refined, promoted and actively utilised within Primary Care and Laboratory Services across all NHS Boards.

4. An expanded set of educational materials must be developed, published and widely disseminated to Primary Care and Laboratory colleagues so as to provide relevant guidance to reduce unwarranted variation.

5. Quality Improvement initiatives are actively championed in NHS Boards. New QI proposals are to be monitored and targeted work undertaken to facilitate the implementation of proposals.

6. Ongoing Demand Optimisation work must continue to uphold alignment with the values of the Realistic Medicine Programme and contribute to the Scottish Government’s vision for the future of Primary Care and diagnostic services.

Funding was agreed for Phase IV of the National Demand Optimisation work, based on the following objectives:

- Data collection of laboratory test use/availability is continued on a quarterly basis as initiated during Phase III – where possible.
- Exploration of the possibility of embedding the Atlas in the existing QI landscape for GPs on iHub; alongside gaining support for the Atlas from the Royal College of GPs.
- Development and refinement of the user interface based on feedback of continued roll out of interactive Atlas dashboards.
- Continued engagement with National Managed Diagnostic Networks (NMDNs) and laboratories to develop educational materials to support the Atlas.
- Ongoing development of an electronic, automated method for extracting relevant data specific for a GP practice and sending practice specific reports.
- Engagement with relevant stakeholders to promote and refine the programme.
- Expanding stakeholder engagement with LIST to develop quality improvement initiatives.
- Where applicable, undertaking internal demand optimisation within laboratories to review and standardise methodologies.
- Monitoring and reporting on QI programmes being delivered.
- Promoting Demand Optimisation and the Realistic Medicine agenda at conferences, in reports to professional bodies and in newsletters.

Phase IV commenced in summer 2020 with the following re-focussed objectives relating to the COVID-19 pandemic:

Additional COVID-19 Pandemic monitoring objectives

- A re-focus on data collection to monitor laboratory test use trends related to the impact of the COVID-19 pandemic and the effect on healthcare flows.
- Development of COVID-19 pandemic monitoring dashboards for both pathology and blood sciences.
- Ongoing monitoring through remobilisation to track healthcare recovery and the impact on laboratory services.
- Additional lab IT support should urgently be provided in order to assist the manual extraction of this data from lab information systems – especially in the boards that currently have limited Lab IT capacity.

- Source data and observations from all boards/networks on the changes in healthcare infrastructure and provision as a result of the COVID-19 pandemic.
- Collect discipline specific laboratory activity data for the main sources – Primary care, Secondary care and out-patients.
- Estimate the “gap” in testing for different areas/disciplines – this is likely to relate to healthcare provision that was missed, delayed or postponed.

- Histopathology – expected that workload will increase as catch up is attempted – needs monitoring and prioritised given the fixed capacity of services. Specimen type, volume of work and complexity needs tracking to assist prioritisation decisions.
- Development of educational guidance as a matter of urgency, mainly via the networks, to roll out across healthcare settings – this needs to focus on avoiding samples as well as tests
    - the limitations are largely with patient interaction/phlebotomy, not with laboratory capacity (for blood sciences).
- Atlas of Variation – needs a re-think – both to acknowledge and track the new post COVID-19 metrics, but also to allow peer comparison across boards, regions, clusters and nations. Such comparisons are likely to be single use rather than looking chronologically at what came before COVID-19. A Post-COVID-19 dashboard needs developing.
- Focus on key areas such as cancer and diabetes where reduced testing during the pandemic is likely to have had a negative effect on individuals. Identification of specific requesting patterns that have failed to catch up.

