



Diagnostic Imaging Workforce Plan for NHS Scotland

May 2023



Contents

Executive Summary	4
Statements of Support	6
Step 1: Defining the Plan	7
Introduction	7
Purpose	8
Approach	8
Scope	9
Ownership	10
Impact	10
Step 2: Demand Drivers and Service Change	11
The Population Served by NHS Scotland	12
The National Context	15
Diagnostic Imaging in NHS Scotland	15
Impact of COVID-19	15
National Waiting Times Targets and Standards	16
Realistic Medicine ¹⁷	17
Health and Care (Staffing) (Scotland) Act 2019 ¹⁹	18
National Workforce Strategy for Health and Social Care in Scotland ⁸	18
Differences Across the United Kingdom	19
Additional Drivers	19

Step 3: Defining the Required Workforce	20
Assessing Demand	20
Workforce Projections	22
Future Workforce	27
Step 4: Workforce Capacity and Capability	32
Current Workforce in NHS Scotland	33
Workforce Forecasting	41
Key Challenges	46
Step 5: Planning to Deliver the Required Workforce	48
Gap Analysis	48
Recommendations	53
Step 6: Implementation, Monitoring and Refresh	63
Proposed Scope Additions	63
Acknowledgements	64
References	65
Appendix A: Diagnostic Imaging Workforce Demand Modelling Tool	66
Appendix B: Scotland Population Data	69
Appendix C: Current Workforce Profile	70
Appendix D: ARSAC Practitioner Licence Imaging Coverage	76
Appendix E: NHS Scotland Employment Forecast	79
Glossary of Terms	80

Executive Summary

This Workforce Plan evidences the future workforce required nationally to ensure delivery of a high-quality, sustainable diagnostic imaging service for the population of Scotland. As a core service, diagnostic imaging and the associated workforce is key to over 80% of hospital patient pathways and, in 2019/20, over 3.9 million radiology examinations were performed across the NHS in Scotland at a cost of more than £325 million.

This plan is an essential element of the radiology Target Operating Model approved by NHS Board Chief Executives and follows the Scottish Government-endorsed Six Steps workforce planning methodology. The modelling developed from data and professional judgement clearly shows that, without action, the projected demand and workforce capacity for diagnostic imaging will never meet, and instead will rapidly diverge.

Patients are waiting longer than they should for diagnostic imaging tests in Scotland, resulting in both delayed primary diagnosis, and essential follow-up imaging, often for patients with cancer.

In addition to the COVID-19 pandemic leading to increased waiting times, there is rapidly growing demand for diagnostic imaging due to people living longer and increasingly with more complex comorbidities. Technological advancements and enhancements of clinical pathways to improve patient diagnosis, treatment, and outcomes are also driving demand.

NHS Scotland currently has a diagnostic imaging workforce shortfall of 48% Consultant Clinical Radiologists when compared to the European average of staff in post per population, and a shortfall of 48% Interventional Radiology Consultants against the recommended minimum staffing requirements. Medical Physics Experts have a shortfall of up to 52% against the recommended guidelines.

Coupled with a shortage of Diagnostic Radiographers, Sonographers, Advanced and Assistant Practitioners, and other imaging staff responsible for direct patient care, this negatively impacts on the ability to provide appropriate and timely access to imaging tests, and contributes to worsening outpatient waiting times, delayed patient discharges, and impacts on patient cancer pathways.

Significant transformation is needed to recover and build the workforce required to provide a sustainable service for patients.

This Workforce Plan provides recommendations ([Step 5](#)) to address this existing and growing gap between demand and capacity for image acquisition and reporting, focusing on the actions required to effectively plan, attract, train, employ and nurture those staff vital to providing the current and future diagnostic imaging service.

As training and recruitment of the required workforce to meet the projected growth in demand in Scotland will be challenging, and improvements to staff capacity and throughput alone will not be enough, recommendations go beyond solely workforce solutions.

Service transformation is also required to manage this growth in demand, including the use of artificial intelligence (AI) and other emerging technologies.

This plan evidences that urgent and ongoing action is required to ensure continued provision of a safe, effective, and sustainable diagnostic imaging service to support patient diagnosis, treatment, and outcomes across Scotland.

Written by Amy Currie, Project Manager, and Clinton Heseltine, Radiology Workforce Planning Clinical Lead, on behalf of the Scottish Radiology Transformation Programme (SRTP)

Statements of Support

The Society of Radiographers (SoR) welcomes the publication of the Diagnostic Imaging Workforce Plan for NHS Scotland.

There has been a tremendous amount of detailed work done to understand the complex and interdependent factors that converge around workforce planning for the imaging workforce.

The plan that has been produced is a clear call to action in order to secure diagnostic imaging services for the people of Scotland.

The plan faces up to the genuinely challenging circumstances for Scotland in addition to the widely known factors of increasing demand and insufficient workforce supply.

Too often we have seen this sort of planning set aside as “too difficult”.

It is commendable that NHS Scotland has the courage and wisdom to commit to a workforce plan and the SoR asks that it is adopted and prioritised by the Scottish Government.

Richard Evans OBE
Chief Executive Officer, the Society of Radiographers

The Royal College of Radiologists is pleased to support the Diagnostic Imaging Workforce Plan for NHS Scotland, compiled with input from Scottish radiologists.

Its projections of the future workforce growth needed to provide optimal imaging services across Scotland are welcome, as is its emphasis upon training the future imaging workforce.

The predicted need for workforce increases draws upon the college's census data, and we welcome efforts to address the current and predicted future shortfalls.

It is pleasing to see that both diagnostic and interventional radiology have been addressed, in an effort to provide comprehensive services across the country.

We welcome the determination to increase workforce across all imaging professions and the acknowledgement of the importance of staff wellbeing and the retention of experienced colleagues.

We sincerely hope that the Scottish government will fund the report's recommendations to build optimum imaging services for patients across the country.

The Royal College of Radiologists

Step 1: Defining the Plan

Introduction

This Workforce Plan provides an overview of the future workforce required to ensure delivery of a high-quality, sustainable diagnostic imaging service for the population of Scotland.

As a core service, diagnostic imaging, also referred to as radiology, is key to diagnosing, treating, and monitoring disease and injuries in over 80% of hospital patient pathways ¹. There is also a growing expectation that it should be used earlier and more extensively in the patient journey to improve patient outcomes and reduce treatment costs. Currently Scotland performs significantly fewer computed tomography (CT) and magnetic resonance imaging (MRI) examinations per head of population than the majority of comparable Organisation for Economic Co-operation and Development (OECD) countries ².

Diagnostic imaging services in Scotland, like the rest of the UK, are at risk of service failure because of increasing demand, a failure to successfully recruit and retain staff, reducing availability of the current workforce, a lack of cross-boundary working mechanisms, and an increasing reliance on outsourcing.

Exacerbated by the impacts of the COVID-19 pandemic, this increasing pressure on services and staff is resulting in further backlogs for image acquisition and reporting ⁴ and increased use of overtime, locums, and external commercial providers at significant cost. It is also negatively impacting staff wellbeing and patient care and outcomes including delayed diagnoses and treatment.

Figure 1: International comparison of CT exams per 1,000 inhabitants, 2019

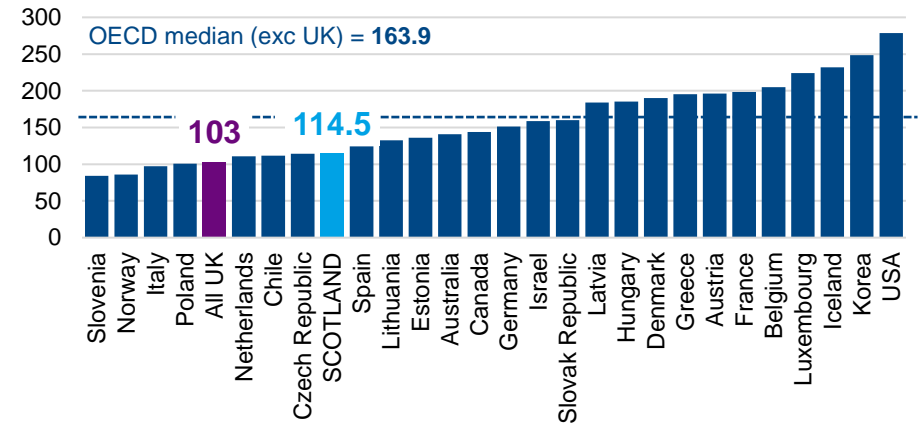
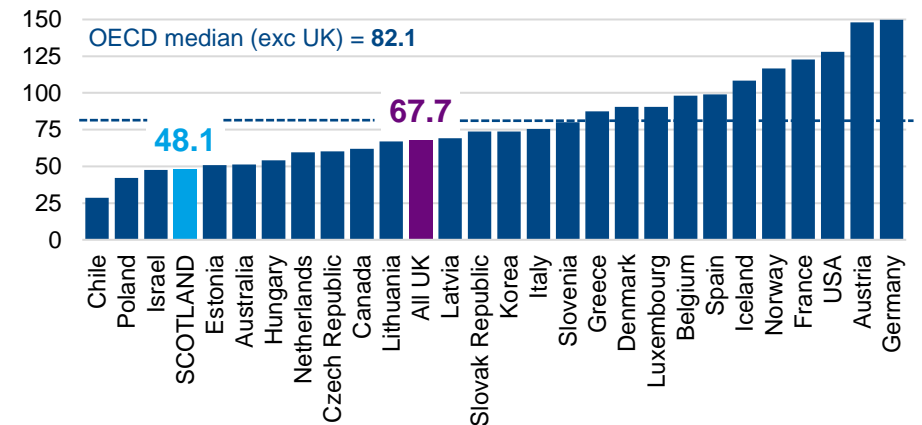


Figure 2: International comparison of MRI exams per 1,000 inhabitants, 2019



Sources: OECD (2023) ², Public Health Scotland ³

The core challenge is that imaging demand is far outweighing capacity, and the scale of the problem is such that it cannot solely be solved by training and recruiting additional staff. Multi-faceted transformation is required to manage demand, redesign the service, address training and recruitment constraints, and make more efficient use of the existing workforce to reduce the gap between demand and capacity.

Purpose

Building upon the recommendations in the Radiology Service Target Operating Model (TOM) ⁵, approved by NHS Board Chief Executives (BCE) in June 2021, this national Workforce Plan for Diagnostic Imaging provides an opportunity to shape the future of how services are delivered across Scotland, particularly with respect to addressing demand and capacity issues, increasing quality, improving patient experience and outcomes, and supporting transformational change at an operational level.

The recommendations ([Step 5](#)) advise of actions required to achieve safe and effective diagnostic imaging services for patients by providing a workforce that has the required capacity and skills. The workforce planning tool ([Appendix A](#)) used to estimate the current and future workforce gap as part of this plan can be used to support future national strategic workforce planning and can also be adapted for local operational workforce planning.

Approach

This Workforce Plan has been developed in line with the NHS Six Steps to Integrated Workforce Planning Methodology ¹⁰ and uses the Five Pillars of The Workforce Journey, as set out in the

National Workforce Strategy for Health and Social Care in Scotland ⁸, to frame the recommended actions. Short-, medium- and long-term solutions are identified to help resolve the current pressures on imaging services and look at future workforce requirements over the next 10 years to ensure succession and retention of staff.

A representative Steering Group was established to provide expert guidance and as part of the agreed governance arrangements, with further approval being sought from the Imaging Executive Board (IEB). The Steering Group membership ([Acknowledgments](#)) included representation from the diagnostic imaging service, partnership, professional bodies, training and education, workforce planning and data.

Due to the absence of an existing mechanism, a specialty-specific workload measurement and workforce planning tool was developed as part of a triangulation approach incorporating professional judgement with quality measures to visualise and model the current and future shape and size of the diagnostic imaging workforce required based on projected service demand. A detailed explanation of this methodology, and link to access the Diagnostic Imaging Workforce Demand Modelling Tool, can be found in [Appendix A](#).

The tool enables calculation of the future imaging staff numbers and roles, expressed in whole time equivalent (WTE) figures, required to meet the projected demand. Future projections or scenario planning can be adjusted to reflect changes in practice and technological advances impacting on patient throughput and pathways.

Wide engagement and consultation with stakeholders was performed throughout this project, including in-person and virtual presentations and a series of virtual workshops, to source and validate data, scope and develop the modelling tool, and generate the recommended actions.

Scope

The examinations in scope for modelling activity and demand, as defined by National Interim Clinical Imaging Procedure (NICIP) modality codes ⁶, are:

- CT
- DEXA
- Fluoroscopy
- Interventional
- Mammography (symptomatic exams only)
- MRI
- Nuclear Medicine (inclusive of SPECT and PET)
- Ultrasound (non-obstetric exams only)
- X-ray

The staff roles in scope for modelling are Consultant Clinical Radiologists, inclusive of Interventional Radiologists, and Diagnostic Radiography staff, inclusive of Healthcare Support Workers, Assistant Practitioners, Reporting Radiographers and Sonographers. Trainees are classified as a supernumerary workforce and therefore not included within the modelling.

Administrative and Clerical staff, Nurses, RIS/PACS Managers, and the Medical Physics workforce are included but not modelled within this first iteration. Some nuclear medicine components have been modelled where data was available.

The ambition is to model all diagnostic imaging services provided by NHS Scotland - all imaging modalities and all staff working within imaging departments - within the Workforce Plan when data allows. Several recommended actions focus on the improvements required to evidence and enable a wider scope for future iterations, and suggestions for a wider scope are listed within [Step 6](#).

This plan sits within the context of a number of national strategic documents, for example, the Radiology Current Operating Model and Target Operating Model ⁵, the NHS Recovery Plan 2021-2026 ⁷, and the National Workforce Strategy for Health and Social Care in Scotland (2022) ⁸, which are referenced throughout this plan.

Further analysis of the UK diagnostic imaging workforce is available within the annual census reports produced by The Royal College of Radiologists (RCR) ¹ and The College of Radiographers (CoR) ⁹.

Ownership

The Diagnostic Imaging Workforce Plan for Scotland has been developed by the Scottish Radiology Transformation Programme (SRTP). The SRTP was established by BCE in 2016 as a 10-year phased programme to help address the risk of service failure. The programme is being delivered by NHS National Services Scotland (NSS) with Scottish Government funding due to end in September 2023.

The delivery of this plan and its recommended actions, and future iterations of the modelling and action plan, require to be owned by the wider diagnostic imaging service. It is anticipated that overall responsibility will sit with the emerging Diagnostics Strategic Network (DSN) which is replacing the current governance framework of the IEB and Diagnostics in Scotland Strategic Group (DiSSG), on behalf of the CEs who commissioned the work.

Impact

Ensuring future delivery of a highly skilled diagnostic imaging workforce that has adequate numbers with the right training will help provide a safe and effective service for patients attending for imaging and interventional examinations.

Referring clinicians will benefit from a service that can provide capacity capable of consistently meeting unscheduled and scheduled imaging demand.

Staff within diagnostic imaging services across Scotland that this Workforce Plan will impact include Clinical Radiologists, Interventional Radiologists, Diagnostic Radiographers, Sonographers, Reporting Radiographers, Assistant Practitioners, Clinical Support Workers, Clinical Leads and Managers, Administrative and Clerical staff, RIS/PACS Managers and e-Health staff, Nursing staff, Porters, and the Medical Physics workforce including Clinical Technologists.

Future staff training requirements, both undergraduate and postgraduate, will impact on Health Education Institutions in Scotland as this Workforce Plan advises increasing staff supply requirements, both medical and non-medical.

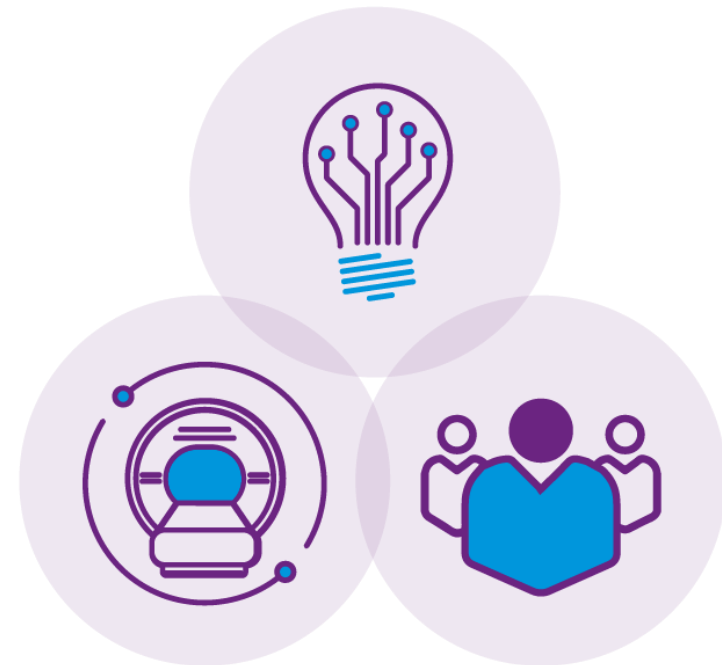
It is expected that reliance on additional commercial scanning and reporting will continue for some time due to demand. Third-party providers of image acquisition and reporting will be impacted by any shift from outsourcing in favour of insourcing or greater establishment figures.

Step 2: Demand Drivers and Service Change

The NHS faces increasing pressure to improve the quality of care while reducing costs, with services influenced by a range of drivers – both internal and external – which must be considered when planning services and the workforce required to deliver them effectively and sustainably. This Workforce Plan is intended to provide an imaging workforce with the capacity and skills to deliver:

- Urgent imaging when required 24/7
- Recovery of outpatient diagnostic imaging examination waiting times
- Timely imaging for emergency admissions and inpatients
- GP patient direct and indirect access to diagnostic imaging examinations
- Scheduled and unscheduled interventional procedures
- Safe staffing levels to provide a high-quality imaging service to patients
- A cost-efficient service less reliant on external providers

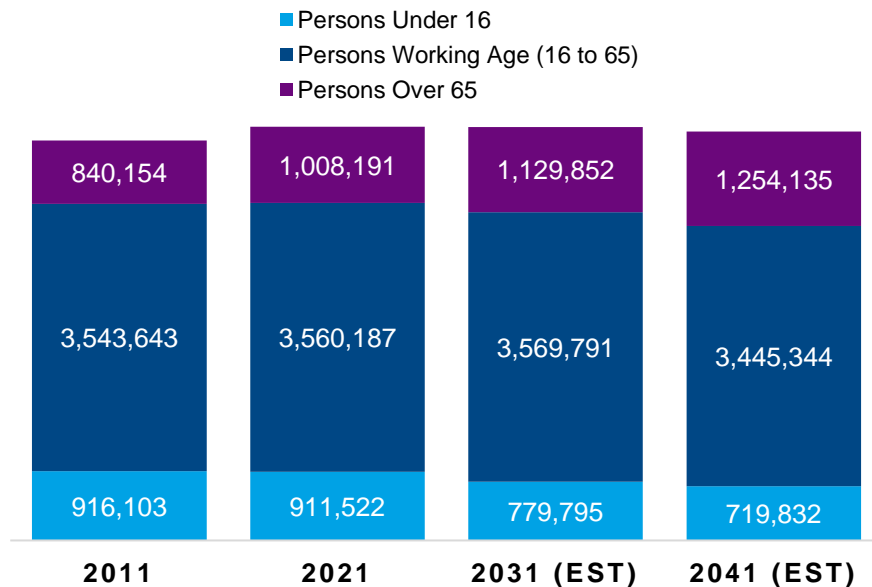
Supporting staff wellbeing is key to sustainability of the workforce, as the welfare of the workforce is a fundamental interdependency that cuts across remobilisation and workforce planning. Staff development and improved working conditions can provide opportunities to improve recruitment, increase staff availability, increase retention, and improve succession planning.



The Population Served by NHS Scotland

The population of Scotland has been rising steadily over the last decade, with a 3.4% increase from 2011 to 2021 ¹¹. Current projections indicate the population will continue to grow until 2028 and will then begin a gradual decline ¹². More significantly, the ratio within the population in terms of age demographics has shifted as indicated in [Figure 3](#) and is projected to continue along this trend. This has a twofold impact in terms of workforce, as it can reduce the available labour pool of those of working age, and as people live longer, increasingly with comorbidities, additional workforce is required to competently meet this growing demand.

Figure 3: Estimated population change of Scotland by age group



Source: National Records of Scotland ^{11, 12}

NHS Scotland is comprised of 14 territorial Health Boards who all provide a diagnostic imaging service alongside the Golden Jubilee National Hospital based in Clydebank. Boards vary in terms of the size of population they serve and their geography, and this can have significant impacts on the challenges faced in meeting demand and recruiting and retaining a sufficient workforce.

[Figure 4](#) demonstrates the population spread across the territorial Boards. NHS Western Isles is the smallest Board serving 0.5% of the total population of Scotland, and NHS Greater Glasgow & Clyde the largest serving nearly 22%. NHS Lothian experienced the greatest growth in population from 2011 to 2021 of 9.5%. NHS Ayrshire & Arran, NHS Dumfries & Galloway, NHS Shetland, and NHS Western Isles were the only Boards to experience a population decrease from 2011 to 2021, of between -1.3% and -3.8%.

The three island Boards – NHS Orkney, NHS Shetland, and NHS Western Isles – are classified as having 100% remote, rural, or remote and rural populations. Remote defines areas that are more than a 30-minute drive from a settlement with a population of 10,000 or more, and rural defines an area with a population of less than 3,000 persons. On the mainland, NHS Highland has the greatest remote and or rural population of 70.4%.

At the other end of the scale, NHS Greater Glasgow & Clyde's population is classified as 96.7% urban. This category combines large urban (settlements of 125,000 people and over), other urban (settlements of 10,000 to 124,999 people), and accessible small towns (settlements of 3,000 to 9,999 people and within a 30-minute drive time of a settlement of 10,000 or more).

Ordinarily an imaging department would need to have sufficient demand from being in a population centre to make the provision of imaging services viable. However, some areas are remote enough to require an imaging department even if the population density does not support it, such as on the Islands, because it is not reasonable or practical to expect patients to travel that far. For these sites, it is image acquisition that must be sufficiently staffed to be performed locally by Radiographers and Sonographers, while reporting can be supported remotely.

How remote and or rural a department is also impacts how attractive a post is for potential applicants, based on what the role is perceived to offer the individual in terms of their career, lifestyle, and family. Larger urban sites often have greater success in attracting applicants and filling posts, and this disparity has resulted in an uneven workforce spread (Figures 18 to 20) which impacts the ability to provide a proportionate service to meet local demand.

Case Study ¹⁴

Orkney is an archipelago situated off the north-eastern coast of Scotland, with a population of 22,540 ¹¹.

There is one rural general hospital, Balfour Hospital, located in Kirkwall.

When patients are referred for an X-ray by their GP, they must travel to Balfour Hospital to attend their scheduled appointment. The patient will either be reimbursed their travel costs, or patient transport via SAS will be pre-arranged and funded by NHS Orkney.

When travelling from Isles such as Hoy, Sanday, Stronsay and Westray, patients often have to take a full day off work to be able to attend at Balfour Hospital for what is normally a 5 to 10 minutes appointment.

In 2020, of the 200 appointments sent, NHS Orkney reported a 'Did not attend' (DNA) rate of 73% for patients who were due to attend for an X-ray.

A mobile x-ray pilot was introduced in 2021 to try and reduce patient travel times and costs, and DNA rates within NHS Orkney.

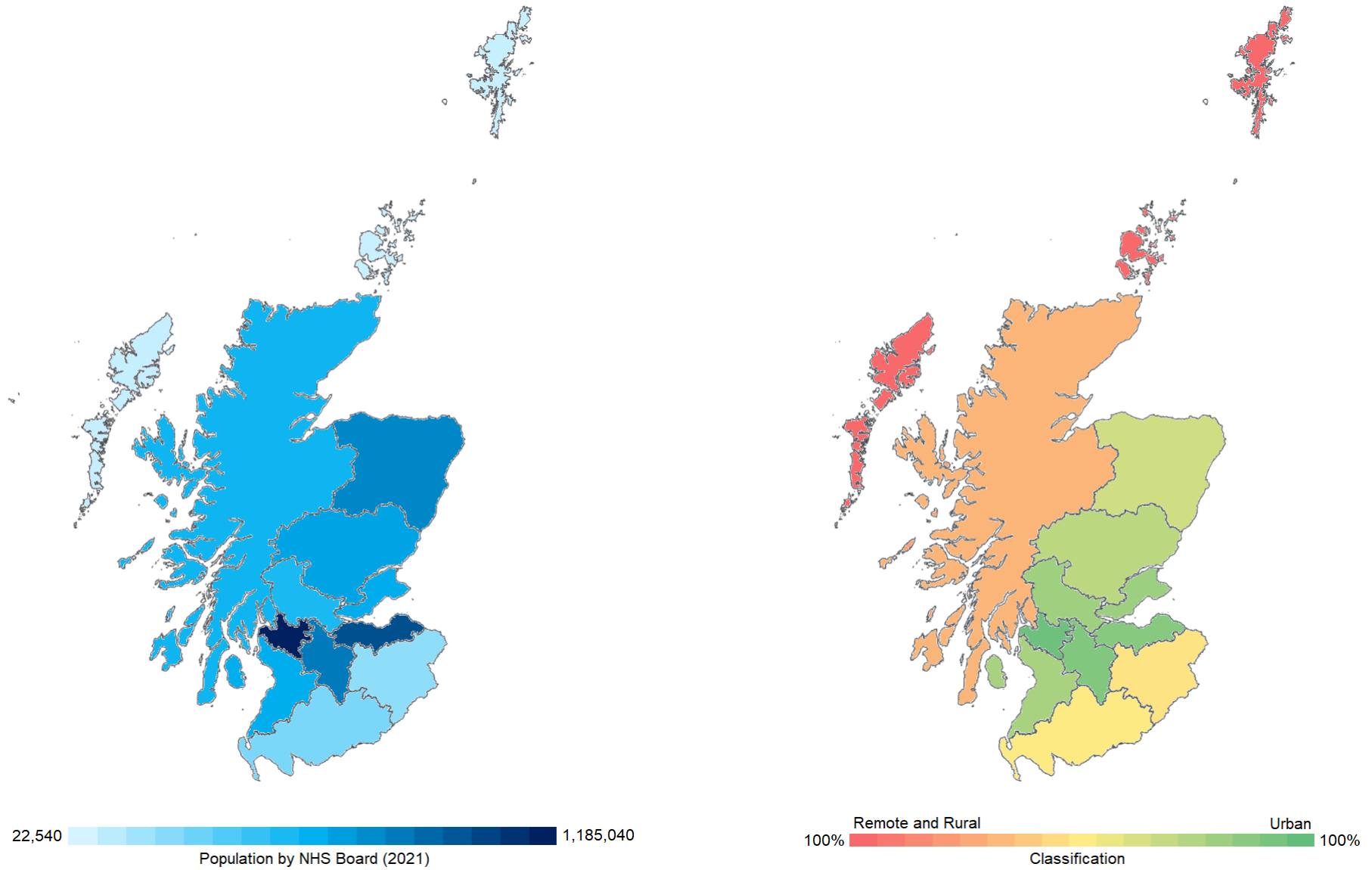
The trial consisted of appointment-based clinics at three GP surgeries on the isles using an XAIR portable X-ray imaging system from FujiFilm, with a total of 30 patients who were deemed eligible across the three-month trial.

Throughout the pilot, all patients offered an X-ray at their GP surgery attended the appointment, reducing the DNA rate to 0%. An estimated 927 miles were saved by patients travelling to a surgery instead of to Kirkwall, with an estimated patient expenses saving of between £729 and £1,497 depending on if travelling by public transport or by car. Factoring in the travel miles and costs of the Radiographers staffing the pilot sites still results in an overall saving across all measured indicators.

Patient feedback collected articulated the success of the pilot and the positive impact on the patients involved, and the DNA reduction demonstrates a clear benefit for the provision of an effective imaging service.

Opportunities are being explored for further pilots across the North of Scotland, including options for purchasing the equipment required to continue the successful Isles clinics.

Figure 4: Population estimate (2021) and Urban Rural classification by Health Board



Sources: National Records of Scotland ¹², Scottish Government ¹³

The National Context

Diagnostic Imaging in NHS Scotland

The imaging service in Scotland has a clear vision and ambitious **Target Operating Model**⁵ (TOM) which was commissioned by BCEs, approved in June 2021, and ultimately owned by the imaging community. The TOM sets out the strategic direction and key principles for imaging for the next 10-15 years that are required to deliver the vision of:

“a world class, person centred, sustainable radiology service that continually improves the health and wellbeing of the people of Scotland”

Developed collaboratively with radiology services across Scotland and informed by the views and experiences of patients, carers, referrers, and other key stakeholders, the vision and TOM were preceded by a **Current Operating Model**⁵ (COM) that details and sets a baseline for how imaging services within Scotland currently operate.

Impact of COVID-19

As stated in the **Diagnostics: Recovery and Renewal** report¹⁵ commissioned by the UK Government, even before the pandemic the need for radical improvement in diagnostic services was clear. Demand had been rising rapidly over the past five years or more, driven by increases in hospital attendances, more direct imaging referrals from GPs, and broader clinical indications for existing technologies such as CT scanning. The progressive

decline in performance was evident by the marked increase in breaches of the Waiting Times targets and by the substantial increase in outsourcing of imaging and reporting.

The COVID-19 pandemic has further amplified the need for fundamental change in the provision of imaging services to deliver the increase in activity required now and over the coming years, and to provide safe, patient-centred pathways. It has also, however, provided opportunities and momentum for change.

The **NHS Recovery Plan 2021-2026**⁷ sets out ambitious aims to address the backlog of care due to services being suspended or reduced in scope and scale through the pandemic, while continuing to meet the ongoing healthcare needs of Scotland, and work towards increasing capacity to deliver improved services. New service models will require major investment in facilities, equipment, and workforce - without this, diagnostic imaging provision within NHS Scotland will become unsustainable.

The **NHS in Scotland 2022**¹⁶ analysis from Audit Scotland asserts that growing financial pressures present a real risk to the investment needed to recover and reform services as laid out in the NHS Recovery Plan, and that workforce capacity remains the biggest risk to the recovery of NHS services. A need for robust demand and capacity modelling to inform planning for future service delivery is stressed, taking into consideration demographic change, service redesign options, and anticipated workforce capacity.

National Waiting Times Targets and Standards

Waiting times are important to patients and are a measure of how the NHS is responding to demand for services, highlighting where there are delays in the system. The Scottish Government waiting time standard from 2009 states that patients will wait no more than six weeks for any of the eight key diagnostic tests and investigations. Within imaging, the four key tests incorporated are CT, MRI, Non-Obstetric Ultrasound, and Barium Studies. Time is measured from receipt of the initial referral to the date the verified report is received or made available to the requestor.

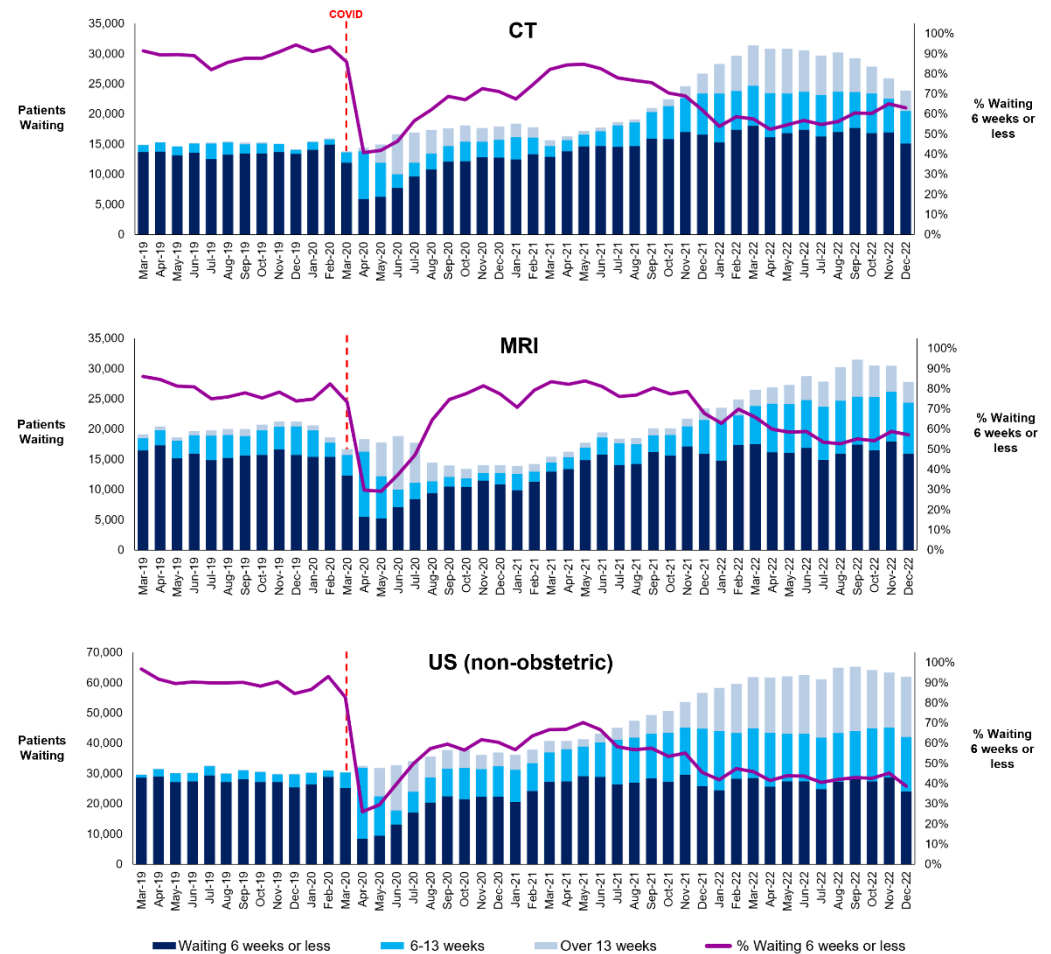
As evidenced in [Figure 5](#), the COVID-19 pandemic had a significant effect on the ability of Boards to meet this standard. Services have yet to recover to pre-pandemic levels, and the proportion of patients waiting over 6 weeks has climbed dramatically. Barium Studies have not been included in this figure as they are now less relevant as a proxy for imaging service performance due to the alternative widespread availability of endoscopy, colonoscopy, and multi-slice CT.

Achieving the A&E standard from 2015 for 95% of patients to wait no more than four hours from arrival to admission, discharge, or transfer for A&E treatment is also dependent on timely imaging, particularly CT.

A key ongoing priority for services is to address the backlog of patients waiting while continuing to prioritise patients based on their clinical urgency. To meet waiting times guarantees for diagnostic imaging and maintain the capacity required to recover from COVID-19, there is currently a high dependence on external provision, agency staffing, and overtime. This application of short-

term solutions is unsustainable, and costs more than investing in a permanent imaging workforce with the required numbers to sustain a reduction in waiting times and be flexible enough to respond to future pressures.

Figure 5: Impact of the COVID-19 pandemic on Diagnostic Waiting Times



Source: Public Health Scotland⁴

Realistic Medicine ¹⁷

The publication of the Chief Medical Officer's Annual Report 'Realistic Medicine' poses key challenges for clinicians about the application of modern medicine within a dynamic and changing healthcare environment. The report highlights the importance of effective patient and clinician communication and describes the limitations of the current healthcare model which does not always suit the needs of patients, their carers, or the aspirations of the workforce.

The introduction of alternative patient pathways to improve efficiency and avoid waste routinely results in an increased, and often unrecognised, demand on diagnostic imaging services. There is a finite capacity for imaging examinations across Scotland, but currently no limitations on the quantity of imaging referrals that can be submitted. One outcome of this imbalance is an unsustainable increase in waiting times for both acute and non-acute imaging, which poses a real risk to patients and staff welfare.

Case Study ¹⁸

Coronary heart disease is Scotland's single biggest cause of death. Each year, heart and circulatory diseases cost NHS Scotland around £800 million and cause more than 15,000 deaths, nearly one third of which are people under the age of 75.

CT Coronary Angiography (CTCA) is a non-invasive, X-ray-based technique that provides images and assessment of the coronary arteries and has almost 100% accuracy in excluding significant coronary artery disease. It is recommended as the first line investigation in patients with suspected angina.

Unfortunately, in Scotland this investigation is currently only performed in a small minority of patients.

Most patients undergo traditional functional testing on an exercise treadmill, or nuclear myocardial perfusion imaging. The former has a higher rate of non-diagnostic results with consequent repeat testing and follow up visits. The latter is not widely available, entails high radiation doses, and is prone to false positive results particularly in women.

The use of CTCA, with consequent changes in treatment, results in a [significantly lower rate of death](#) from coronary heart disease or nonfatal myocardial infarction than standard care alone, and leads to notable [cost savings](#) through avoiding invasive investigation and treatment.

There is notable inequity of provision across NHS Scotland - as of June 2021, only NHS Western Isles reported that all suitable patients were referred for CTCA as a first line investigation, and four Boards had no CTCA service at all. NHS Borders has been the only Board in Scotland to perform the anticipated minimum rate of 200 scans per 100,000 population in recent years.

Equitable access to CTCA would be of clear benefit to patients, however the current healthcare model does not have sufficient capacity or resource to deliver this service.

The length of time required for patient preparation and scanning impacts the ability to deliver other CT scanning appointments which may be regarded as a higher priority. Advanced training is required for both the specialist CT Radiographers and Clinical Support staff to provide CTCA, and reporting of these complex imaging procedures requires appropriately trained Consultant Radiologists.

Suitable training and support of the requisite workforce is key to increase CTCA capacity, however such development could result in, or exacerbate, Radiographer and Radiologist shortfalls in other areas without appropriate action around recruitment, training, and retention.

Health and Care (Staffing) (Scotland) Act 2019 ¹⁹

The Act aims to enable high-quality care and improved outcomes for service users by putting in place a framework to support appropriate staffing. Provision of high-quality care requires the right people, in the right place, with the right skills at the right time to ensure the best health and care outcomes for service users and people experiencing care.

The Act places a duty on every Health Board to ensure that, at all times, suitably qualified and competent individuals, from such a range of professional disciplines as necessary, are working in sufficient numbers as are appropriate for the health, wellbeing and safety of patients, the provision of safe and high-quality healthcare, and to safeguard the wellbeing of staff in so far as it impacts the previously listed aims.

Passed by the Scottish Parliament in 2019, implementation was paused due to the pandemic. All provisions within the Act will come into force in April 2024, with annual reports submitted to Scottish Ministers from 2025 onwards. The data from these reports will help inform local and national workforce planning, along with health and social care policies.

NHS Healthcare Improvement Scotland (HIS) is supporting Health Boards to prepare for implementation of the Act, will monitor Boards for their compliance following implementation, and has a role in designing and developing tools to assist NHS managers with assessing what is appropriate staffing. Work is underway with HIS to explore possible incorporation of the tool developed as part of this Workforce Plan as a specialty-specific tool to support Boards.

National Workforce Strategy for Health and Social Care in Scotland ⁸

Published in March 2022, the Strategy sets out a national framework to achieve the vision of “a sustainable, skilled workforce with attractive career choices and fair work where all are respected and valued for the work they do.” The Strategy sets out the evidence base and actions that will be taken over the short-, medium-, and long-term to achieve the tripartite ambition of Recovery, Growth, and Transformation of the health and social care services and workforce, and establishes the Five Pillars of the Workforce Journey. The recommended actions within this Workforce Plan are aligned to this framework.

Figure 6: The Five Pillars of the Workforce Journey



Differences Across the United Kingdom

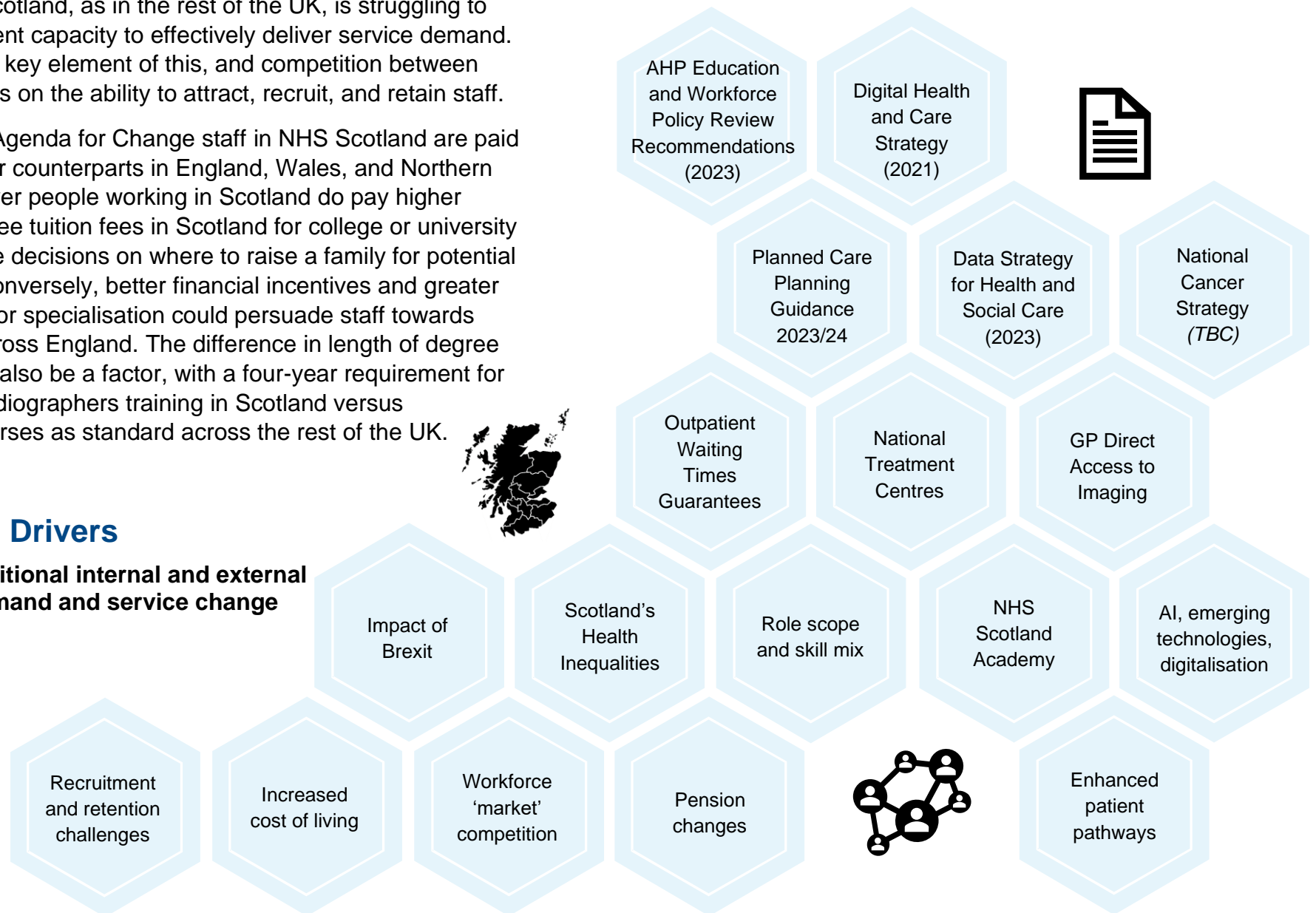
The NHS in Scotland, as in the rest of the UK, is struggling to provide sufficient capacity to effectively deliver service demand. Workforce is a key element of this, and competition between nations impacts on the ability to attract, recruit, and retain staff.

For instance, Agenda for Change staff in NHS Scotland are paid more than their counterparts in England, Wales, and Northern Ireland, however people working in Scotland do pay higher income tax. Free tuition fees in Scotland for college or university could influence decisions on where to raise a family for potential employees. Conversely, better financial incentives and greater opportunities for specialisation could persuade staff towards larger sites across England. The difference in length of degree courses could also be a factor, with a four-year requirement for Diagnostic Radiographers training in Scotland versus three-year courses as standard across the rest of the UK.



Additional Drivers

Figure 7: Additional internal and external drivers of demand and service change



Step 3: Defining the Required Workforce

Assessing Demand

The required workforce to deliver the projected diagnostic imaging demand has been modelled for Consultant Clinical Radiologists, Diagnostic Radiography staff by Agenda for Change banding, Reporting Radiographers, Sonographers, and where appropriate Clinical Technologists, based on the proxy measures of image acquisition and reporting.

Activity and demand are expressed on the basis of individual examination requests, as collected within Radiology Information Systems (RIS) and submitted by Boards to the National Radiology Information and Intelligence Platform (NRIIP)²⁰ hosted within Public Health Scotland (PHS). Manual quality adjustments were performed on the data as required to correct issues while NRIIP completes a data quality assurance exercise.

Full rationale and data sources for the metrics and assumptions used within the model such as for capacity, throughput, and scenario modelling can be found in [Appendix A](#).

Demand for imaging has been rising rapidly in recent years, driven partly by increases in acute hospital activity and wider indications for tests such as CT scanning. Even before the pandemic, this was impacting on achievement of diagnostic waiting times standards, with knock-on effects on cancer and elective care.

New demand is expected to impact the imaging service from several drivers such as the National Treatment Centres, revisions or additions to existing screening services and other patient pathways, the Cancer strategy, expanded access for referrers, and an ageing population with rising morbidity.

This compound growth, combined with the impact of the pandemic and the as yet unquantified new demand, creates difficulties with following historical demand trends to effectively project future demand due to the changing patterns.

Yearly demand projections per modality as shown in [Figure 8](#) have therefore been created using a combination of historical trends, professional judgement, and triangulation with recent reviews and reports that quantify imaging requirements. Additionally, for CT, MRI and US, a lower and upper range has been used to better demonstrate the possible service impact of this rising demand.