10 Appendices

10.1 Appendix A Phase III NDOG Membership

Chair of the Group	Dr Bernie Croal, Consultant Chemical Pathologist, NHS Grampian.
Scottish Government Sponsor	Catherine Ross, Chief Healthcare Science Officer Karen Stewart, Healthcare Science Officer
Scottish Government Lead	Mike Gray, Service Manager, Laboratory Medicine, NHS Lothian
NHS National Services Scotland	Dr David Stirling, Director of Healthcare Science
NSS Programme Management / Programme Support	Liz Blackman, Senior Programme Manager, NSD Dr Niove Jordanides, Programme Manager, NSD Claire Lawrie, Senior Programme Manager, IMS Gavin Hallford, Data Analyst, IMS Dr Karl Hope, Programme Support Officer, NSD
General Practice	Dr Ben Hall, GP and Scottish Clinical Leadership Fellow
Specialism Covered	**Membership**
Biochemistry	Dr Janet Horner, Consultant Biochemist Dr Sara Jenks, Consultant Clinical Scientist Dr Rebecca Pattenden, Consultant Biochemist
Microbiology/Virology	Linda Mulhern, Operational Science Manager, Microbiology
Pathology	Dr Fiona Payne, Consultant Pathologist David Topping, Clinical Lab Manager/Lead BMS
Haematology	Dr Alastair Hart, Consultant Haematologist Robyn Gunn, Healthcare Science Manager Sonja Wright, Clinical Scientist
Clinical Immunology	Dr Liz Furrie, Clinical Scientist Dr Charu Chopra, Consultant Immunologist
Genetics/Molecular Pathology Consortia	Dr David Baty, Consultant Clinical Scientist Caroline Clark, Consultant Clinical Scientist
Transfusion	Dr Alastair Hart, Consultant Haematologist

10.2 Appendix B List of tests included in the Atlas

Test name	Test name
AGPCA	IF
Albumin:creatinine ratio	IgA TTG
ANA	IgE - Aspergillus
ANCA	IgE - Birch
Anti-Cardiolipin	IgE - Cat
B12	IgE - Dog
Beta 2 glycoprotein	IgE - Egg
Bilirubin	IgE - Grass
BNP	IgE - HDM
C3/C4	IgE - Milk
CA125	IgE - Peanut
Calcium	IgE - Total
Calprotectin	IgE - Wheat
Catheter specimen of urine (CSU)	IgM RF
CCP	IgG/IgA/ IgM
CEA	Liver autoantibody - AMA
Cholesterol	Liver autoantibody - ASM
Coagulation Screens	Liver autoantibody - LKM
C-reactive protein	Mid-stream sample of urine (MSSU)
CRP	MPO
CTDS/ENAS	Plasma Viscosity
D Dimer	PR3
Ds DNA Ab	Prostate-specific antigen
Electrophoresis/ immunofixation/ immunosubtraction	Protein Electrophoresis
ESR	Rheumatoid Factor
FBC	Serum Free Light Chains
Ferritin	Sodium
Folate	Testosterone
Follicle Stimulating Hormone	Thrombophilia Screen
Free T3	Thyroid stimulating hormone
Free T4	TPO
Glucose (including fasting glucose)	Triglyceride
HbA1c (glycated haemoglobin)	Urine - other
HDL-Cholesterol	Urine Bence Jones Proteins
High Vaginal Swab (HVS)	Vitamin D