Figure 8: Yearly demand projections by modality used within modelling

Modality	Projected Demand Year-on-Year Increase
CT	7% to 9%
DEXA	1%
Fluoroscopy	1%
Interventional	6%
Mammography (symptomatic)	1%
MRI	7% to 11%
Nuclear Medicine	6%
Ultrasound (non-obstetric)	4% to 6%
X-ray	1%

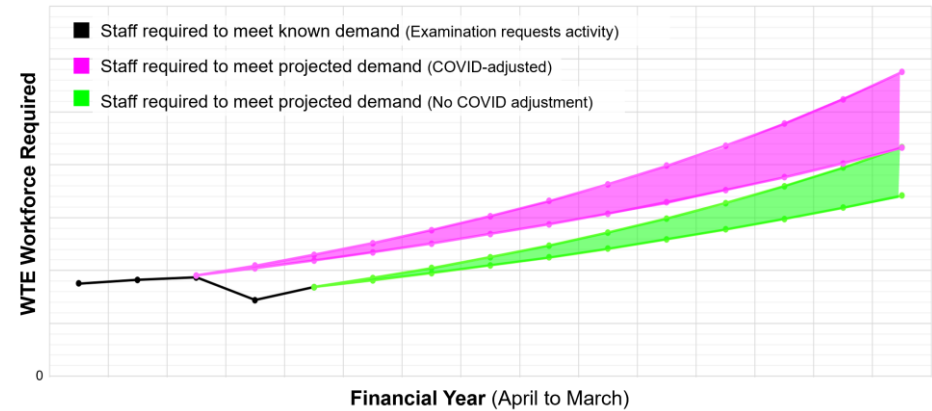
Due to the added uncertainty from the pandemic, two demand scenarios have been modelled for each workforce projection as demonstrated in [Figure 9](#).

The first, as indicated in green, projects forward from the end of March 2022 using the yearly growth predictions by modality. It makes no account for any recovery of the presumed missing activity due to COVID-19 stopping and reducing services.

In contrast, the second projection, as indicated in pink, assumes all missing activity is required and demonstrates the presumed demand had the pandemic not occurred. It adjusts for the presumed missing activity in early 2020 and projects from this

adjusted March 2020 figure forward using the yearly growth projections by modality.

Figure 9: Example projected demand scenarios used within modelling



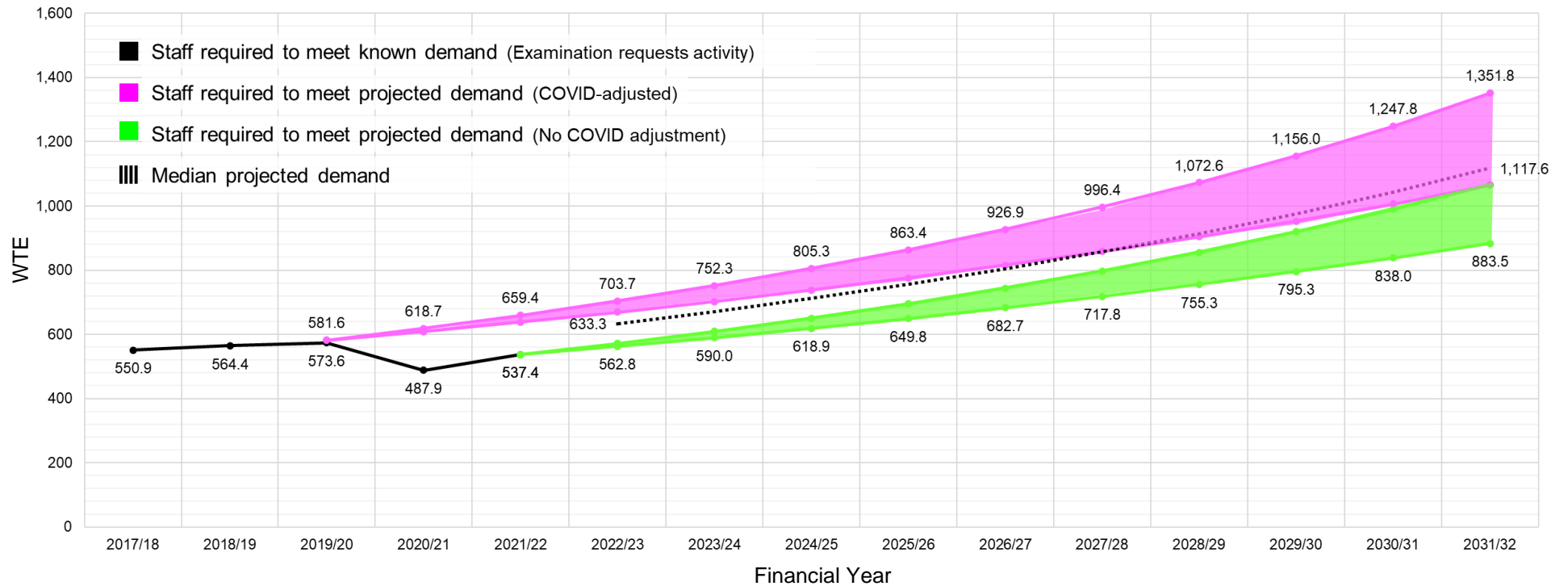
The future demand will likely fall in between the two scenarios modelled. Not all examinations that were ‘missed’ due to the pandemic will still be required due to patients no longer requiring diagnostic imaging, generally due to a change in their clinical condition. However, a significant proportion still need to be performed, as evidenced by the increased waiting lists, and service capacity recovery is required to greater-than pre-pandemic levels to meet future rising demand.

Workforce Projections

Consultants have been calculated based on five sessions' worth of reporting from a 10-session job plan. The modelling shown assumes 10% of all X-rays undertaken is auto reported, that 30% of MSK X-ray reporting is undertaken by Reporting Radiographers, and that 90% of all US is undertaken and reported by Sonographers. These metrics can vary significantly across and between Boards and can be adjusted within the tool – the charts shown in this report demonstrate the presumed national averages.

The RCR guidelines for the minimum requirement to fully staff a 24/7 interventional radiology rota equate to a minimum requirement of 64 WTE Consultant Interventional Radiologists for NHS Scotland ([Appendix C](#)). The modelling uses the higher value of this guideline, and the calculated workforce required based on projected interventional modality demand each year.

Figure 10: Projected WTE Consultant Clinical Radiologists required to meet demand



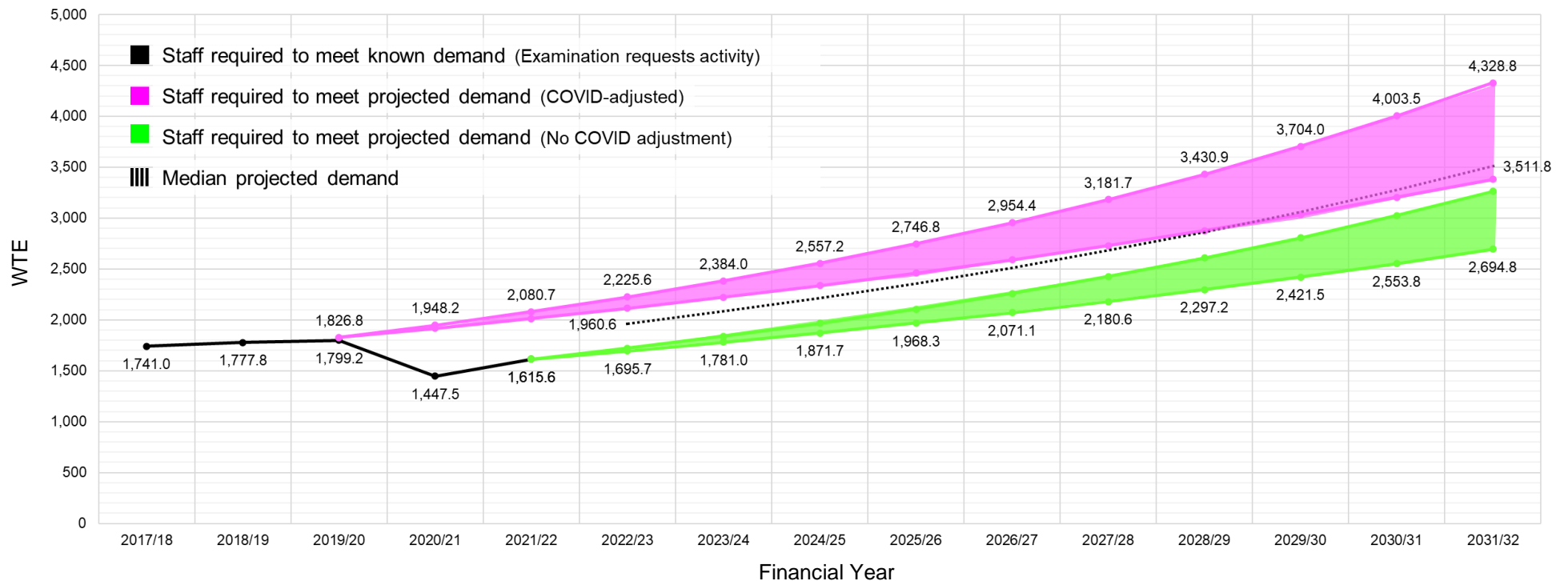
Diagnostic Radiographers of Bands 5 to 7 have been modelled together, excluding those of Band 7 estimated to be a Reporting Radiographer or Sonographer who have been calculated separately. This is because the workforce pipeline for image acquisition commonly begins with staff entering at Band 5 and feeds upwards as other staff develop and advance their practice into areas such as cross-sectional imaging and leadership.

Bands 5 and 6 staff are modelled based on modality throughput metrics detailed in [Appendix A](#). The modelling shown assumes 100% of all NM is undertaken by Radiographers, and a proportional requirement of 100% of the calculated workforce required for Interventional is needed in addition to cover Cardiology labs, although these can vary significantly depending

on site and can be adjusted within the tool. US is modelled separately and assumed to be wholly undertaken by Sonographers and Radiologists.

Band 7 staff (excluding Reporting Radiographers and Sonographers) are modelled as a proportion of the entire calculated diagnostic radiography workforce required – Bands 2 to 6 plus Reporting Radiographers and Sonographers – on the basis of their supervisory and management roles. The modelling shown assumes a 14% proportional requirement from an analysis of example working practice.

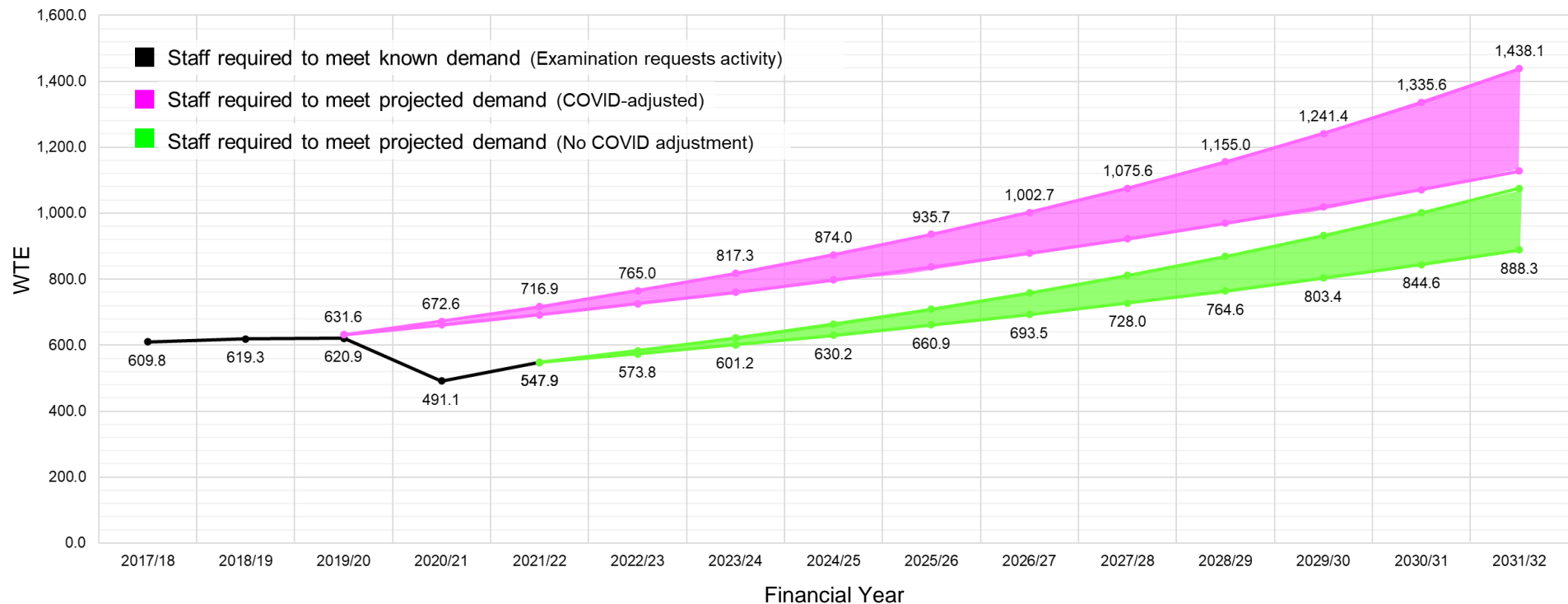
Figure 11: Projected WTE Diagnostic Radiographers (Band 5, Band 6, and Band 7 excluding Reporting Radiographers and Sonographers) required to meet demand



Diagnostic Radiography staff of Bands 2 to 4 have been modelled together. Bands 2 and 3 are modelled as a proportion of the calculated workforce required to undertake US, plus a proportion of the calculated Band 6 workforce required, to account for supporting modalities such as CT, MRI and interventional alongside US. The modelling shown assumes a 1:1 ratio with the calculated Sonographer and Consultant Radiologist workforce for US, plus 30% of the calculated Band 6 workforce, based on an analysis of example working practice.

Band 4 staff have been modelled as a proportion of the calculated Band 5 workforce required to account for covering general X-ray. The modelling shown assumes a 30% requirement.

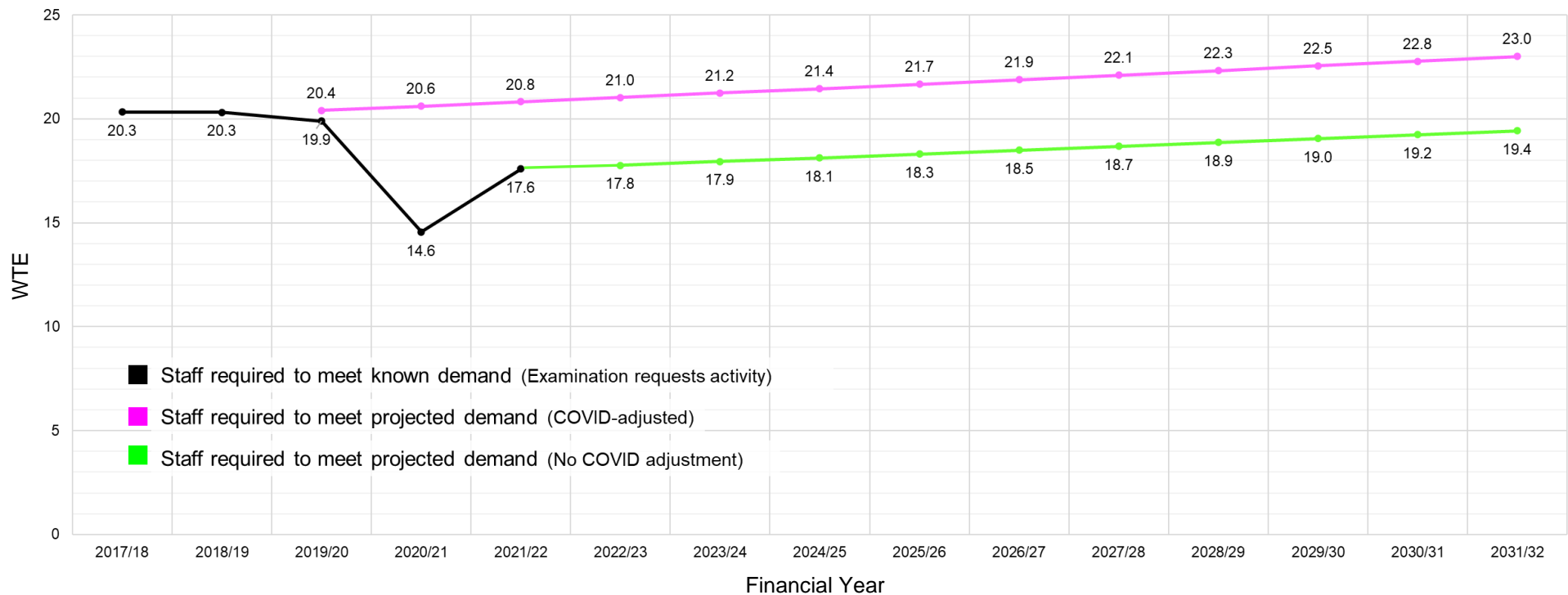
Figure 12: Projected WTE Diagnostic Radiography support workforce (Band 2 to Band 4) required to meet demand



Reporting Radiographers are modelled on the basis they spend 60% of their time reporting and undertake 30% of all MSK X-ray reporting. The actual reporting time available of the workforce in post and their reporting scope currently varies greatly between Boards, and requires survey questioning to capture information.

There is evidently reporting capacity available if sufficient staffing enables those Radiographers who can report, to report. There is also an opportunity to both standardise and expand the scope of Reporting Radiographers across NHS Scotland, and the resultant impact of this can be seen in [Figure 16](#).

Figure 13: Projected WTE Reporting Radiographers required to meet demand

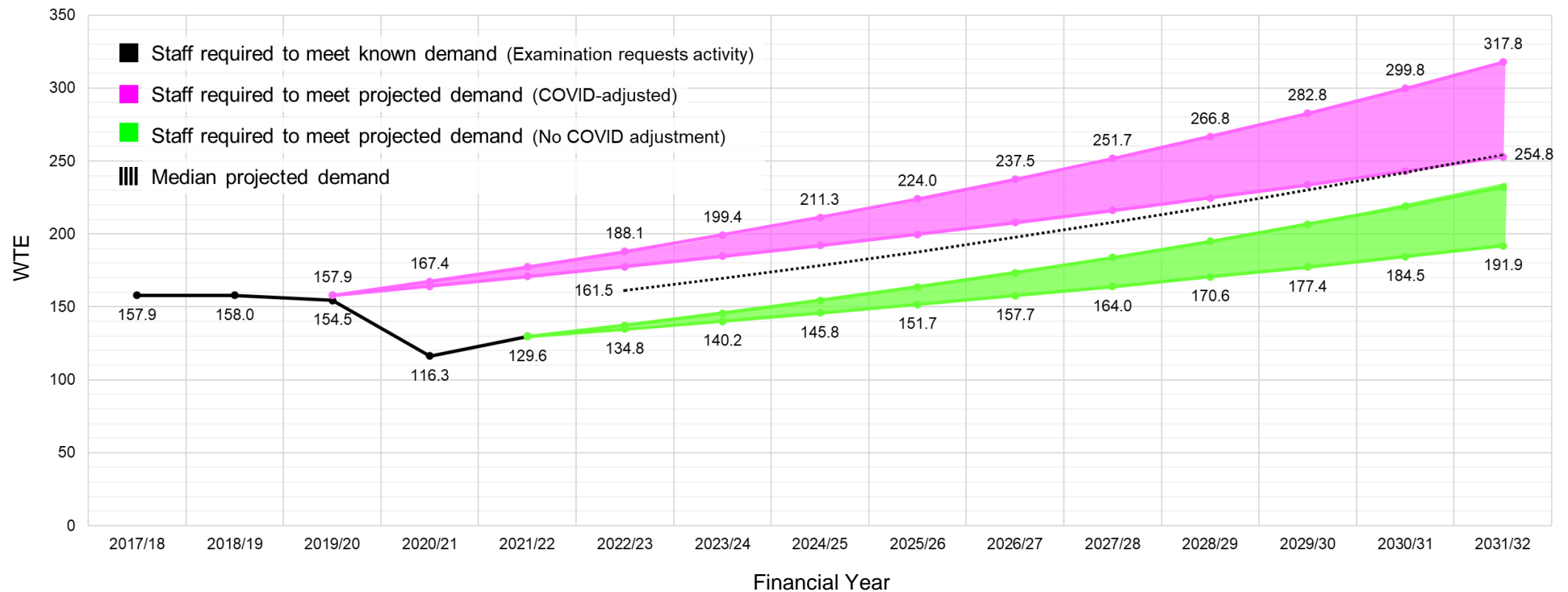


For Sonographers, like Reporting Radiographers, it is difficult at present to easily obtain accurate data regarding workforce and working practice can vary significantly between Boards in terms of throughput and split of exams undertaken.

The modelling shown is on the basis that Sonographers spend 85% of their available working time undertaking US, and undertake 90% of all US demand with an average throughput of 9 exams per session.

The 2021 paper National Ultrasound Service Provision: Demand, Capacity & Succession Planning²¹ - an early driver for the development of the National Ultrasound Training Programme within the NHS Scotland Academy - was used to inform modelling metrics where possible from Board survey submissions.

Figure 14: Projected WTE Sonographers required to meet demand



Future Workforce

The future imaging workforce will evidently require greater numbers of staff but will also need to embrace change to be able to adapt to variations in the type and increased quantity of demand.

- Increased demand for CT, MRI, NM, cancer imaging and sub-specialist reporting such as neurology, breast, and paediatrics will continue to require additional training and support for reporters
- Increased training places, provision of workstations to enable reporting at home, and use of insourcing will not be enough alone to meet the continually increasing demand from the many patient pathways that rely on imaging

Consultant Clinical Radiologists

While the role of Consultant Radiologists in diagnostic imaging may evolve with technological advances and changes to departmental skill mix, the demand for their expertise will continue as they are integral to interpreting diagnostic imaging results and providing critical information for patient care.

Consultants are trained as doctors, with experience of looking after patients on the ward and have a broad range of medical knowledge outside of their specialty which allows them to bring together a more holistic view in diagnosis in general, and comment at a professionally competent level on management strategies for the patient, unique to this reporting workforce.

Consultants' time is increasingly required to provide valuable contributions to multidisciplinary team meetings (MDTs), both cancer and non-cancer, to engage with clinicians to determine best management for patients. Alongside this, time is focused on reporting of sub-specialist complex examinations, and performing image-guided interventions such as biopsies and drainages which are standard radiology tasks not limited to Interventional Radiologists. Other responsibilities of the role include providing clinical leadership, supporting the training of Radiologists and Reporting Radiographers, and undertaking clinical research.

To help reduce the gap between imaging capacity and demand, it is essential to improve recruitment and retention of new Consultants and other staff as well as expanding training. Home working, flexible working, and out-of-hours outsourcing are likely to make jobs more desirable. Job planning should build in home working and offering a home workstation to all Consultants would be an adjunct to improving patient safety, reporting efficiency, and staff quality of life.

Advancements in teleradiology are enabling reporters to work remotely as part of a network, such as the SNRRS (Scottish National Reporting Radiology Service) Bank, and reducing the impact of geographical workforce disparity by providing equitable remote access to clinical expertise. Insourcing is beneficial to imaging reporting with regards to cost, governance, and specialist networks.

The rise of AI technology is also expected to change ways of working in the future, as automated algorithms can perform some image interpretation, creating a shift in work routines for Radiologists who will focus more on complex and unusual cases involving elevated levels of expertise, intervention, and judgement.