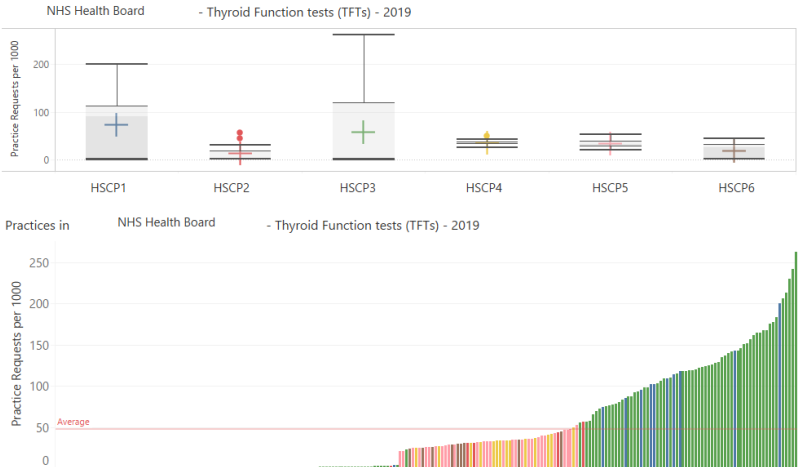
10.3 Appendix C Stakeholder engagement

Steering Groups	• Diagnostics in Scotland Strategic Group • Demand Optimisation Group • Scottish Microbiology and Virology Network (SMVN) • Scottish Pathology Network (SPAN), • Scottish Clinical Biochemistry Network (SCBN) • Haematology and Transfusion Scotland network (HaTS)
Education events	• SCBN Education Event • SPAN Education Event • HaTS Education Event
Other interest groups	• Clinical Immunology • Genetics / Molecular Pathology consortia • Scottish National Blood Transfusion Service
Scottish Government Realistic Medicine team	• Realistic Medicine Atlas Development Subgroup
Scottish Government Primary Care Team	• Primary Care advisory group
Primary care cluster groups	• Lothian Primary Care Laboratory Interface Group • Dumfries and Galloway Clinical Optimisation Group
ISD Local Intelligence Support Team (LIST)	
Roadshow events	• NHS Ayrshire and Arran • NHS Lanarkshire • NHS GG&C • NHS Grampian • NHS Dumfries and Galloway • NHS Western Isles
NHS Scotland Events	• Healthcare Science event • NHS Scotland Event 2019 • NHS Scotland Event 2020 – abstract submitted, delayed until further notice
Association for Clinical Biochemistry (ACB) focus	• 2019 • 2020 Abstract accepted, meeting delayed until further notice

10.4 Appendix D Flash report

Thyroid function testing in primary care

TFTs are requested for the diagnosis and monitoring of thyroid disease.



Appropriate indications for requesting TFTs in primary care[3]	
Indication	**Recommended frequency**
Patient with signs and symptoms of thyroid disease *(Including new presentations of atrial fibrillation, hyperlipidaemia, osteoporosis and oligoamenorrhea)*	
Patient's stabilised on T4 therapy	2 yearly TSH check for males/post-menopausal females Annually for women of child bearing age
Treated hyperthyroidism	Annually
Type 1 diabetes	Annually
Type 2 diabetes	At diagnosis only *(check annually if TSH >2.0mU/L & anti-TPO Ab +ve)*
Down's syndrome & Turner's syndrome	Annually
Lithium and amiodarone therapy	6 monthly intervals
Pregnancy and known thyroid disease	Preconception and at various intervals during pregnancy *(see refhelp guidelines[2])*
Subclinical hypothyroidism (Free T4 normal, TSH high)	Repeat at 3 months to exclude transient rise in TSH. After this if not requiring therapy monitor annually and pre-conception

When not to test
Repeat testing of normal TFTs is not indicated unless the clinical picture changes or the patient is at high risk e.g. type 1 diabetes[1].
Do not routinely request annual monitoring in type 2 diabetes, hypertension, atrial fibrillation, osteoporosis
For asymptomatic male/post-menopausal females stable on T4 therapy a 2 yearly TSH check is sufficient

For additional data on individual practice laboratory test requesting please see the National Atlas of Variation in Laboratory testing.

References/Further reading

1. Cook Rob, Fortescue-Webb Duncan, Taft Rachel. Repeat thyroid function tests for healthy older people are not needed BMJ 2019; 364 :l805
2. https://apps.nhslothian.scot/refhelp/guidelines/ResourcesLinks/Endocrine%20-%20Thyroid%20Function%20Testing%20in%20Pregnancy%20Guidance%20Lothian%20Jan%2023.01.20.pdf
3. https://apps.nhslothian.scot/refhelp/guidelines/ResourcesLinks/ENDO%20THY%20-%20%20Thyroid%20Function%20Testing%20in%20Primary%20Care%20Guidance%202017%20PLIG%20approved.pdf

https://www.british-thyroid-association.org/sandbox/bta2016/uk_guidelines_for_the_use_of_thyroid_function_tests.pdf

10.5 Appendix E Feedback from event

Twitter engagement following GP Lothian event 23rd January

and PC leads meeting 29th January

GP Liaison Services @GP_LiaisonUK · 23 Jan
Replying to @Black8Gordon, @DrGregorSmith and 3 others
Excellent inniative; closer and more regular engagement between the lab and it's partners in primary care is essential to remove variation and waste.