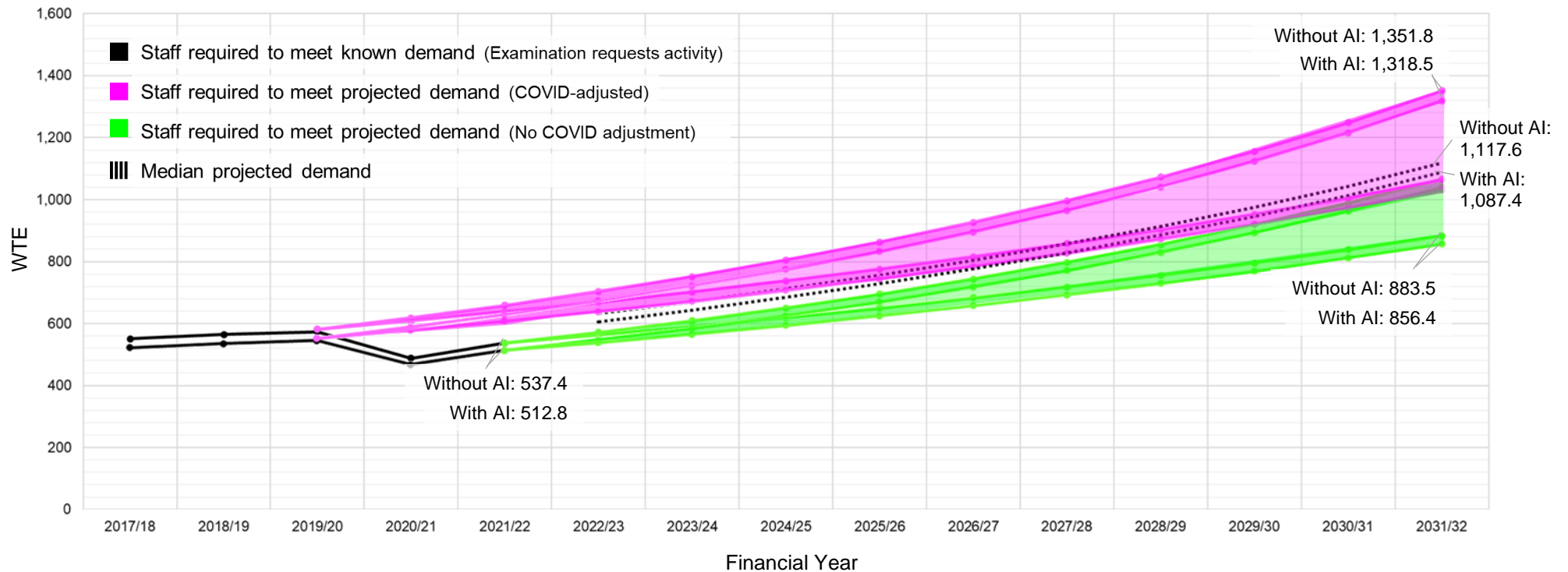
Adoption of Artificial Intelligence (AI)

AI products and improved technology have the potential to be increasingly adopted by imaging departments to improve throughput and quality of care for patients, but it will be some time before the benefits are fully realised. The projected impact of this adoption on the required reporting workforce also proves that AI is not a panacea for imaging demand, as may have been previously suggested.

Figure 15 demonstrates the difference in required Consultant Clinical Radiologists over the next 10 years, with and without implementation of AI products.

The Scottish Imaging Artificial Intelligence Steering Group provided information on the most probable scenarios in the coming years based on the products currently being piloted or available on the market. AI is therefore modelled to undertake 50% of all MSK X-ray reporting, 20% of all Chest X-ray reporting, and 100% of all DEXA reporting.

Figure 15: Projected impact of AI on WTE Consultant Clinical Radiologists required to meet demand



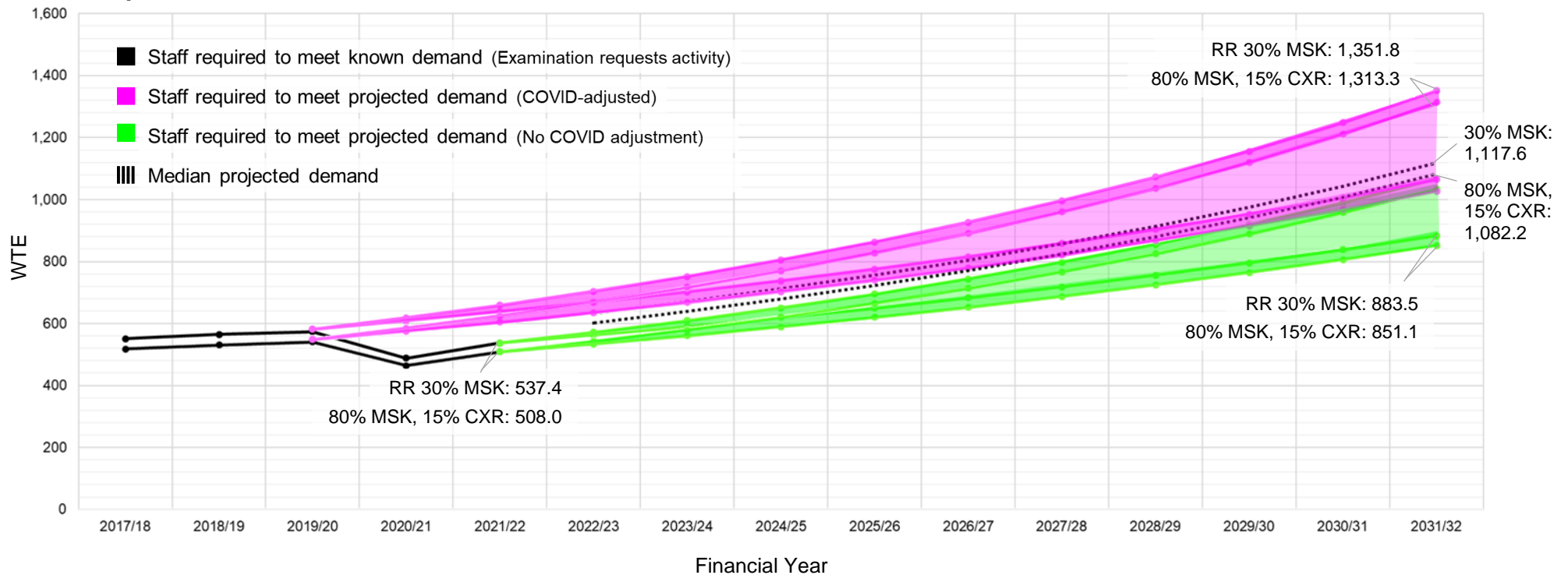
Increased Reporting Radiographer Scope

Increased training and utilisation of **Reporting Radiographers** is an effective way to provide reporting capacity and alleviate pressures related to the increasing demand which cannot be fulfilled by Consultant Radiologists or AI. This staff group is relatively inexpensive to train, although there is currently significant variation in the use and scope of Reporting Radiographers across Scotland.

A whole-service NHS Scotland approach to invest in a more consistent workforce can increase and support additional reporting capacity within relatively short timescales.

Figure 16 demonstrates the difference in required Consultant Clinical Radiologists if Reporting Radiographers cover 30% of MSK X-ray reporting (the current modelling scenario) versus if their scope and numbers increase to undertake 80% of MSK X-ray and 15% of Chest X-ray reporting. Figure 17 demonstrates the impact on required Reporting Radiographers.

Figure 16: Projected impact of increased Reporting Radiographers scope on WTE Consultant Clinical Radiologists required to meet demand



Increased Reporting Radiographer Scope (continued)

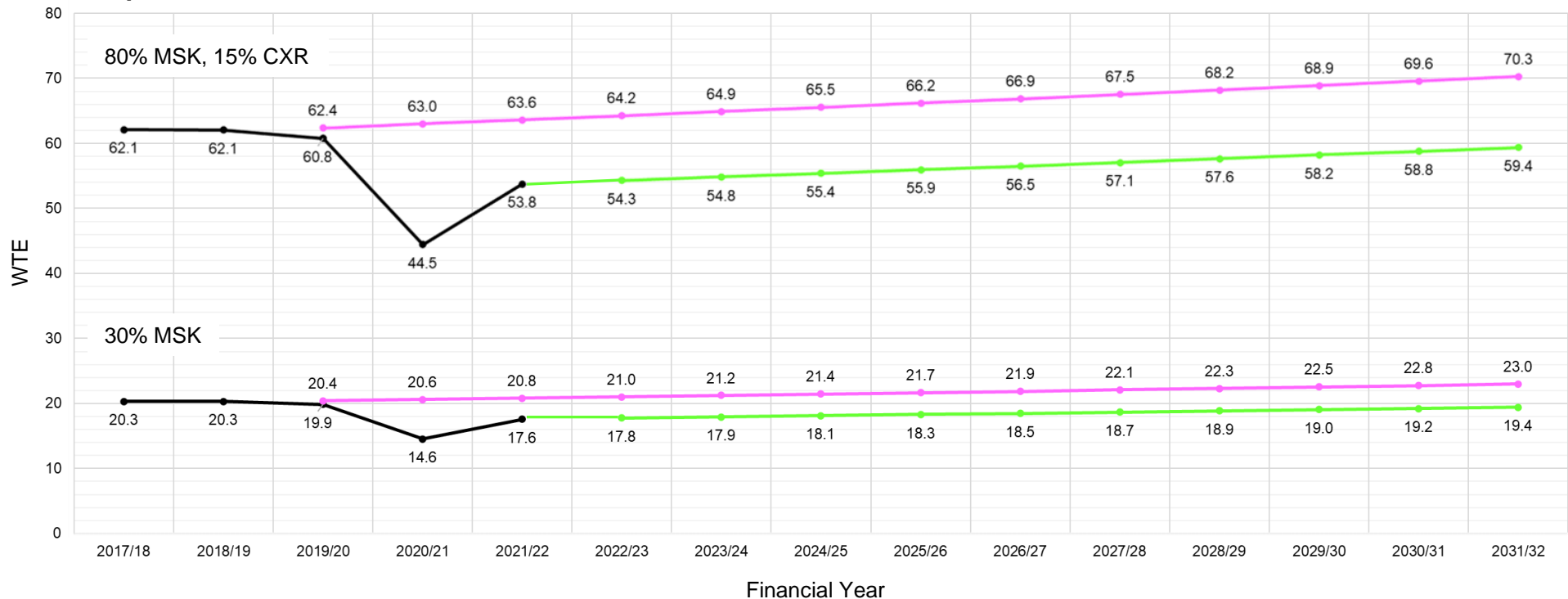
The scope increase demonstrated is based on recent figures from NHS Ayrshire & Arran, and comparable to the 2021/22 NHS England average of X-rays reported by Reporting Radiographers as presented by RCR.

It is worth noting that some UK sites report using Reporting Radiographers to cover nearly all X-ray reporting to enable more effective use of their Radiologist workforce, so there are clear opportunities to expand in terms of scope.

If Scotland followed what is being seen in England and Reporting Radiographers also undertook 3% of CT and 3% of MRI reporting, this would equate to a further release of around 10 WTE Consultant Clinical Radiologist capacity across the year based on examination requests activity for 2021/22. From the projected demand, by 2031/32 this freed capacity would grow to between 20 WTE and 25 WTE Consultant Radiologists.

Any increase in scope would need to consider possible impacts of AI that could negate the required reporting and allow sufficient provision of reporting for trainee reporters.

Figure 17: Projected impact of increased Reporting Radiographer scope on WTE Reporting Radiographers required to meet demand



As CT and MRI scanning services increase, in line with the additional outpatient demand to meet waiting time guarantees, the additional specialised radiography posts required are depleting the Band 5 **Radiographer** numbers, as they are typically promoted to Band 6 posts when trained in cross-sectional imaging. Band 5 Radiographers are often newly qualified and provide the 24/7 frontline services required including A&E, theatre, and inpatient imaging acquisition. Effective recruitment, training, and retention of staff at Band 5 is essential for service sustainability and to supply the upwards pipeline of diagnostic radiography staff.

Increased training and utilisation of **Assistant Practitioners**, who work at Band 4, would provide additional capacity as they can undertake much of the more routine imaging examinations required daily in support of Band 5 Radiographers. Increasing numbers and developing their scope of practice, in combination with implementing recommendations such as Earn As You Learn and conversion modules, would also contribute towards a more attractive progression throughout the diagnostic radiography workforce as a whole, and provide better service sustainability.

The actual capacity available to undertake non-obstetric ultrasound continues to be a significant challenge, contributed to by an ageing workforce, attraction of private sector roles, and an inability to recruit sufficient **Sonographer** numbers to reduce waiting times and sustain the future service required. Urgent succession planning, including further expansion of the National Ultrasound Academy, feasibility of Sonographer banks, and an increase in training places across Scotland, will be essential to fill the staffing capacity gap and improve patient care.

Leadership training within imaging services is another area that would benefit from substantial development to ensure there are suitable candidates to provide succession into new and existing Radiology Manager, Clinical Director, and Specialty and Modality Lead roles. Leadership is essential at all levels, and the right behaviours, competencies, skills, and education are vital to enhance the future imaging workforce in Scotland ²².

Healthcare Support Workers (HCSW) play a key role in supporting the high level of patient care required prior to, during and after imaging and interventional procedures. In some sites they are instead identified as **Radiography Department Assistants** (RDA). A chaperone is required for every ultrasound examination to support the Sonographer or Radiologist and patient during what are often intimate procedures. This is not always possible due to a lack of HCSW/RDA staff who are also required to support patients attending for X-ray, interventional, CT and MRI. Greater provision of the HCSW/RDA role will enable Radiographers, Radiologists and Sonographers to be more effective and improve patient safety and throughput.

Better utilisation of capacity can also be achieved by streamlining booking systems, in collaboration with **e-Health** colleagues. By including patient appointment choice, email confirmation, and texting reminders, the rate of patients who did not attend (DNA) appointments and the resultant costly wasted capacity could be greatly reduced. **Administrative and Clerical** staff who are experts in the patient booking processes can manage patient scanning lists and answer patient enquiries, and, with the required numbers and skills, can also be further utilised to free up Radiologist, Radiographer and Sonographer clinical time.

Step 4: Workforce Capacity and Capability

Diagnostic Imaging departments are staffed by multi-disciplinary teams with a range of roles and skills to provide a safe and effective service for patients. Robust team working underpinned by relevant professional education and strong governance enables roles and responsibilities to be shared across professional groups to deliver cost-effective, high-quality clinical imaging services, with real benefits for both patients and referrers²³.

The patient pathway into diagnostic imaging starts with a referral from a suitably qualified **medical** or **non-medical professional**.

Administrative and Clerical staff are responsible for direct communication with patients and appointment booking arrangements at all stages of the patient journey.

Radiology Services Managers, Clinical Directors, and Team Leads provide the guidance and supervision required in all departments to ensure adherence to national and local policies, service planning, and day to day management.

Radiologists provide approval for, and any required supervision of, imaging procedures and communicate directly with referring clinicians and their patients both pre- and post-imaging acquisition. Radiologists undertake image reporting and interventional procedures, which can be required 24/7. Their input at multi-disciplinary team (MDT) meetings is also key to supporting a patient's diagnosis and treatment plan.

Clinical Support staff are essential in assisting imaging staff with the preparation of patients and providing post-examination care and comfort.

Diagnostic Radiographers, Assistant Practitioners and Sonographers are responsible for undertaking the majority of image acquisition procedures, which involve direct patient-facing care and can be required on a 24/7 basis. They also undertake quality and safety measurements and procedures required daily to guarantee a safe imaging service for patients.

Advancing Practices - such as MSK and Chest X-ray reporting, CT Colonography, and US-guided breast biopsy - are undertaken by suitably trained and qualified **Consultant Radiographers, Highly Specialised Radiographers, and Sonographers**.

Specialist Nurses are employed in diagnostic imaging departments to provide direct patient care, particularly during interventional procedures, and are also key in providing staff training and immediate response to emergencies or urgent patient care.

PACS and RIS are managed within imaging departments by dedicated staff with the required IT skills, often with a clinical or administrative radiology background, who are essential in maintaining, supporting, and developing the infrastructure required to enable safe image acquisition, reporting, and distribution 24/7.

Medical Physics Experts are required by law to confirm all ionising radiation examinations undertaken and imaging equipment are safe for patients and staff, amongst other duties. Medical Physics also provide **Radiation Protection Advisors, Radioactive Waste Advisers** and **Magnetic Resonance Safety Experts** to ensure compliance in all imaging departments, and **Clinical Technologists** who can also undertake NM imaging procedures.

Patient transfer to and from imaging departments is dependent on **Porters** who can be employed directly within radiology.

Clinical Radiology Workforce Profile ²⁴

Unless otherwise stated data as at 30 September 2022, WTE, Consultant grade only



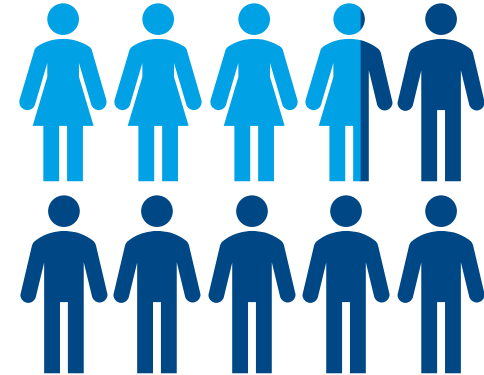
365.4 staff in post
(389 Headcount)



21.7 vacancies

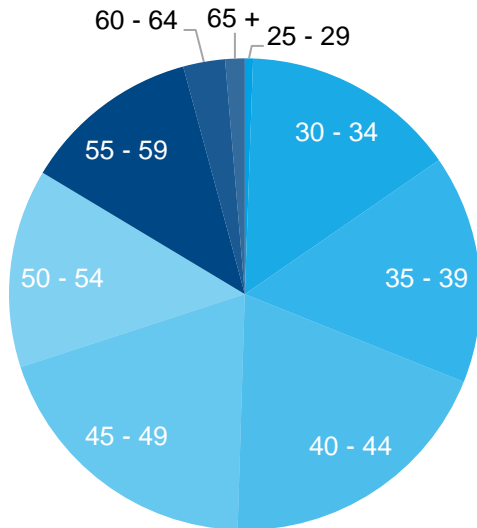


14.7% of staff are part-time

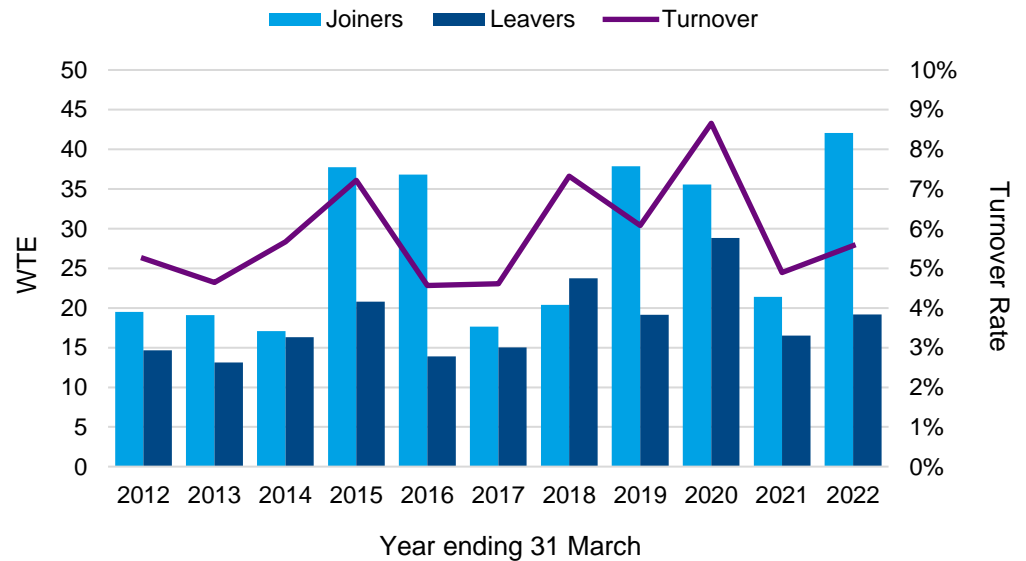


37.1% are female

62.9% are male



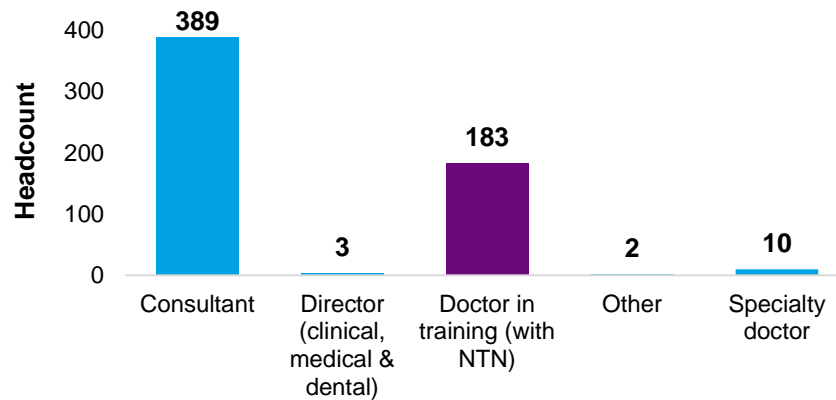
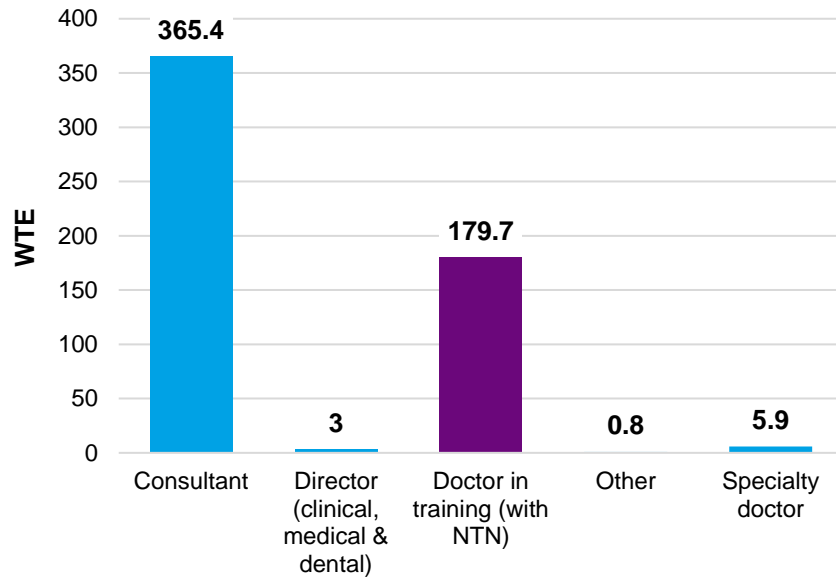
16.4% are age 55 and over
(as at 30 September 2021)



Between April 2021 and March 2022, **19.2 WTE** (21 Headcount) left Consultant Radiologist posts across NHS Scotland, and turnover was **5.6%**, an increase on the previous year when it stood at **4.9%**.