Ben Hall @bwgh87 · 23 Jan
Thank you for the fantastic opportunity to share this work from @NHSNSS @ClaireLawrie @LizBlackman1 @NMDNScot Looking for lots of volunteers to take this forward to the next stage!

Gregor Smith @DrGregorSmith · 23 Jan
A superb initiative and great addition to our Atlas if Variation. This has tremendous potential for use in #GPClusters and I'm really grateful for all the work that @Karenmstew , @bwgh87 and others have put into it.

Lucy Munro @DrLucyMM · 29 Jan
Replying to @ClaireLawrie, @Karenmstew and 3 others
Huge amount of enthusiasm for this AoV from Primary Care leads. Lots of applicability. Well done @NHSNSS and our #SCLF @bwgh87 @DrGregorSmith

Gordon @Black8Gordon · 23 Jan
300 GPs hearing about the Atlas of Variation in lab testing in Primary Care. Great opportunity for GP clusters. @DrGregorSmith @ManiraAhmad @michellewatts68 @jillgillies989

Lorna Ramsay @DrLornaRamsay · 23 Jan
Replying to @DrGregorSmith, @Karenmstew and @bwgh87
Really great work by colleagues in @NHSNSS using our BI capabilities

Jo Smail @SmailJo · 23 Jan
Replying to @Black8Gordon, @DrGregorSmith and 3 others
Great to see this in action at the PLIG meeting tonight. Exciting times for primary care in Scotland

Michelle watts @michellewatts68 · 19h
Replying to @ClaireLawrie, @Karenmstew and 4 others
Thanks for coming along- great to see this, and how it aligns with the NTI work, and the data our List analysts are producing.Some really exciting opportunities to help the system connect with more of itself.👍

10.6 Appendix F Quality Improvement Initiatives

Network/ Specialty	QI initiative
SCBN	**iLFTs-** Fully operational across NHS Tayside. Conducting a survey across all health the other boards to determine uptake.
SCBN	**Standardising Lipid requesting-** Document has been sent to the Scottish Lipid forum for an opinion.
SCBN	**Minimal requesting interval recommendations-** Approved by the network and published on the SCBN website.
SCBN	**AKI alerts-** Reviewing the current status of AKI alerts in each health board.
SCBN	**NHS GG&C- Reduction in Vitamin D requesting-** Have installed a new ICE interface at point of requesting for GPs and started a trial in March 2020 to reduce Vitamin D requesting.
SCBN	**Guidance-** Have produced guidelines on Thyroid testing.
HaTS	**Guidance-** Have produced laboratory and GP guidelines for B12. Re-developing Ferritin guidelines to take into account pre-op anaemia pathway.
SMVN	**NHS A&A - Reduction of High Vaginal Swabs-** Have a protocol to follow and have been granted approval from GUM to proceed. Anticipated start date of April 2020.
SMVN	**NHS Fife - Reduction of urine samples-** The current guidance has been presented to the PLIG meeting held in January and plan to progress the initiative shortly.
SMVN	**NHS Lothian - Reduction of leg ulcer swabs-** Have a protocol that can be used to manage urine.
SPAN	**Placenta and gastric biopsy survey-** A survey across all health boards highlighted differences in practice, leading to decisions to review differing practices.
SPAN	**NHS Lanarkshire - Endoscopy guidance-** Have formed a new governance group to implement the recommendations.
SPAN	**Cancer tracking of endoscopy samples review-** NHS Fife have an overarching cancer group that have established criteria for how to remove people from the cancer tracker. Cancer tracking practices are to be reviewed in other health boards.
Immunology	**National Diabetes Testing-** NHS Lothian were the first Board to conduct Triple Antibody testing and are in progress of analysing the outcomes.
Immunology	**Auto-immune Hepatitis Testing-** Identifying method to triage auto immune hepatitis testing for liver screening to primary care.
Immunology	**ANCA screening-** Three of the 4 immunology laboratories have moved from immunofluorescence to using ELISA's, which provides a quicker result and is more cost and time efficient.

11 Addendum: Phase IV Update on Pandemic Monitoring

Lab Activity as a Metric for Pandemic Healthcare Trends

The National Demand Optimisation Group (NDOG) for Laboratory Medicine has developed a monitoring tool that tracks diagnostic activity during the pandemic and into recovery. This information is a direct surrogate metric for associated clinical activity and can be used to identify healthcare gaps, monitor recovery, and enable better informed prioritisation decisions.

Background

The NDOG was established in 2016 as a collaborative initiative aimed at developing a programme of work to optimise the use of laboratory testing to reduce unwarranted variation in the delivery of healthcare. The group has developed an interactive Atlas of Variation (AoV) for laboratory tests that tracks lab test use at regional, board, cluster, and GP practice levels. This allows unwarranted variation to be identified and targeted via peer comparison and educational interventions.

During the COVID-19 pandemic, emphasis has shifted towards using the same data collection and AoV structure to develop dashboard intelligence on lab test trends. Given the integral importance of lab testing throughout healthcare, these trends are an indirect marker for diagnosis, monitoring and treatment modalities throughout the pandemic period and into the recovery phase. Such information may be vital at identifying reductions in diagnoses and treatment of specific malignancies and other disease pathways such as diabetes, heart disease and chronic conditions.

Pathology and Cancer

Pathology specimens serve as a robust marker of healthcare activity associated with the diagnosis and treatment of various malignancies and other serious diseases. Figure 1 shows the total number of pathology requests, received by Scottish labs during the pandemic, adjusted to the 2019 average for each health board. Similar trends are seen when specific specimen types are looked at in isolation.

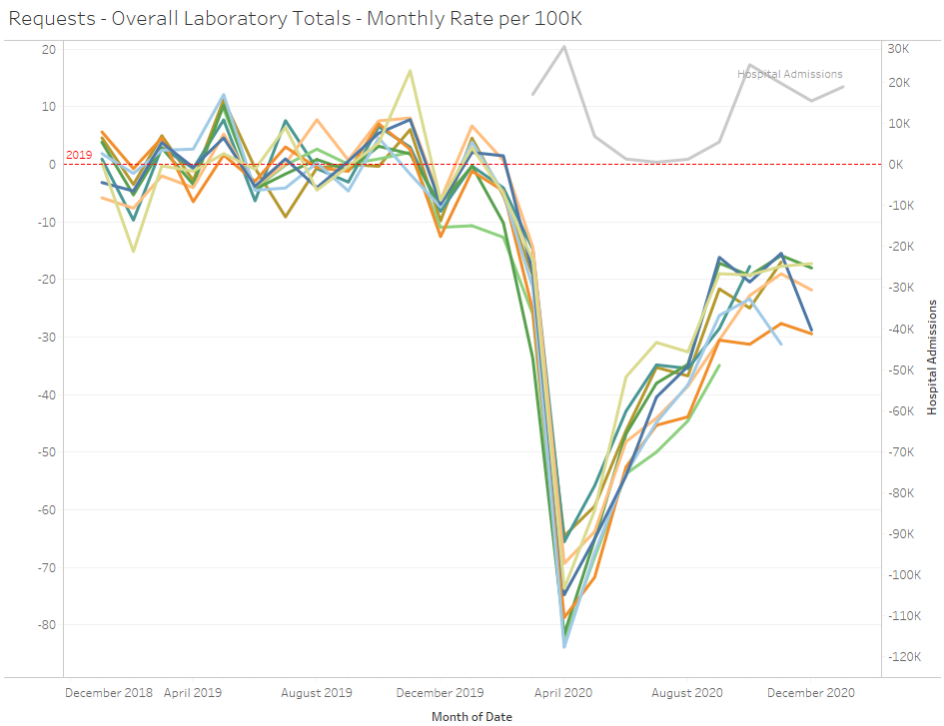


Figure 1. Total pathology requests per health board adjusted to 2019 average and COVID-19 hospital admissions - monthly

Interactive Dashboard Development

An AoV style Tableau dashboard (Figure 2) has been created that allows interrogation of the data to focus on specific health boards, specimen types and even complexity of specimen requests by virtue of the number of blocks and slides generated.