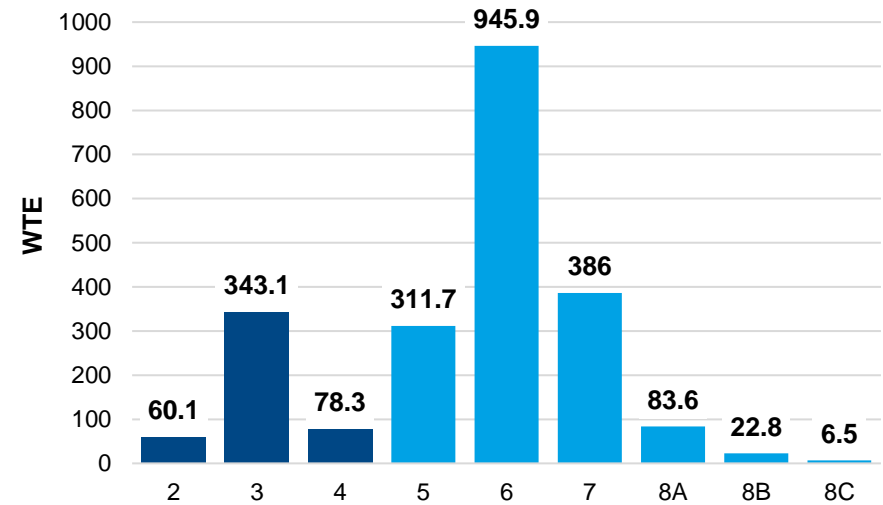
Clinical Radiology Workforce Profile ²⁴

Data as at 30 September 2022, Staff In Post by Grade



Diagnostic Radiography Workforce Profile ²⁴

Data as at 30 September 2022, Staff In Post by Agenda for Change Band



Of all WTE diagnostic radiography staff in post, **21.5%** are in support roles and **78.5%** are in qualified roles

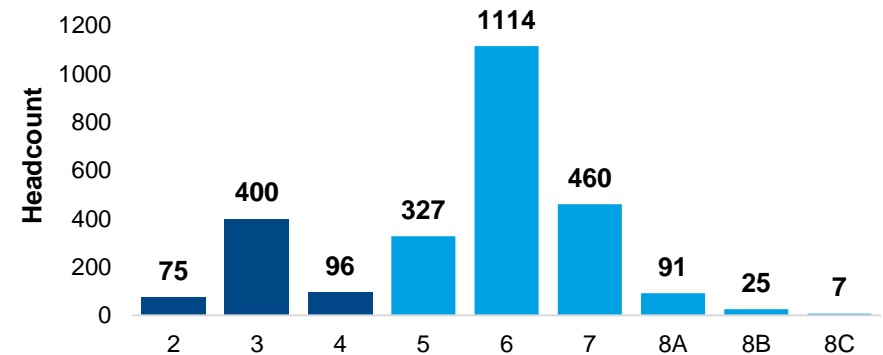
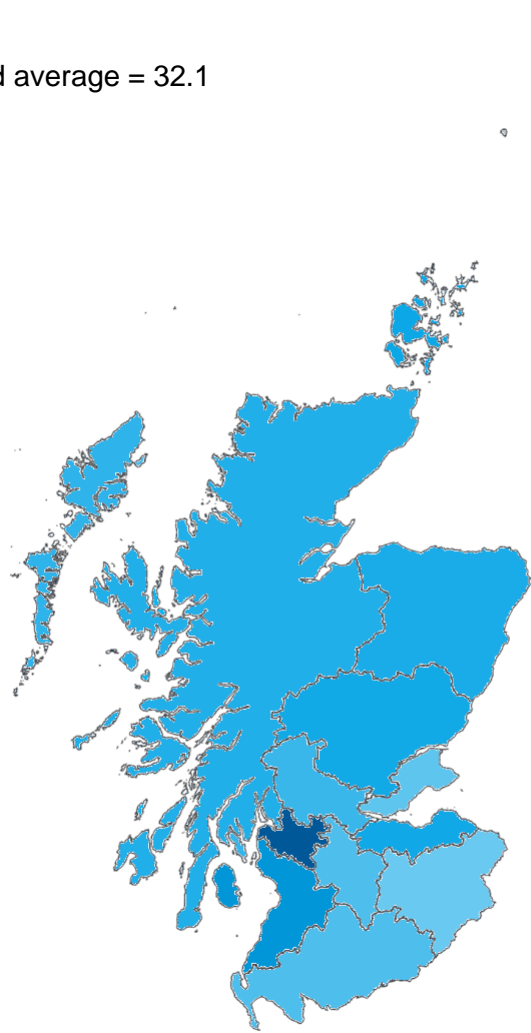


Figure 19: Ratio of WTE Qualified Diagnostic Radiographers in post as at 30 September 2022 per 100,000 population

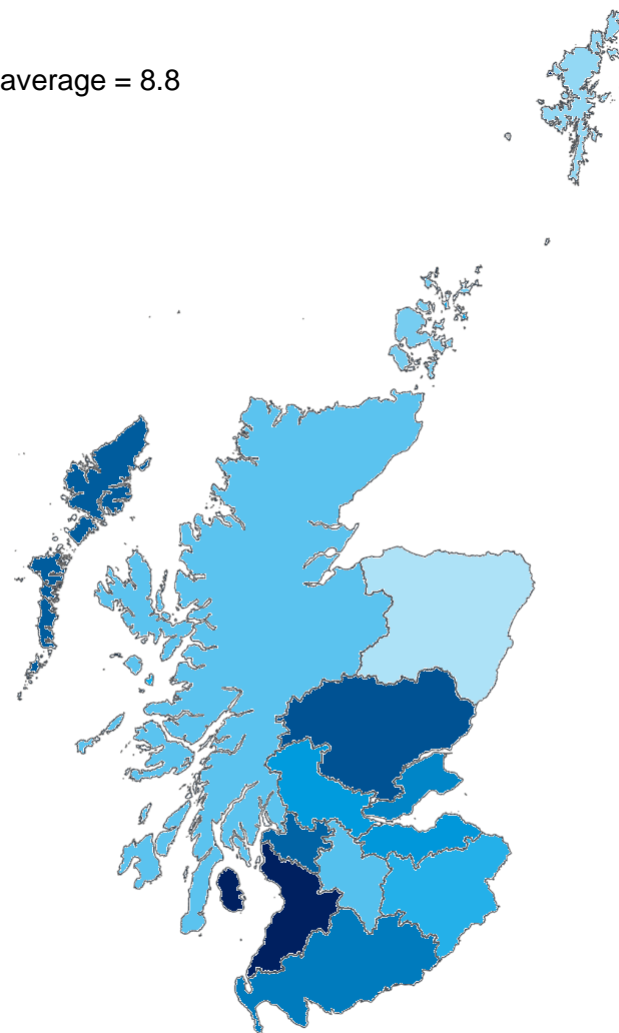
Scotland average = 32.1



Sources: National Records of Scotland ¹¹, NHS Education for Scotland ²⁴

Figure 20: Ratio of WTE diagnostic radiography support staff in post as at 30 September 2022 per 100,000 population

Scotland average = 8.8



Sources: National Records of Scotland ¹¹, NHS Education for Scotland ²⁴

Qualified Diagnostic Radiography Workforce Profile ²⁴

Unless stated otherwise data as at 30 September 2022, WTE, Qualified (Band 5 to 8)



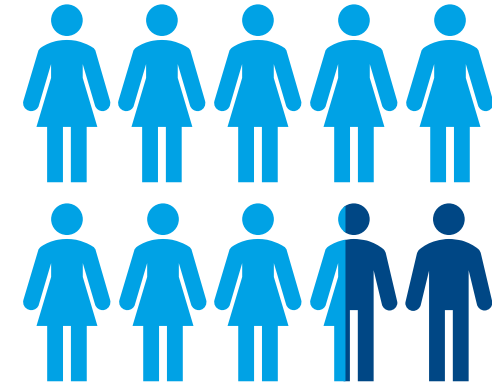
1,756.5 staff in post
(2,013 Headcount)



223.0 vacancies

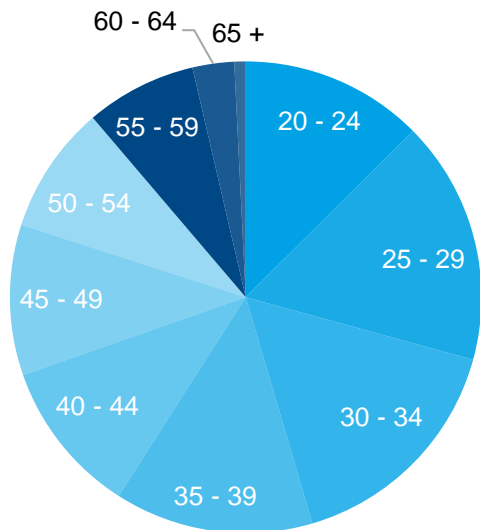


27.5% of staff are part-time

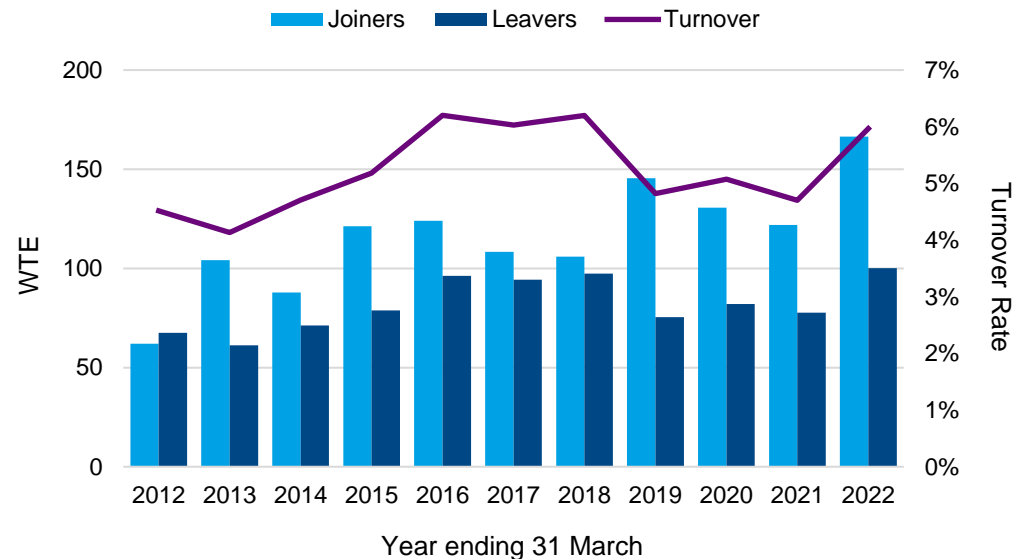


83.6% are female

16.4% are male



11.2% are age 55 and over
(as at 30 September 2021)



Between April 2021 and March 2022, **100.2 WTE** (118 Headcount) left qualified diagnostic radiography posts across NHS Scotland, and turnover was **6%**, an increase on the previous year when it stood at **4.7%**.

Support Diagnostic Radiography Workforce Profile ²⁴

Unless stated otherwise data as at 30 September 2022, WTE



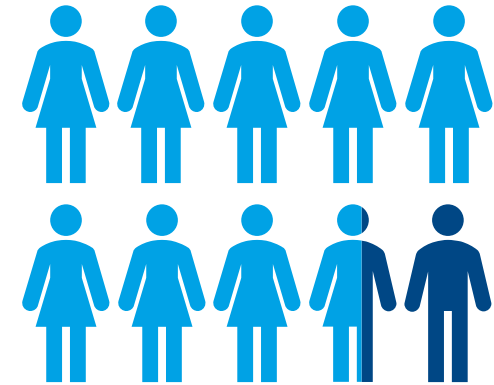
481.6 staff in post
(566 Headcount)



10.4 vacancies

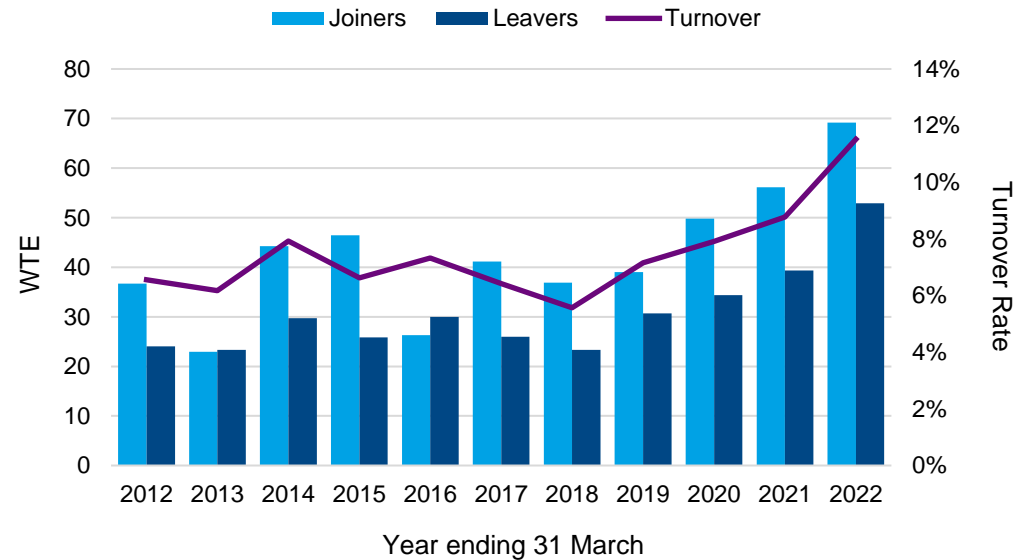


34.2% of staff are part-time



88.3% are female

11.7% are male



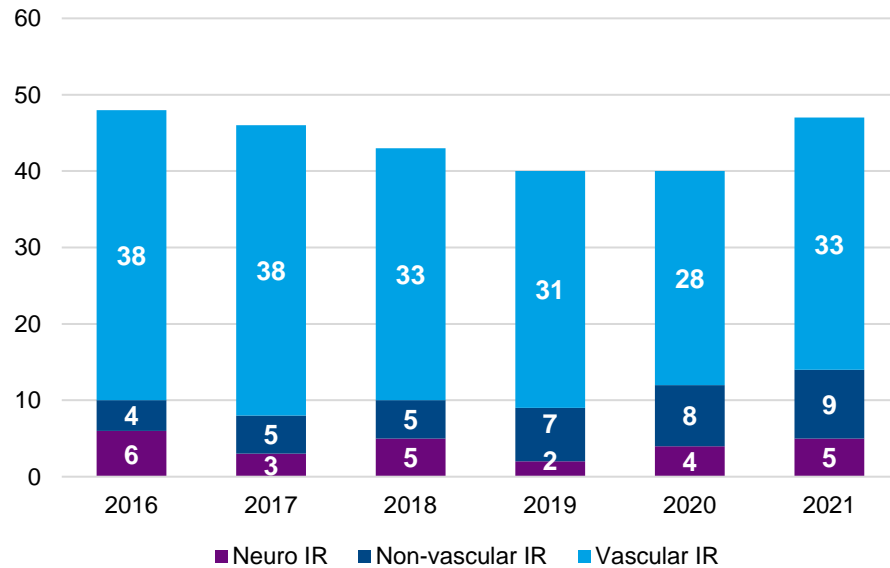
Age data not available for Support (Band 2 to 4) diagnostic radiography workforce

Between April 2021 and March 2022, **52.9 WTE** (65 Headcount) left support diagnostic radiography posts across NHS Scotland, and turnover was **11.5%**, an increase on the previous year when it stood at **8.8%**.

Interventional Radiology Workforce Profile

Interventional Radiologist workforce data is reliant at present on the figures collected from Boards for the annual RCR census, as it cannot currently be isolated from the published NES workforce statistics. As of 2021 there were 47 WTE Interventional Radiology (IR) Consultants in post across NHS Scotland.

Figure 21: WTE Interventional Radiology Consultant employment trend in Scotland by primary interest



Source: RCR ¹

The RCR guidelines state a minimum requirement of 6 WTE IR Consultants per NHS Board to provide a fully staffed 24/7 rota for an interventional radiology service, or a minimum requirement of 8 WTE to serve populations greater than 1 million.

NHS Borders and the islands Boards have formal arrangements in place with another Board to provide IR cover. NHS Greater Glasgow & Clyde and NHS Lothian both cover populations greater than 1 million.

NHS Scotland therefore has a minimum requirement of 64 WTE IR Consultants to provide a fully staffed 24/7 rota, not accounting for any additional workforce required to meet IR demand above this capacity. The figures as at 2021 demonstrate an over 26% shortfall within NHS Scotland against this minimum requirement.

A recommendation has been made ([Step 5 and 6](#)) to obtain more comprehensive data on this staff group to allow for more detailed forward planning.

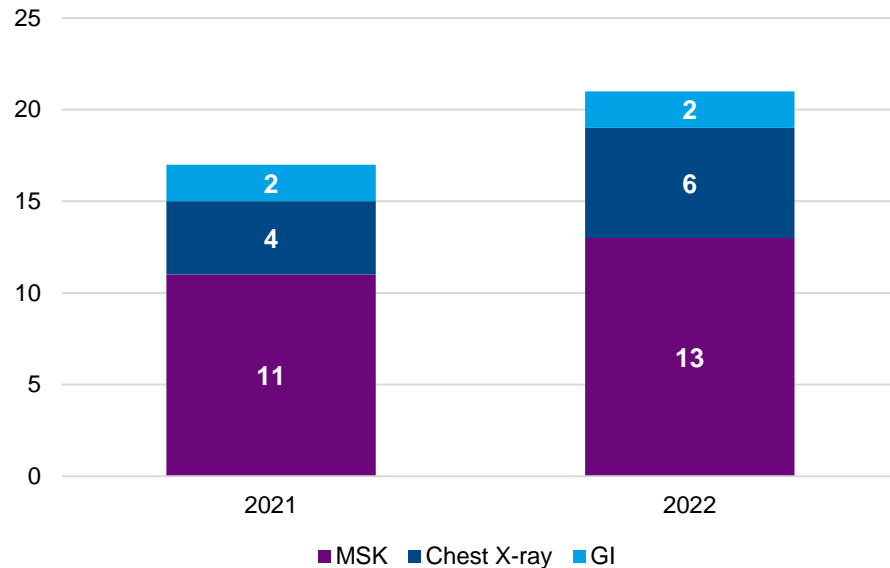
Reporting Radiographers

A data breakdown by NHS Board from the available workforce figures can be found in [Appendix C](#). There are currently around 40 WTE Reporting Radiographers in post across Scotland, although the actual reporting WTE as per job plans is not known at present. Recommendations have been made to undertake further work alongside RRIGS and SCIN to better determine, and develop, the numbers and scope of Reporting Radiographers.

As referenced in the NHS Recovery Plan ⁷, funding was made available by the Chief Nursing Officer's Directorate (CNOD) of the Scottish Government to train an additional 30 Reporting Radiographers over three years by 2023. SRTP facilitated distribution of this funding, and in response to service needs and demand a total of 38 Reporting Radiographers were funded to enable training in MSK, Chest X-ray and Gastrointestinal Tract radiography (GI), as seen in [Figure 22](#).

From qualification, Service Managers suggest it takes around 18 months for a Reporting Radiographer to reach optimal reporting performance.

Figure 22: Breakdown of additional funded Reporting Radiographer training places

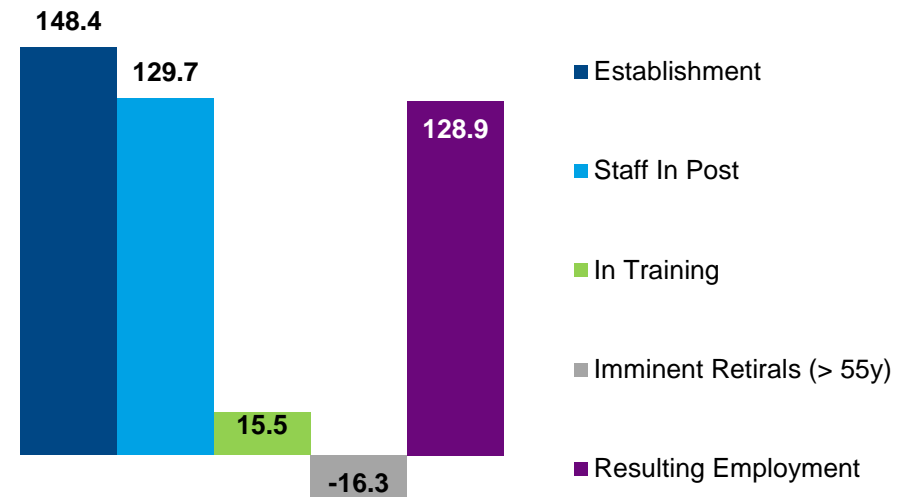


Funding was linked to the provision of a substantive post for Reporting Radiographers on completion, however due to budgetary pressures, not all candidates who have completed training have a full-time post yet. An exercise is underway to determine the impact the training has had, both in terms of the individuals, the service and ultimately the patient. This will help inform the decision about future training funding and the value of developing the scope of existing staff.

Sonographers

A data breakdown by NHS Board can be found in [Appendix C](#), from the workforce figures that are currently available. Of the 129.7 WTE Sonographers reported as being in post, it is unclear what proportion remain in active employment as opposed to being on long term sickness absence or maternity leave - anecdotally this figure is significant.

Figure 23: WTE Sonographer workforce forecast, 2021



Source: National Ultrasound Service Provision ²¹

Using the present data results in misrepresentative modelling in comparison to what would be expected from conversations with those in the service. Again, recommendations have been made to improve the accessibility and quality of sonography workforce data to facilitate future planning. Effective succession planning will be key to tackling US demand.

To boost ultrasound training numbers across Scotland a National Ultrasound Training Programme was established in 2022 in collaboration between the NHS Scotland Academy, SRTP, Scottish Government and Glasgow Caledonian Academy. It provides dedicated mentorship and practical support to facilitate additional training opportunities without negatively impacting Board staffing levels, and future expansions aim to specifically target remote and rural learners through a hub and spoke model.

Workforce Forecasting

NES has provided ten-year employment forecasts for Consultant Clinical Radiologists and Qualified (AfC Bands 5 to 8) Diagnostic Radiographers. Predicted inflows and outflows of staff, including expected graduates and retireals, are used to determine the employment level.

These forecasts have been incorporated into the modelling to demonstrate the projected gap between demand and capacity as shown in [Step 5](#).

Increased training places, more flexible working, and improved recruitment, retention, and utilisation of staff nearing retirement could all ameliorate the size and shape of the future workforce available. Detailed recommendations are also given in [Step 5](#).

Source: NHS Education for Scotland ²⁴

Figure 24: Employment forecast for Consultant Clinical Radiologists, WTE

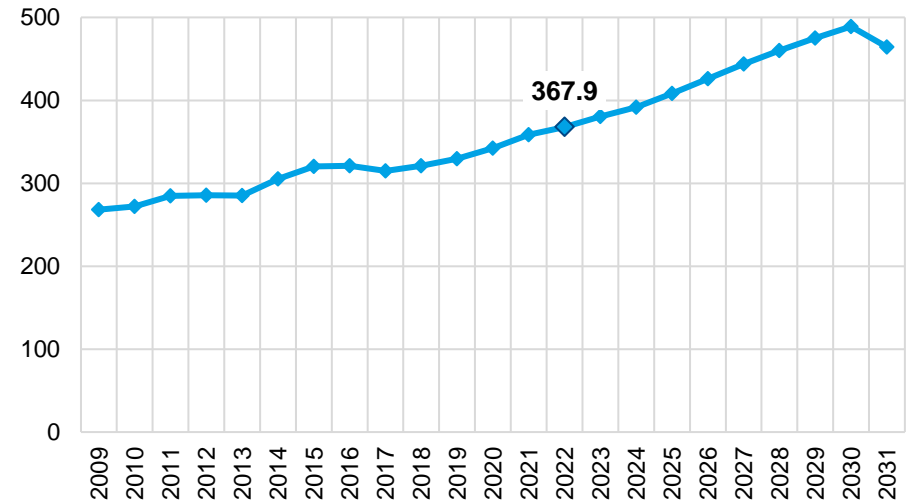
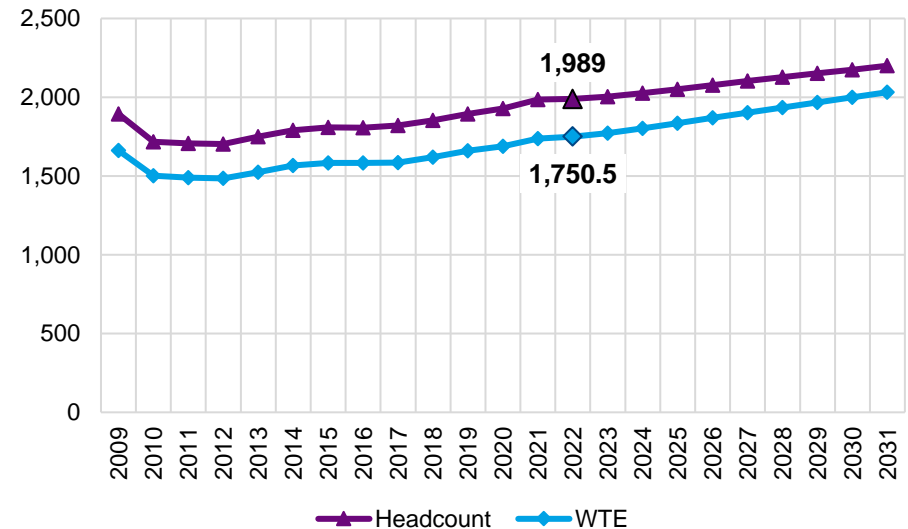


Figure 25: Employment forecast for Qualified Diagnostic Radiographers, WTE and Headcount



NES forecasts were not available for Clinical Scientist and Clinical Technologist staff who work within diagnostic imaging and across the nuclear medicine service, mainly due to the inability at present to separate this cohort from the full workforce dataset.

Estimated forecasts have been provided by the Scottish Nuclear Medicine Scientific Leads Group, Scottish Radiation Protection Advisers Group, and MRI Physics group. Recommendations have been made (Step 5 / 6) for further work to be undertaken to enable more detailed workforce planning and modelling for these staff groups.

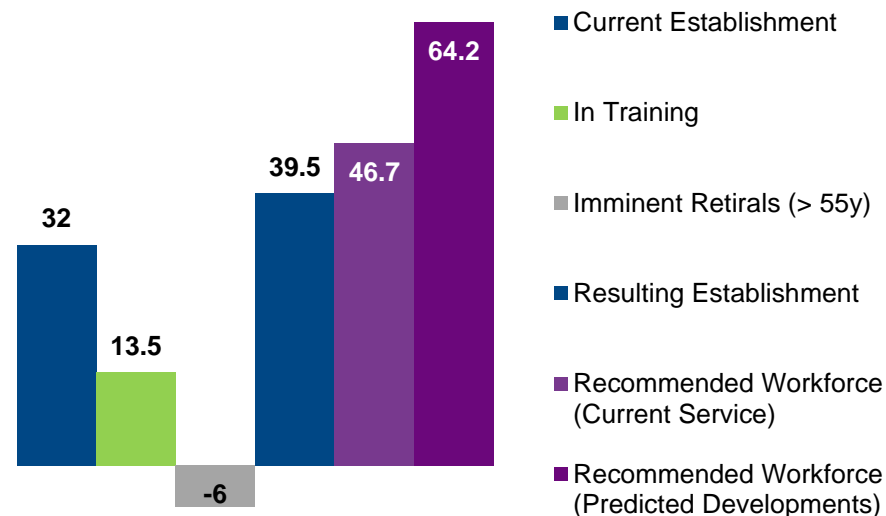
A data breakdown by Health Board can be found in Appendix C.

Nuclear Medicine Medical Physics Experts

In the UK, MPE forecasts for nuclear medicine are informed by the Institute of Physics and Engineering in Medicine (IPEM) recommendations²⁵, and have been combined with predicted increases in demand from known developments to the service, such as rising demand for PET-CT. Assuming satisfactory completion of training and no drop out or staff movement, and factoring in those expected to retire, within the next few years there should be an establishment of 39.45 WTE.

As seen in Figure 26, assuming all posts are filled this puts the imaging service at a shortfall of 7.2 WTE against the recommended levels of support. When accounting for the expected demand from changing patient pathways this shortfall grows to 24.7 WTE, or 32.2 WTE against the current workforce figure.

Figure 26: Medical Physics Experts forecast for nuclear medicine provision, WTE



Sources: IPEM²⁵, Scottish NM Scientific Leads Group

Securing funding and capacity to train additional staff, and backfill any internal clinical scientist posts they develop from, will be essential to sustain a safe and high-quality nuclear medicine service across NHS Scotland.

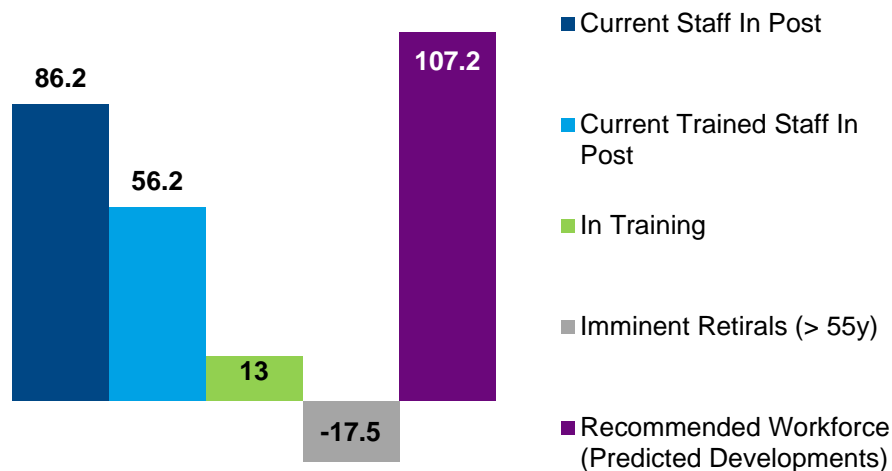
Nuclear Medicine Clinical Technologists

Certain sites and Boards across Scotland predominantly use a Radiographer workforce within nuclear medicine, as opposed to Clinical Technologists, and these staff are not included in the following analysis.

For technologists within nuclear medicine there are currently 69.18 WTE staff in post, as shown in Figure 27, 13 of whom are

currently in training and therefore cannot work without supervision. Including the trainees gives a current vacancy rate of 20%, growing to a vacancy rate of 40% when factoring in expected imminent retirements over the next few years if no or limited succession planning is put in place to train and recruit more staff.

Figure 27: Clinical Technologists forecast for nuclear medicine provision, WTE



Source: Scottish NM Scientific Leads Group

Factoring in the expected increase in demand across nuclear medicine alongside the trainees and retirements results in a shortfall of 38 WTE staff in post. Again, securing funding and capacity to train and recruit additional staff will be essential to sustain a safe and high-quality nuclear medicine service across NHS Scotland.

Diagnostic Radiology Medical Physics Experts

The revised Ionising Radiation (Medical Exposures) Regulations (2017) (IRMER) significantly increased the range of mandatory duties specified in the legislation and increased the degree of involvement expected of Diagnostic Radiology MPE with regard to CT and interventional radiology.

Current staffing levels of MPE in Scotland are significantly below that recommended by European guidelines ²⁵, as illustrated in [Figure 26](#) and [Figure 28](#).

In addition to the increasing regulatory demand on MPE, there has also been a significant increase in the installed base of highly complex X-ray equipment since the role was first established in 2000.

HIS, the designated enforcement authority in Scotland, have at recent inspections questioned the level of MPE support provided to Boards and necessitated plans to evaluate how resource may be adequately provided in future.

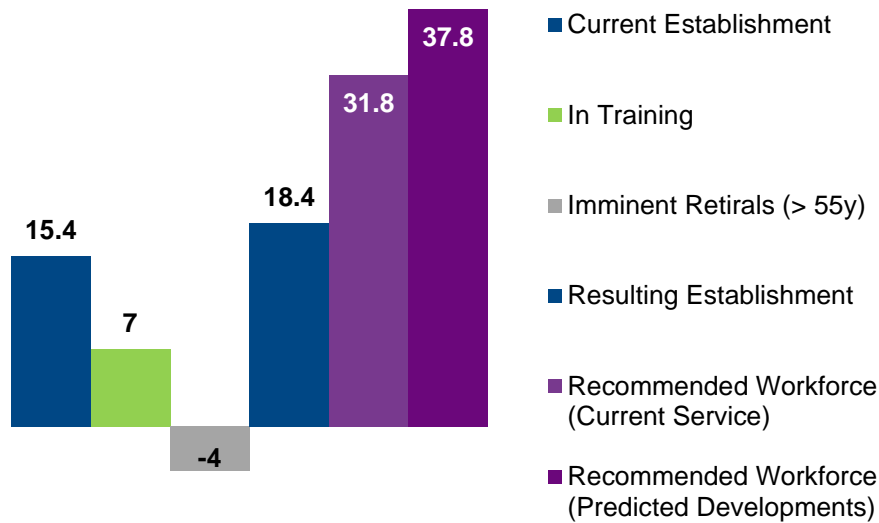
There are currently 15.4 WTE Diagnostic Radiology MPE established posts across Scotland. For the existing equipment and service profile, the recommended guideline calculations indicate a 51.6% shortfall in the number of posts. When calculating against the forecast service need over the next five years this shortfall increases to 59.3%.

Current MPE resource across NHS Scotland is evidently insufficient to meet the increasing regulatory demands being placed upon it.

Diagnostic Radiology MPE have also had to respond to the growth in imaging service provision, including a key role in

supporting CTCA expansion in terms of optimisation and dosimetry, the increasing complexity of equipment, and are expected to advise on new technologies such as AI and deep learning methods employed by new equipment.

Figure 28: Medical Physics Experts forecast for diagnostic radiology provision, WTE



Sources: IPEM²⁵, Scottish Radiation Protection Advisers Group

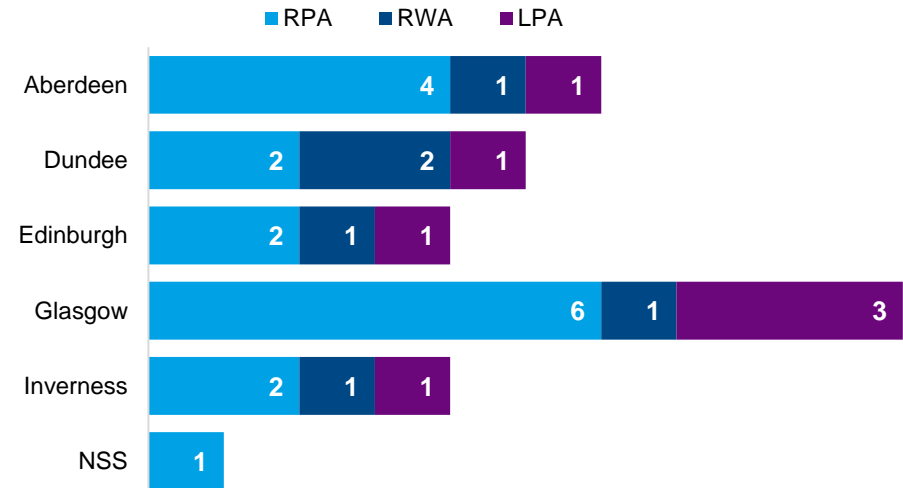
The training requirements for MPE certification are significant, time-consuming, and require support and guidance from existing MPEs. Efforts to increase recruitment are essential to the long-term viability of services, and an expansion of DR MPE numbers can only be achieved from an enhanced base of HCPC-registered Medical Physicists within the diagnostic radiology and radiation protection specialism.

Diagnostic Radiology RPA and RWA

The majority of DR MPE also fulfil the roles of one or more of Radiation Protection Adviser (RPA), Radioactive Waste Adviser (RWA), and Laser Protection Adviser (LPA). Additional workload required of one role will adversely affect the others and must be considered when calculating future workforce requirements.

Figure 29 gives an indicative headcount of staff with roles in addition to MPE, as provided within the five radiation protection centres in Scotland and the Scottish Breast Screening Programme. NHS National Services Scotland (NSS) have one additional RPA currently in training.

Figure 29: Radiation Protection Staff appointed to roles other than MPE, Headcount



Source: Scottish Radiation Protection Advisers Group

RPA, Diagnostic Radiology MPE and RWA are all critical to the current and future provision of diagnostic imaging in Scotland and require sufficient investment of experienced clinical physicists.

MRI Physics

There are several initiatives – exemplified below - that are increasing the demand for MRI Physics support across the NHS, and a push to provide some services more locally to the patient rather than having to travel to a tertiary or specialist centre. MRI Physics staff would be a key component to establishing and supporting this increase in breadth and depth of service across Scotland.

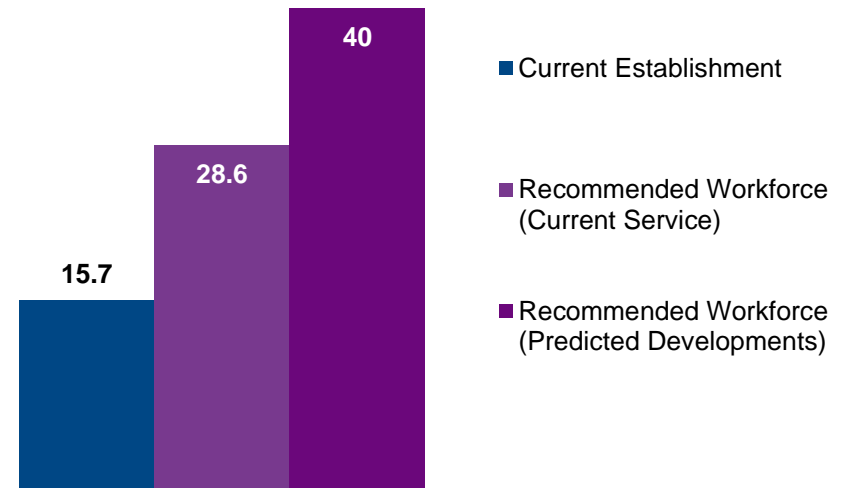
- Increased investment in MRI scanners
- Development and implementation of advanced techniques requiring physics support within the clinical environment (such as intra-operative MRI, advanced neuro MRI, implementation of AI techniques for faster or higher resolution scanning)
- Increased numbers of MRI safety issues and enquiries, particularly concerning patients with implants
- Increased demand for clinical MRI research support within NHS departments

IPEM developed and distributed a recommended minimum staffing levels calculator to review MRI Physics staffing levels across the UK. [Figure 30](#) summarises the individual responses received from each MRI Physics department across NHS Scotland.

Currently there are a total of 15.7 WTE MRI Clinical Scientists, including 10.7 WTE Magnetic Resonance Safety Experts (MRSE), and no imminent retirements. Against the recommended

minimum staffing levels this equates to a shortfall of 12.9 WTE, growing to a shortfall of 24.3 WTE when factoring in the expected increase in demand and equipment over the next three years.

Figure 30: MRI Physics recommended minimum staffing levels, WTE



Sources: IPEM²⁶, Scottish MRI Physics Group

In a previous workforce planning exercise in 2014, IPEM recommended that an adequately supported service requires between 0.67 and 1.25 WTE MRI Clinical Scientists per scanner, and also recommended taking into account the provision of advanced techniques when defining minimum staffing levels.

NHS Scotland currently has 52 MRI scanners, with more planned, which would equate to between 35 and 65 WTE MRI Physics staff required to adequately support these scanners.

MRI is a rapidly expanding field with an increasing number of scanners, increasing scanning hours, more complex techniques, and increasing complexity of implants to be scanned. There is also a drive to increase MRI capacity, and sufficient staffing would enable MRI Physics to support this while maintaining safety through the introduction of advanced acceleration techniques.

Securing funding and capacity to train additional Clinical Scientists will be critical to achieving the increase in MRI Physicists and MRSEs required to safely support and sustain the diagnostic imaging service across NHS Scotland.

Key Challenges

There are many current challenges to identify and address when planning the future of the Scottish diagnostic imaging workforce. This list is not exhaustive but will help provide an understanding of the current position and barriers faced in developing and expanding imaging services that are very reliant on a highly skilled workforce with the required numbers in post.

- **Recruitment and Retention**

Recruitment into imaging services is dependent on having an adequate supply of trained staff available, and the ability to successfully attract these staff into NHS Scotland roles. There is a challenge in ensuring this supply is both consistent and can accommodate the required numbers of applicants to fill the increased number of posts required to meet demand. There is growing competition from other countries that may be perceived as having more to offer current and newly qualified staff, and

internal competition between imaging departments and NHS Boards that can create staff shortfall, often in the smaller sites.

Retention of staff is impacted by the unsustainably increasing workload, exacerbated by COVID-19 and influencing decisions to retire early or change career, although the rising cost of living may be resulting in some staff returning to work or increasing hours. Imaging staff may also be disillusioned as they do not see the required resources being applied to support diagnostic imaging development that is required for providing safe and effective patient services.

- **Remote and Rural**

Recruitment of diagnostic imaging staff into more remote and rural locations continues to present a challenge, despite the recognisable lifestyle benefits. Newly qualified staff often seek to work in a department that can provide them with the speciality training and potential career advancement they desire, which may only be available – or at least better advertised - in the larger urban areas such as the Central Belt in Scotland.

- **Workforce Disparity** ([Figures 18 to 20](#))

There is a noticeable disparity in employment of staff across Scotland comparative to population, indicative of departmental success in attracting and retaining individuals. In order to provide a truly equitable diagnostic imaging service, workforce growth would need to be better targeted by staff ratio.

- **Unsustainable Staffing Rotas**

Staffing rotas are generally designed to provide a regular daytime/weekend service and emergency out-of-hours services,

often 24/7. Increasing demand for imaging such as CT for Emergency Department patients and inpatients has increased the requirement for staff working overnight and at weekends, which in turn depletes the number of staff available during busy daytime shifts. Newly qualified Radiographers are under great pressure to maintain these services, and as more are promoted to undertake CT and MRI or train as Sonographers this is adding further pressure on staff rota management. It has also not always been possible to develop e-rostering in imaging services.

- **Ageing Workforce**

Diagnostic imaging is physically and mentally demanding for all staff involved, and as staff near retirement age they may not be physically capable of, or desire to work, the existing shift pattern or number of hours. The changing staff demographic will need to be taken into consideration for modelling staff throughput and capacity, and succession planning.

- **Outsourcing, Insourcing and Locums**

Diagnostic imaging services across NHS Scotland will continue to be reliant on insourcing and outsourcing of reporting and image acquisition due to workforce shortages for some time. Locum and agency staff provision is effective in supporting patient imaging throughput when required but is expensive and can negatively impact employee wellbeing and morale.

- **ARSAC Practitioner Licence Coverage ([Appendix D](#))**

There are numerous existing single points of failure across NHS Scotland in terms of holders of ARSAC Practitioner Licences, which are required to provide a NM service, and limited succession planning to ensure future sustainability of this service.

- **Training Numbers**

Any changes to training programmes, including an increase in available places, will require discussion and agreement with the relevant education partners and clinical placement providers across Scotland, and likely take several years to facilitate. The modelling also evidences that it is not possible to solve the gap between capacity and demand solely through increased training numbers.

- **Clinical Placements**

As diagnostic imaging departments increase activity to meet demand, this impacts on the ability to provide an increased number of clinical placements for training, which in turn impacts on overall training availability. Busy working environments have limited capacity to provide safe and effective training at the same time as a high-quality imaging service to patients.

- **Staff Wellbeing**

Staff safety and security in their working environment is a legal requirement, but as imaging departments struggle to meet ever-increasing demand there is less time or prioritisation to provide the care and support required for staff. Physical working environments may also have deteriorated largely due to ageing hospitals and a lack of timely refurbishment.

- **Flexible Working**

Imaging staff recruitment and retention would be enhanced by an increase in flexible working opportunities. Unfortunately, it is not always possible within existing complex rota systems to offer reduced hours when requested, which can result in poor staff morale and ultimately poor retention.

Step 5: Planning to Deliver the Required Workforce

Gap Analysis

Figure 31: Projected WTE Consultant Clinical Radiologists required to meet demand with workforce forecast

The below modelling assumes 90% of US is undertaken and reported by Sonographers, and 30% of MSK X-ray is reported by Reporting Radiographers.

- Staff required to meet known demand (Examination requests activity)
- Staff required to meet projected demand (COVID-adjusted)
- Staff required to meet projected demand (No COVID adjustment)
- ▨ Median projected demand
- WTE Establishment
- WTE Staff In Post
- ▨ WTE Staff Employment Forecast

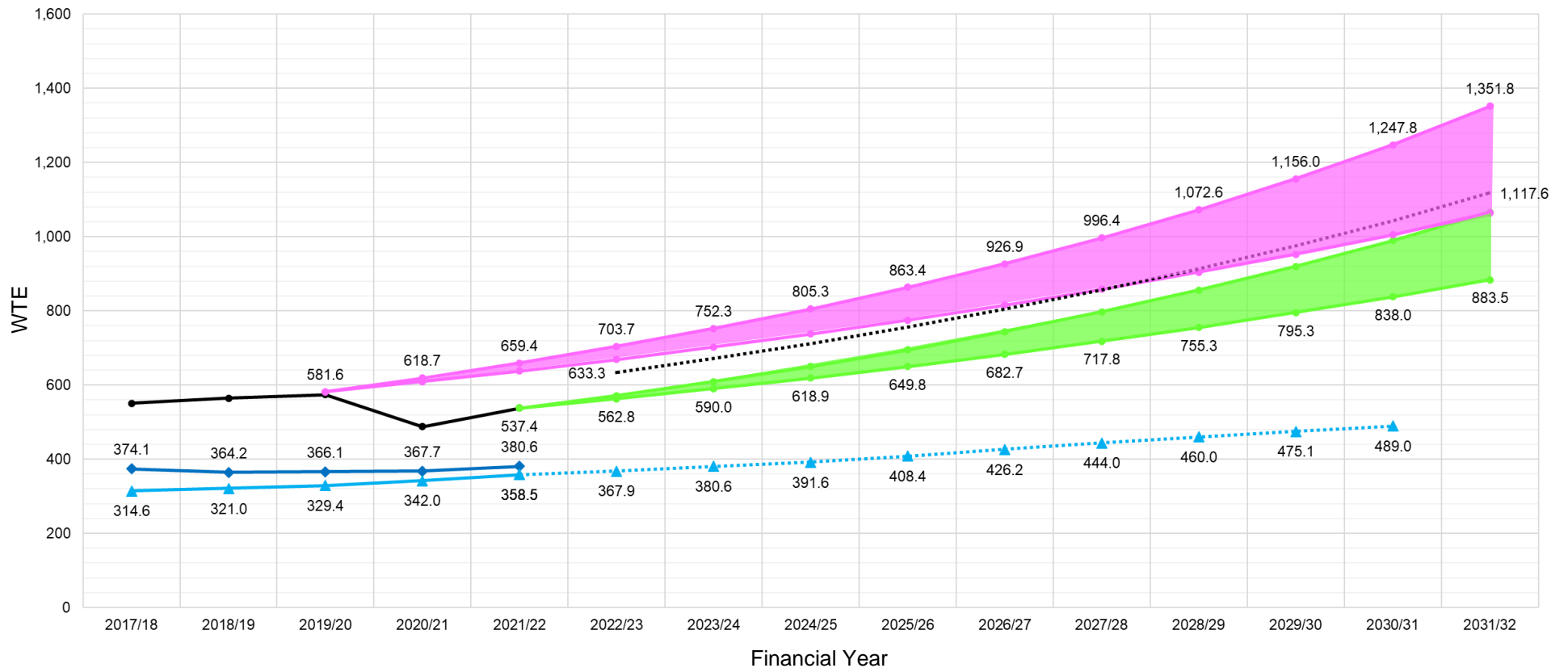


Figure 32: Projected WTE Diagnostic Radiographers (Band 5, Band 6, and Band 7 excluding Reporting Radiographers and Sonographers) required to meet demand with workforce forecast

The below modelling assumes 100% of NM is undertaken by Diagnostic Radiographers.