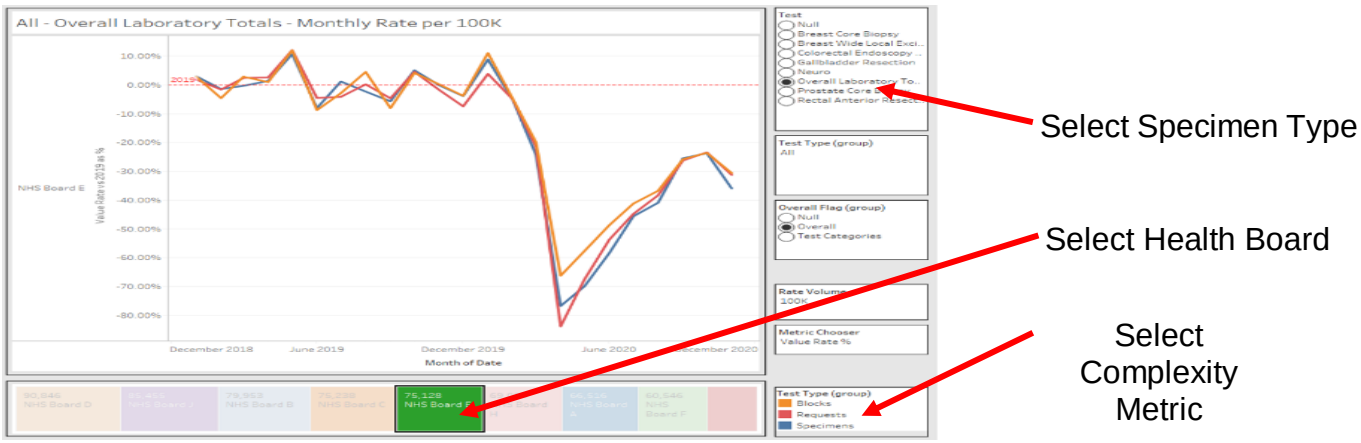


Figure 2. Interactive tableau dashboard

Blood Sciences and Diabetes

Blood tests are a good measure of healthcare activity within both Primary and Secondary care. Significant reductions in blood test requesting have been observed throughout the pandemic because of reduced activity (out-patients, GP led clinics) and significant phlebotomy capacity issues in the community due to social distancing measures and staff pressures.

The diagnosis and monitoring of diabetes is crucially dependent upon blood testing for HbA1c. Figure 3 shows Primary Care HbA1c requesting trends during the pandemic period adjusted to the average 2019 activity. The significant reductions observed in HbA1c testing are likely to have significant clinical consequences for both new diagnoses and the adequate monitoring of existing diabetic patients.

Interactive dashboards are being created for HbA1c and other key blood markers, including those related to cancer diagnosis and monitoring. These will allow trend interrogation by health board down to GP practice level.

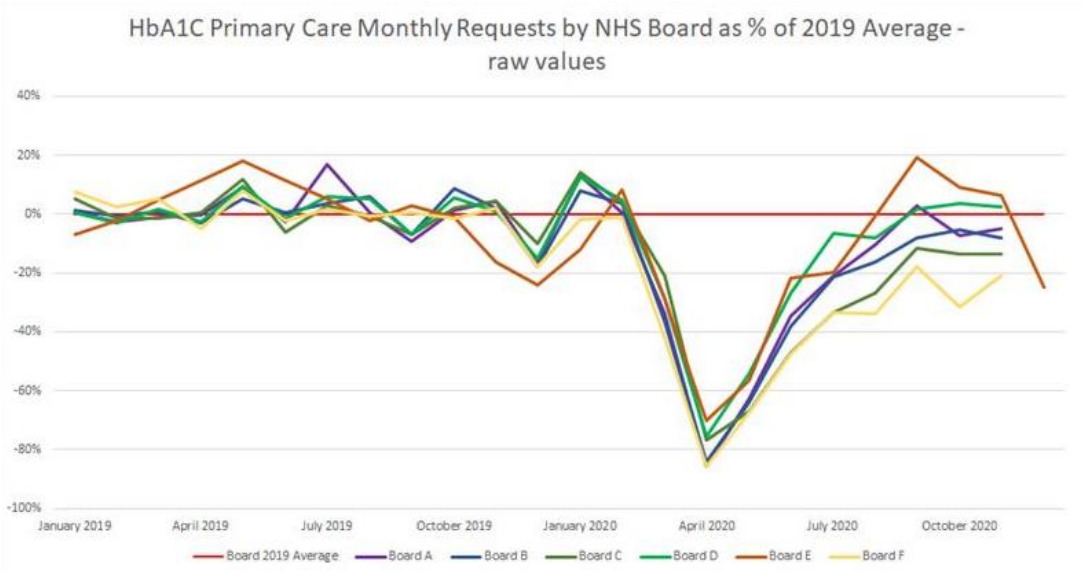


Figure 3. Primary Care HbA1c requesting trends per health board adjusted to 2019 levels.

Data Collection and IT Limitations

Data collection of laboratory test use on a national basis is difficult because of outdated lab IT systems, inconsistent coding systems and a lack of interoperability between health boards. Automated collection on a national basis is therefore not possible but must rely on manual downloads from individual health boards. Data collection is therefore patchy and will depend upon IT resource availability within the boards, which is under intense pressure due to the pandemic. *If lab test trend analysis is important then consideration should be given to provide additional resource allocation to assist data collection by local IT personnel.*

Potential Uses of the NDOG Lab Activity Dashboard

As a result of the pandemic, established metrics of healthcare activity/demand have become unreliable due to the huge shift away from traditional modes of care, referral, waiting list accumulation and reluctance of patients to seek direct medical input. The Lab Activity dashboard can therefore serve as a useful surrogate metric for healthcare activity across cancer and other chronic conditions. Specific uses could include:

1. **Phlebotomy Capacity** – using blood sciences data to identify demand and shortfall in phlebotomy provision across Primary/Secondary care and monitor the impact of developing Community Phlebotomy Hubs.
2. **Cancer** – using pathology and blood sciences data to identify gaps in the screening, diagnosis and monitoring of specific malignancies.
3. **Chronic Disease Pathways** – Similarly, focus in on specific disease pathways to identify healthcare gaps from health board down to individual GP practice level.
4. **Recovery Targeted Prioritisation** – identified healthcare gaps can be assessed and prioritised at health board level during recovery programmes.
5. **Targeting and Reducing Unwarranted Variation** – Ensuring appropriate lab test use is tracked and optimised – especially important during post pandemic recovery period.
6. **Laboratory Resource Allocation** – Much of the gap lab activity will likely return, and with the inevitable enhanced recovery initiatives to enable catch up, this will likely put huge pressures on lab services – especially within pathology, given the predicted consultant shortfall.

Recommendations

The Scottish NHS has faced a huge crisis associated with the COVID-19 pandemic. As we hopefully emerge from the second wave, another healthcare crisis associated with the missed diagnoses, delayed treatments, and the continuing impact of COVID-19 long term, will require focus – both to identify the gaps and to prioritise scarce resource. The NDOG Lab Activity dashboard will be an important tool going forwards and the following should be considered:

- **Awareness** – Scottish Government, Health Boards, Chief Executives, Remobilisation Groups and Lab Services should be aware of this potentially valuable resource in identifying pandemic driven healthcare gaps and enabling targeted prioritisation of resource moving into the post-pandemic recovery period.
- **Collaboration** – Clinical groups should consider working alongside the NDOG to develop specific lab metric bundles linked to their patient pathways.
- **Resource** – Additional resource input should be considered to allow the NDOG/ISD and local lab IT provision to deliver this initiative.
- **Lab Services** – Careful resource planning to enable lab services to cope with likely enhanced activity they will face as services recover and overshoot normal capacity - especially given the existing shortfall in Consultant pathologist capacity across the UK.

Dr Bernie Croal on behalf of the NDOG
February 2021

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