- Staff required to meet known demand (Examination requests activity)
- Staff required to meet projected demand (COVID-adjusted)
- Staff required to meet projected demand (No COVID adjustment)
- ▨ Median projected demand
- WTE Staff In Post
- ▨ WTE Staff Employment Forecast

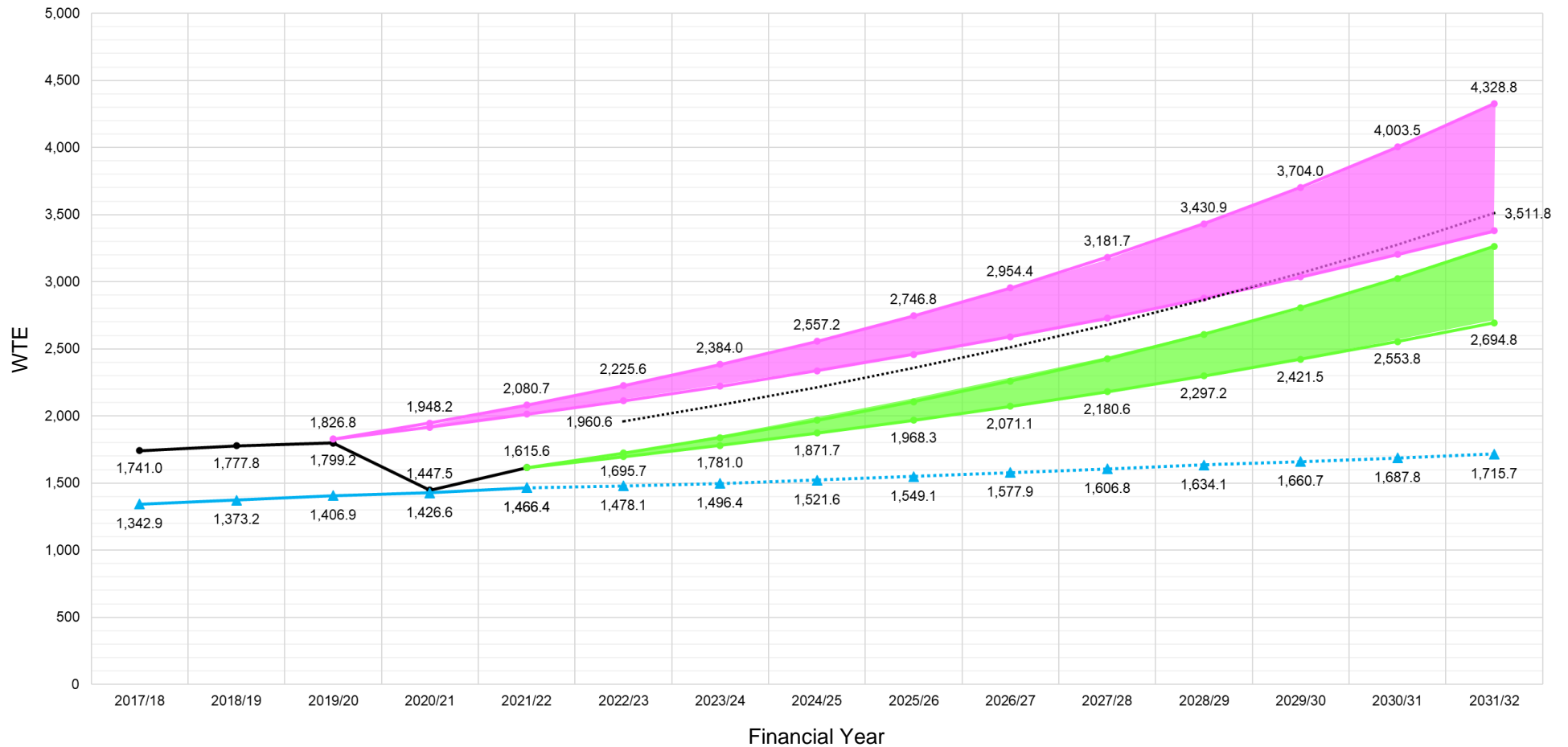


Figure 33: Projected WTE Diagnostic Radiography support workforce (Band 2 to Band 4) required to meet demand with workforce comparison

- Staff required to meet known demand (Examination requests activity)
- Staff required to meet projected demand (COVID-adjusted)
- Staff required to meet projected demand (No COVID adjustment)
- ▨ Median projected demand
- WTE Establishment
- WTE Staff In Post

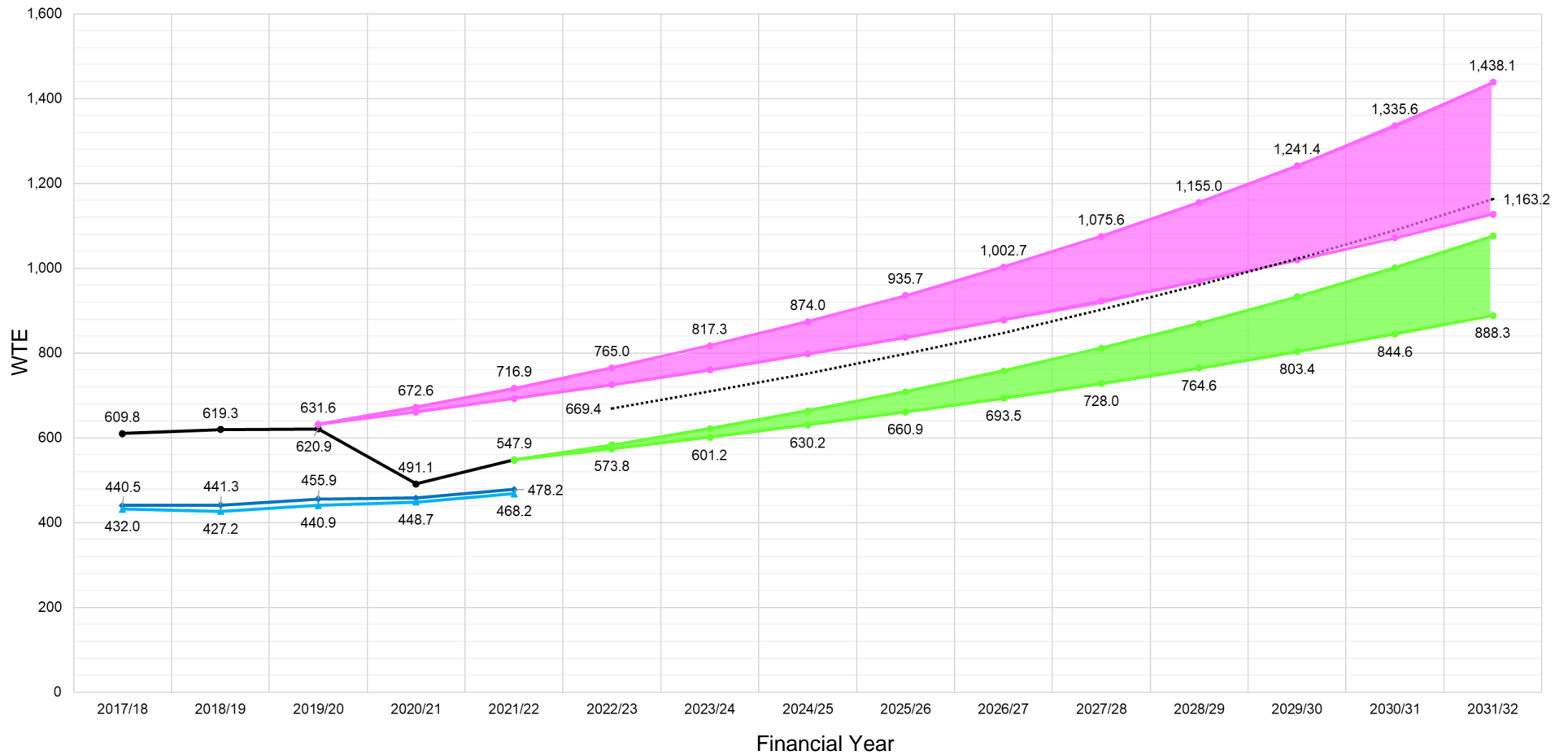


Figure 34: Projected WTE Reporting Radiographers required to meet demand with workforce comparison

Improved workforce data collection will enable a more accurate representation of actual contracted versus reporting time of Reporting Radiographers in post across NHS Scotland. The below modelling assumes 30% of MSK X-ray is reported by Reporting Radiographers.

- Staff required to meet known demand (Examination requests activity)
- Staff required to meet projected demand (COVID-adjusted)
- Staff required to meet projected demand (No COVID adjustment)
- WTE Staff In Post (Board survey estimate)

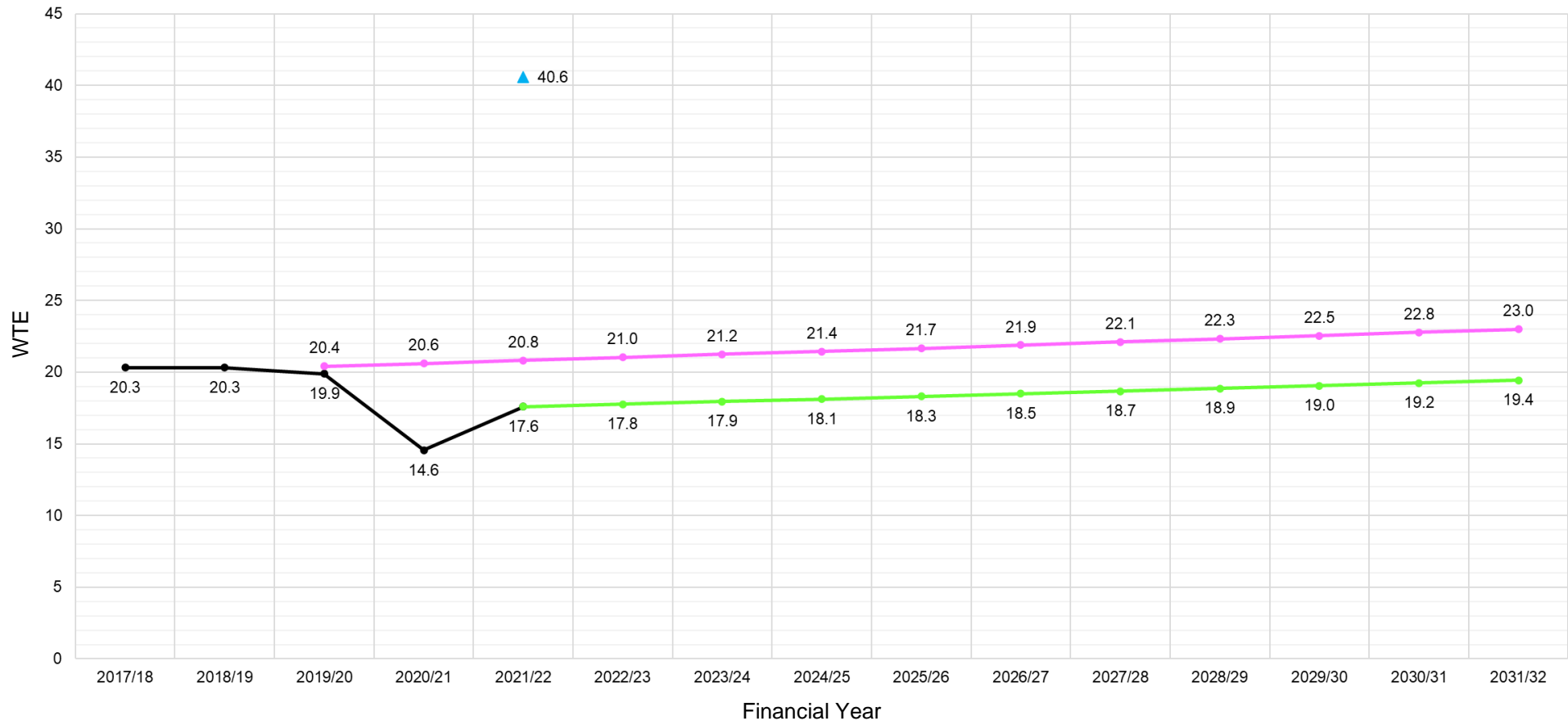
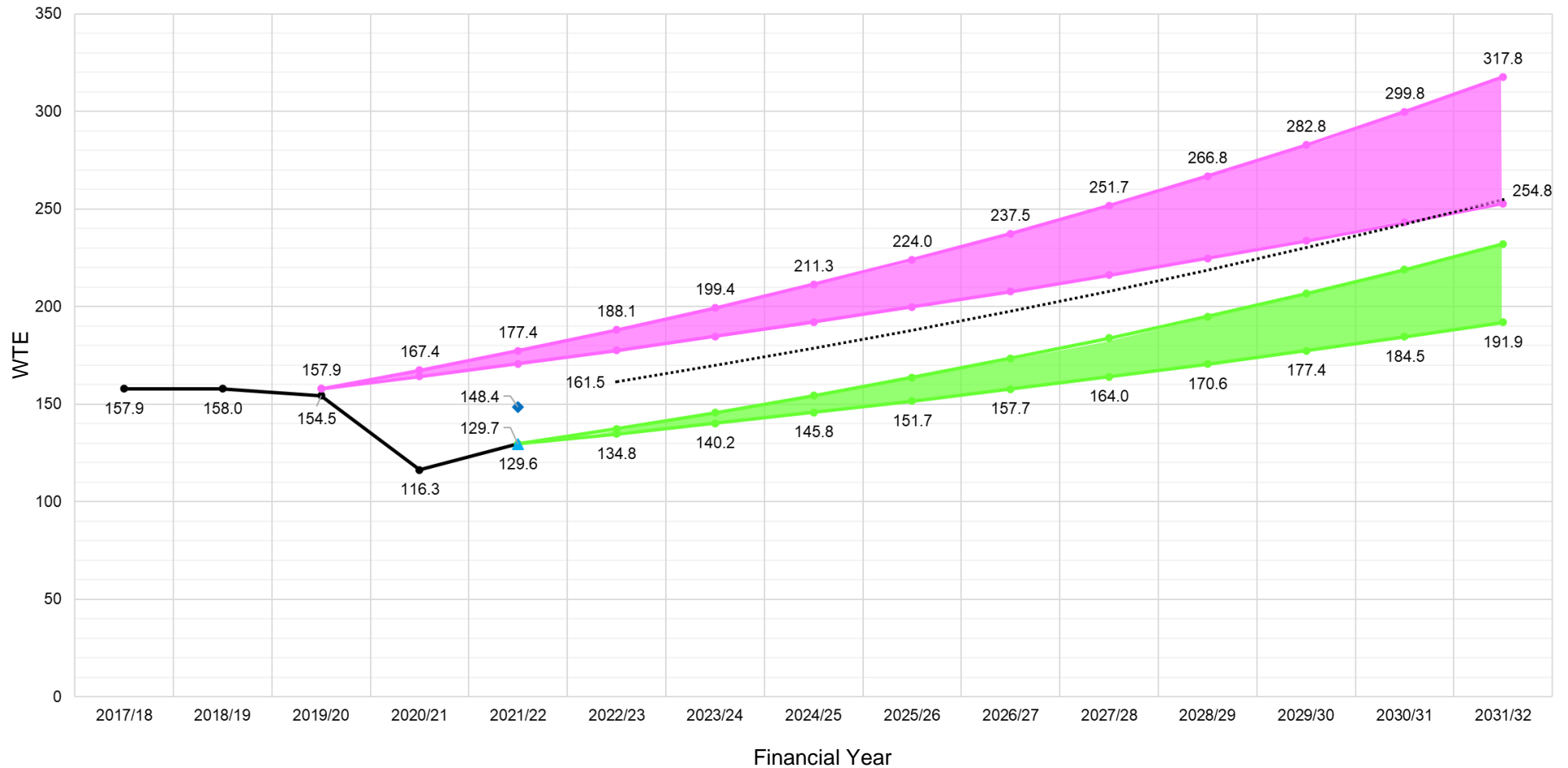


Figure 35: Projected WTE Sonographers required to meet demand with workforce comparison

As detailed in [Step 4](#), improved workforce data collection will enable a more accurate representation of actual Sonographers in post across NHS Scotland. The below modelling assumes 90% of US is undertaken and reported by Sonographers.

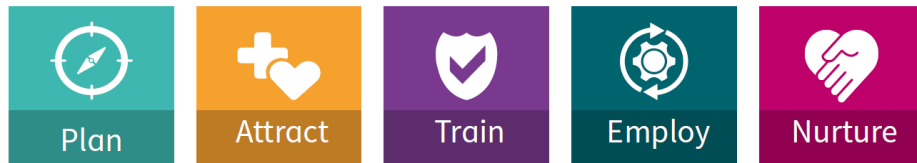
- Staff required to meet known demand (Examination requests activity)
- Staff required to meet projected demand (COVID-adjusted)
- Staff required to meet projected demand (No COVID adjustment)
- ▨ Median projected demand
- WTE Establishment (Board survey estimate ²¹)
- WTE Staff In Post (Board survey estimate ²¹)



Recommendations

The significant imbalance between imaging capacity and demand is evident from the modelling analysis, and the size of the gap dictates that actions required to address this imbalance cannot solely be solved by workforce solutions. Actions across demand management, digital technology including the potential impact of AI, staff recruitment and retention, training and education, and new and improved ways of working will all be required to enable continued provision of safe imaging services within Scotland.

The full set of recommendations are presented below using the Five Pillars framework ⁸.



A suggested timeframe is given for each recommendation, to indicate short- (up to 1 year), medium- (1-3 years), and longer-term (3-5 years +) actions.

Subject to funding, the prioritisation and development of an action plan to monitor the delivery of the recommended actions will be led by SRTP throughout 2023/24 on behalf of the current and emerging imaging governance structures.

Subsequent delivery of the recommendations will rely on provision of additional resources and requires collaborative working at a national, regional, and local level. A whole system approach, with appropriate support, is required to mitigate the risks of further deterioration of the imaging workforce capacity, service provision, and quality of patient care able to be delivered.

It is further recommended that the demand modelling tool is used at all levels to evidence the projected workforce impact of proposed service or role changes, and inform subsequent planning for matters such as additional funded establishment or training places as necessary. The adjustable metrics within the tool such as throughput and skill mix allow for adaptation of the model to local working practices. Scenario modelling could also help facilitate decisions around prioritisation of current imaging capacity.

Workforce Recommendations

Plan

Attract

Train

Employ

Nurture

- P1** Work with NHS Boards and the Scottish Government to support effective **workforce planning for diagnostic imaging at a national, regional and local level**, ensuring the analysis informs and is considered in policy development. The workforce plans must be part of wider integrated plans which include and triangulate with emerging strategic plans and financial and service/operational planning arrangements. (M)
- P2** Promote, maintain, and refine **tools to support workforce planning** capability across diagnostic imaging services, including refreshing the Workforce Demand Modelling Tool as data quality and availability improves, and reviewing the projections annually in line with emerging evidence. (S)
- P3** Ensure the diagnostic imaging workforce continue to have the **skills** to deliver services and contribute to service transformation and role redesign. (L)
- P4** **Embed** an effective national workforce planning system within the existing and emerging **diagnostic imaging governance** framework which enables the service to predict future capacity and capability requirements along with identifying gaps and pressure points. (M)
- P5** Improve parity of diagnostic imaging service provision and workforce fulfilment within **remote and rural communities**, including identifying options for establishing general and specialist **networks, mobile imaging, role incentivisation, and remote support**. Build upon the Scottish Government Remote and Rural workforce recruitment strategy (in development) to ensure that the needs of people who live and work in remote and rural communities are met. (M)
- P6** Analyse and do a needs assessment of nationally available diagnostic imaging **workforce and DCAQ data and sources** building recommendations for workforce data collection design, quantity and quality; identifying options for working collaboratively with stakeholders to review the imaging data landscape as part of a whole system approach, including an options appraisal for a functionally **national RIS**; and working to improve the parity of data collection design, data quality, integration and coding standardisation across the service. (M)

Workforce Recommendations (continued)



Plan



Attract



Train



Employ



Nurture

- P7** Assess and identify the realistic **role of AI** in delivering diagnostic imaging services to help bridge the gap between capacity and demand, including the resource required to evaluate, implement, manage, and continue to identify **emerging technology**. (M)
- P8** Identify options for obtaining accurate and more detailed **data on the imaging workforce**, including non-obstetric Sonographers, Reporting Radiographers, Interventional Radiologists, Administrative and Clerical staff, Medical Physicists and Nursing, ensuring the whole workforce is considered when planning. (S)
- P9** **Actively share workforce data**, intelligence, training and developed tools for use in planning across all aspects of diagnostic imaging in order to enable flexible service delivery, more agile ways of working, and **support national standardisation**. (S)
- P10** Obtain accurate and detailed **data on the use of insourcing, outsourcing and locums** across the diagnostic imaging service for both reporting and image acquisition, to enable more effective demand modelling, service provision, and financial planning. (S)
- P11** Scope and establish **clinical radiology networks** to support sub-specialty and generalist reporting, and provide education and training activities; to maximise use of Imaging capacity, help ensure more equitable access to specialist opinion, and provide greater service resilience. (M)
- P12** Identify options for improving diagnostic imaging **demand management** in line with realistic medicine, including the implementation of Clinical Decision Support software and wider adoption of nationally mandated radiology clinical pathways, to reduce unwarranted variation and unnecessary examinations and ultimately make more effective use of service capacity. (L)
- P13** Assess and quantify the **workforce requirements** to deliver diagnostic imaging across NHS Scotland, including **Nuclear Medicine and PET-CT**, for Clinical Technologists, Clinical Scientists, Medical Physicists, Medical Physics Experts, Radiation Protection Advisers, Radioactive Waste Advisers, Magnetic Resonance Safety Experts and support staff, to enable relevant training provision for a sustainable workforce and to protect patient safety. (S)

Workforce Recommendations (continued)

 Plan

 Attract

 Train

 Employ

 Nurture

A1 Explore feasibility of developing or contributing to **‘Once for Scotland’ policies** for the diagnostic imaging workforce, such as contract passporting or national job plans, to promote diagnostic imaging in NHS Scotland as a modern, exemplar employer; showcasing its core values; and promoting consistent employment policy and practice that supports effective recruitment and retention. (M)

A2 Assess and identify the **key attraction factors** for prospective diagnostic imaging employees that influence recruitment and retention of staff, including determining why trainees choose not to take up a post within NHS Scotland, and use these findings to ensure diagnostic imaging can be a competitive and attractive employer. (S)

A3 Identify options for **enhancements to pay and terms and conditions** of diagnostic imaging staff, being mindful of potential unintended consequences, to remain competitive and for NHS Scotland to be an employer of choice for people seeking a career in Diagnostic Imaging. Explore **financial incentives**, incentives to specifically address remote and rural recruitment and retention challenges, and a comparison against effective techniques currently utilised in NHS England. (M)

A4 Continue to promote fair work and support employers to embed **Fair Work** practices within diagnostic imaging services, to ensure work offers individuals an effective voice, opportunity, security, fulfilment, and respect. (L)

NHS Scotland Values

Care and compassion

Dignity and respect

Openness, honesty and responsibility

Quality and teamwork

Workforce Recommendations (continued)

 Plan

 Attract

 Train

 Employ

 Nurture

- A5** Work with relevant stakeholders to identify options for **increasing** the number of **training places and funded establishment posts** available for Clinical Radiologists and Diagnostic Radiography staff, including Sonographers and Reporting Radiographers, to better attract existing and prospective trainees and help address the significant workforce gap. (M)
- A6** Work with education institutes and key partners to **promote** the wide range of **career opportunities** available in the diagnostic imaging workforce, including through schools and college career fairs, to attract new people to diagnostic imaging and help address recruitment and retention issues. (S)
- A7** Support and encourage **recognition of title and professional registration** of Sonographers and Assistant Practitioners within the diagnostic radiography workforce. (L)
- A8** Work with key partners to develop and promote the diagnostic radiography career pathway, including establishing **'Earn As You Learn'** programmes such as apprenticeships and conversion modules, considering placement expansion and redesign to address training constraints, and exploring opportunities to develop programmes in conjunction with other Allied Health Professions or from NHS England established programmes. (M)
- A9** Support NHS Boards to **coordinate recruitment efforts** and act on intelligence to increase response rates to recruitment efforts, including utilising local and national leads for **international recruitment**, and ensuring trainee diagnostic imaging staff are guaranteed employment within NHS Scotland upon qualification through collaborative recruitment. (S)

Workforce Recommendations (continued)



Plan



Attract



Train



Employ



Nurture

- T1** Assess opportunities to **increase training place numbers** to help address current and projected diagnostic imaging workforce supply challenges, as quantified within the modelling, and taking into account additional imaging demand arising from increases to other healthcare professions and **revised clinical pathways**, to safeguard sustainable service provision. (S)
- T2** Review the **wider opportunities** available to access a career across diagnostic radiography and explore the potential to further increase the use of approaches such as Open University and 'Earn As You Learn' models, to assist in ensuring the **recruitment pipeline** and future service models meets the needs of the population while promoting **diversity** in the workplace. (S)
- T3** Improve and promote **career pathway opportunities** for the diagnostic radiography workforce from Bands 2 through to 8, including the development of **'Earn As You Learn'** programmes, to ensure it is accessible to all as a career choice. (L)
- T4** Encourage and expand **advancing practice** opportunities within diagnostic imaging to strengthen multi-disciplinary teams and maintain service resilience. (M)
- T5** Work with relevant stakeholders to identify options for **clinical placement reform** to address capacity and resource challenges, such as determining the feasibility of developing alternatives to traditional training routes, intake dates, and innovative scheduling, to provide certainty and sustainability to the diagnostic imaging workforce. (S)
- T6** Explore opportunities to expand upon the **National Ultrasound Academy** model from the NHS Scotland Academy to further increase training capacity within the diagnostic imaging workforce, and address parity of training for remote and rural communities. (S)
- T7** Review the current landscape and identify training required to increase numbers of **ARSAC practitioner licence holders** to guarantee continuation of NM and PET service provision. (S)

Workforce Recommendations (continued)

 Plan

 Attract

 Train

 Employ

 Nurture

T8 Promote **digital skills** as core skills for the diagnostic imaging workforce, in line with the Digital Health & Care Strategy, and support training to improve staff retention, mobilisation, and effective utilisation of AI and advancing technologies. (L)

T9 Continue to assess and identify options to **build workforce quality, capacity, standardisation and capability** to ensure high standards of practice and consistently measured competencies are maintained through a culture of learning, qualifications, registration and regulation for the diagnostic imaging workforce. (L)

T10 Continue to assess and **improve education and career pathways** for the diagnostic imaging workforce, ensuring provision of relevant skills and training, including guidance and support on developing leadership skills, and training to maximise the benefits of technological advances across imaging. (L)

T11 Progress the outcomes relevant to diagnostic imaging from the recently published **AHP Education and Workforce Policy Review** that seeks to identify gaps in training programmes and the actions required to meet future service needs. (M)

T12 Continue to progress education and career development for the radiography workforce by adopting the **CoR Education and Career Framework (4th edition)** to support improved patient outcomes. (L)

Workforce Recommendations (continued)

 Plan

 Attract

 Train

 Employ

 Nurture

- E1** The diagnostic imaging **workforce requires additional funded posts** for Consultant Clinical Radiologists, Diagnostic Radiography staff including Reporting Radiographers and Sonographers, and Medical Physics staff, to ensure there is sufficient workforce establishment capacity in line with workforce supply forecasts to address imaging demand and guarantee safe healthcare provision for patients. (L)
- E2** Work with NHS Boards, education providers and other key partners to support the development and increased use of national **'Earn As You Learn'** schemes to offer additional entry routes and enhanced career pathways for those wishing to join the Diagnostic Radiography workforce. (M)
- E3** Improve the sustainability and utilisation of the diagnostic imaging workforce by establishing **national contracts**, enabling **contract passporting**, and making use of national and regional job planning and redesign. (L)
- E4** Identify the financial investment required to increase the **provision of home workstations** for reporters to offer greater flexibility and more competitive job plans while balancing on-site service need. (S)
- E5** Work with relevant stakeholders to identify options to capitalise on the upcoming **'window of opportunity'** when the previously increased radiology trainee numbers begin entering the workforce, to ensure provision of and effective recruitment into Consultant posts within NHS Scotland. (S)
- E6** Explore partnerships with individual countries which will support **direct access to international** labour markets for ethical diagnostic imaging **recruitment**. (S)
- E7** **Support international staff** through development of support, such as CESR training, to help gain regulatory body registration, balanced against departmental staffing requirements. (M)
- E8** Continue to **assess and review** approaches to recruitment for diagnostic imaging, maximising opportunities and learning from previous experience at a local, regional, and national level. (L)

Workforce Recommendations (continued)

 Plan

 Attract

 Train

 Employ

 Nurture

- N1** Work with key partners to determine the fundamental **attraction factors** for the diagnostic imaging workforce that influence recruitment and retention of staff, and use these findings to improve trainee communications, recruitment strategies, job planning, and career promotion to ensure NHS Scotland can be a competitive and attractive employer. (S)
- N2** Continue to work in **partnership** to achieve the best possible outcomes for the workforce and the people of Scotland as transformation progresses towards an effective and sustainable diagnostic imaging service. (L)
- N3** Support diagnostic imaging departments to comply with the **Health and Care (Staffing) (Scotland) Act 2019**, sharing knowledge and tools to obtain national standardisation where possible. (M)
- N4** Encourage and expand opportunities relating to the NMAHP career development framework, **Four Pillars of Practice** (Clinical Practice, Facilitating Learning, Leadership, and Evidence, Research and Development) to support the development of Diagnostic Radiography staff and the service as a whole. (L)
- N5** Explore opportunities to better promote **professional identity** across the diagnostic imaging workforce to aid with recruitment, retention, and staff development. (S)
- N6** Identify options to improve the formal conditions associated with **Continued Professional Development (CPD)** time for the diagnostic imaging workforce to ensure they have the time to attend learning activities, including support for **leadership** and career progression. (S)

Workforce Recommendations (continued)

 Plan

 Attract

 Train

 Employ

 Nurture

N7 Encourage the adoption of **The Quality Standard for Imaging (QSI)** which identifies the national quality criteria for imaging services. (S)

N8 Improve the **granularity of workforce data**, including information on pay, promotion and recruitment, and use of insourcing and outsourcing, ensuring this is recorded in a standardised way, so it can be published and used to support future developments. (L)

N9 Explore options, including financial investment, to **support new and existing diagnostic imaging staff** with their practical and emotional needs, including pastoral care and other measures to aid rest and recuperation such as improved onsite staffrooms and facilities. (S)

N10 Encourage the introduction of the **Flying Finish** initiative across all NHS Boards to enhance the retention of highly experienced staff entering the latter stages of their professional careers within diagnostic imaging. (S)

N11 Explore options to build on previous work to ensure diagnostic imaging within NHS Scotland has **equitable and inclusive** recruitment, retention, representation, and promotion practices; and that the experiences and needs of the workforce underpin the principles and delivery of any changes. (L)

N12 Encourage the development and adoption of initiatives that seek to support the **mental health and wellbeing** of the diagnostic imaging workforce, including opportunities to improve **staff networking** across diagnostic imaging, to enable a supportive culture that shares good practice, shaped by the workforce. (M)

Step 6: Implementation, Monitoring and Refresh

In line with the tripartite ambition set out in the National Workforce Strategy for Health and Social Care to **recover**, **grow**, and **transform** the workforce, it is proposed that this Diagnostic Imaging Workforce Plan and the progress of the recommended short-, medium-, and long-term actions will be managed and monitored initially via SRTP on behalf of the existing and emerging governance structures. Future management and monitoring will be agreed as part of the new governance arrangements.

It should be acknowledged that although the scope of this Workforce Plan and modelling sets out recommended actions over the course of the next 10 years, this information is subject to change as new workforce drivers, data, challenges, and opportunities emerge.

These changes will be reflected in the annual updates that will be presented to the appropriate imaging, diagnostics, and workforce governance groups throughout the time period this Workforce Plan covers.

Proposed Scope Additions

For future iterations of the Workforce Plan and modelling, as data quality and availability improve:

- Accurate assessment of imaging referral sources as data quality improves to enable comparison, development, and improvement of more effective patient pathways

- Detailed sub-specialty analysis of Interventional service provision (such as neuro, paediatric, vascular) to assess Radiologist and Radiographer training support required to enhance future capacity without detriment to the other imaging modality provision
- Detailed assessment of the Sonography workforce to identify the future staffing required to effectively deliver obstetric and non-obstetric ultrasound services, including quantification of increased training numbers required (incorporating the National Ultrasound Academy) to provide safe and sustainable services with the rising demand
- Quantification of current and future workforce requirements to deliver national Mammography symptomatic and screening services provided by Radiologists, Radiographers, and Assistant Practitioners – staff often provide cover in both elements of the breast service for patients, including interventional procedures
- National modelling of the qualified workforce and subsequent training numbers required to undertake MPE, RWA, RPA, MRSE and Clinical Technologist roles to sustainably deliver diagnostic imaging services
- Further assessment of out-of-hours provision to fully understand the imaging capacity required, and enable exploration of alternative working solutions often specific to local service delivery
- Outputs from the National Imaging Equipment Group to help define future workforce skills and numbers required as imaging technology develops

Acknowledgements

Input was sought from a wide range of health professionals and other key stakeholders to help develop this Workforce Plan and modelling tool. We would like to thank all individuals for their time and participation in one or more of the following ways: as a member of the imaging governance structures, professional advisor, data/information provision, consultative meetings/workshop attendance, and general correspondence.

With recognition to the following individuals who participated as a member of the project Steering Group:

Alan Neil, Partnership

Dr Alastair McKenzie, representing Trainees and Registrars

Andrea Marshall, representing Trainees and Registrars

Caroline Blower, NHS Ayrshire & Arran

Chris Carron, Scottish Government

Claire Donaldson, Society of Radiographers and NHS Tayside

Colin Tilley, NHS Education for Scotland

Dr David Cowell, NHS Greater Glasgow & Clyde

David Wylie, NHS Education for Scotland

Dr Eileen Anderson, NHS Highland

Dr Fiona Ewing, NHS Education for Scotland

Freya Johnson, NHS Greater Glasgow & Clyde

Dr Hamish McRitchie, NHS National Services Scotland

Jacqueline Porter, NHS Lothian

Jane MacDonald, NHS Western Isles

Jean Wright, Scottish Government

Dr Jenny Ballantyne, NHS Lanarkshire

Dr Judith Anderson, Royal College of Radiologists and NHS Lothian

Jules Silverton, NHS Greater Glasgow & Clyde

Julie Rankin, Society and College of Radiographers

Kevin Colclough, NHS Highland

Lindsey Mathieson, NHS Education for Scotland

Lisa Marley, NHS Ayrshire & Arran

Lisa Turki, NHS Lanarkshire

Lorna Pennycook, North Imaging Alliance

Maria Murray, Society and College of Radiographers

Mary MacFarlane, NHS Greater Glasgow & Clyde

Dr Maggie Brooks, Scottish Radiology Society and NHS Highland

Mary McKee, NHS Greater Glasgow & Clyde

Morag Stout, NHS Education for Scotland

Dr Neil McIntyre, representing Trainees and Registrars

Paul Hudson, NHS Lothian

Dr Ross MacDuff, NHS Greater Glasgow & Clyde

Dr Sahar Naaseri, NHS Lothian

Sharon Jones, NHS Grampian

Dr Shilpi Pal, NHS Tayside

Simon Holmes, Queen Margaret University

Dr Simrit Ghatorae, representing Trainees and Registrars

Dr Sudhakar Unnam, NHS Ayrshire & Arran

References

1. Royal College of Radiologists, [Clinical radiology census report 2021](#)
2. Organisation for Economic Co-operation and Development (OECD), [Health Indicators](#)
3. Public Health Scotland, [NHS Costs Book R120 \(2019 to 2020\)](#)
4. Public Health Scotland, [Diagnostics Waiting Times \(Published 28 Feb 2023\)](#)
5. SRTP, [Radiology Vision and Target Operating Model](#)
6. NHS Digital, [National Interim Clinical Imaging Procedure \(NICIP\) Code Set](#)
7. Scottish Government, [NHS Recovery Plan 2021-2026](#)
8. Scottish Government, [National Workforce Strategy for Health and Social Care in Scotland \(2022\)](#)
9. Society and College of Radiographers, [Diagnostic radiography census 2021](#)
10. Skills for Health, [Six Steps Methodology to Integrated Workforce Planning](#)
11. National Records of Scotland, [Mid-Year Population Estimates \(mid-2021\)](#)
12. National Records of Scotland, [Population Projections \(2020-based\)](#)
13. Scottish Government, [Urban Rural Classification 2020 \(6-fold\)](#)
14. NHS Scotland North, [Case Study - NHS Orkney Mobile X-ray Pilot](#)
15. NHS England, [Diagnostics: Recovery and Renewal \(2020\)](#)
16. Audit Scotland, [NHS in Scotland 2022](#)
17. NHS Scotland, [Realistic Medicine](#)
18. NHS Scotland National Planning CTCA Position Paper (November 2022)
19. Scottish Government, [Health and Care \(Staffing\) \(Scotland\) Act 2019](#)
20. Public Health Scotland, [National Radiology Information & Intelligence Platform \(NRIIP\)](#)
21. Morag J. Stout (2021) National Ultrasound Service Provision: Demand, Capacity & Succession Planning
22. NHS Leadership Academy, [Healthcare Leadership Model](#)
23. RCR and SCoR, [Team working in clinical imaging \(2012\)](#)
24. NHS Education for Scotland, [NHS Scotland Workforce Dashboard](#)
25. Institute of Physics and Engineering in Medicine, [Medical Physics Expert Support for Nuclear Medicine Policy Statement \(2022\)](#)
26. Institute of Physics and Engineering in Medicine, [Recommendations for the Medical Physics support of an MR Service \(2022\)](#)

Appendix A: Diagnostic Imaging Workforce Demand Modelling Tool

[Access the Diagnostic Imaging Workforce Demand Modelling Tool \(National Data and Template version\) on the SRTP website](#)

This tool calculates the WTE workforce required to deliver the projected diagnostic imaging demand wholly within NHS Scotland, meaning it does not take into account nor quantify the use of insourcing, outsourcing, and locums.

The majority of the evidence base used for this first version of the tool is management data, in the absence of sufficiently available published statistics. A full list and explanation of the data sources and rationale used can be found within the tool.

Validation of the tool and metrics was performed using testing against sample Health Board data, and triangulation against appropriate projections such as those from the Richards' Report and RCR Census.

The tool uses the proxy measures of image acquisition and reporting to quantify the projected demand as the estimated WTE workforce required to deliver the service, using the below base calculation. Throughput and capacity metrics are set for each staff group and modality, alongside scenario modelling variables.

$$\text{Estimated workforce required (WTE)} = \frac{\text{Projected demand (number of exams)} \times \text{Throughput per exam (mins)}}{\text{Capacity available per WTE (mins)}}$$

The modelling variables allow users to easily model the impact on staff groups from proposed scenarios or changes in working, such as expanding the scope of Reporting Radiographers or the potential workforce impact of AI product implementation.

The model is designed to work with five years' worth of historical examinations data (the current scope held within the National Radiology Dashboard, NRIIP) and projects forward two demand scenarios with and without presumed COVID-19 recovery.

Table A1: NHS Scotland exam requests activity by modality

Modality	April 2017 to March 2018	April 2018 to March 2019	April 2019 to March 2020	April 2020 to March 2021	April 2021 to March 2022
X-ray	2,175,315	2,173,790	2,128,956	1,557,457	1,882,918
DEXA	19,574	33,422	28,101	10,403	9,600
Mammography (symptomatic)	68,720	67,851	65,822	57,574	61,834
Ultrasound (non-obstetric)	547,475	547,916	535,652	403,403	449,571
NM/RNI	49,505	50,103	49,283	34,433	36,895
MRI/MRA/MRV	257,576	265,763	269,364	204,522	216,590
Interventional	33,366	33,843	36,305	35,054	37,883
Fluoroscopy	69,415	75,204	78,555	60,342	71,861
CT	507,296	523,734	546,279	507,706	563,735
Total	3,728,242	3,771,626	3,738,317	2,870,894	3,330,887

Source: NRIIP ¹⁸

The following metrics have been used within the national modelling and are based on Scotland averages. There can be significant variation between Boards and individual departments in terms of service provision including equipment, and the modelling tool allows for these metrics to be adjusted to reflect local practices.

Please note that nuclear medicine as used within this modelling is inclusive of SPECT and PET examinations, as submitted from local Board RIS to NRIIP.

Table A2: Average national throughput modelled per WTE by staff group

Consultant Clinical Radiologists		
Modality	Reporting Activity per Hour	Minutes per Report / Exam
CT (complex)	2.4	25
CT (simple)	4	15
DEXA	24	2.5
Fluoroscopy	3	20
Interventional	-	45
Mammography (symptomatic)	6	10
MRI (complex)	2.4	25
MRI (simple)	4	15
NM	6	10
X-ray	24	2.5
Ultrasound (non-obstetric)	-	20

Reporting Radiographers		
Modality	Reporting Activity per Hour	Minutes per Report / Exam
X-ray	24	2.5

Diagnostic Radiographers				
Modality	Exam Activity per Hour	# Staff Required	AfC Assumption	Minutes per Exam
CT	4	2.7	Band 6	40
DEXA	6	1.3	Band 5	13
Fluoroscopy	3	1.3	Band 6	27
Interventional	1.3	2.5	Band 6	113
Mammography (symptomatic)	4	1.3	Band 6	20
MRI	1.3	2.5	Band 6	113
NM	1.6	2.5	Band 6	94
X-ray	5	1.3	Band 5	16

For example, if MRI image acquisition takes an average of 45 minutes per exam and requires five Radiographers to staff a double scanner to run continuously while allowing for staff breaks, this would equate to 113 minutes per MRI exam per WTE staff.

Sonographers		
Modality	Exams per Session (3.75 hours)	Minutes per Exam
Ultrasound (non-obstetric)	24	25

Table A3: Available capacity modelled per WTE by staff group

Consultant Clinical Radiologists	
Total theoretical working days	260 days
Less annual leave	33 days
Less public holidays	8 days
Less sick leave	9 days
Less study leave	10 days
= Total working capacity available	200 days
Less % sessions required to fulfil other role responsibilities (eg on call, MDTs, clinical discussions, consultations)	50%
= Total 'proxy measure' capacity available	100 days (48,000 minutes)

Reporting Radiographers	
Total theoretical working days	260 days
Less annual leave	33 days
Less public holidays	8 days
Less sick leave	9 days
Less CPD	6 days
= Total working capacity available	204 days
Less % sessions required to fulfil other role responsibilities	40%
= Total 'proxy measure' capacity available	122.4 days (55,080 minutes)

Diagnostic Radiographers	
Total theoretical working days	260 days
Less annual leave	33 days
Less public holidays	8 days
Less sick leave	9 days
Less CPD	6 days
= Total working capacity available	204 days
Less % available working capacity required to fulfil other role responsibilities	10% for Band 5
	30% for Band 6
	70% for Band 7 <i>(Excluding Sonographers and Reporting Radiographers)</i>
= Total 'proxy measure' capacity available	Band 5 183.6 days (82,620 minutes)
	Band 6 142.8 days (64,260 minutes)
	Band 7 <i>(Excluding S, RR)</i> 61.2 days (27,540 minutes)

Sonographers	
Total theoretical working days	260 days
Less annual leave	33 days
Less public holidays	8 days
Less sick leave	9 days
Less CPD	6 days
= Total working capacity available	204 days
Less % sessions required to fulfil other role responsibilities	15%
= Total 'proxy measure' capacity available	173.4 days (78,030 minutes)

Appendix B: Scotland Population Data

Table B1: Mid-year population estimates by Health Board

Area	2011 Population (Persons)	2021 Population (Persons)	Growth
Scotland	5,299,900	5,479,900	3.4%
NHS Ayrshire & Arran	373,760	368,690	-1.4%
NHS Borders	113,880	116,020	1.9%
NHS Dumfries & Galloway	151,410	148,790	-1.7%
NHS Fife	365,300	374,730	2.6%
NHS Forth Valley	298,080	305,710	2.6%
NHS Grampian	569,580	586,530	3.0%
NHS Greater Glasgow & Clyde	1,135,400	1,185,040	4.4%
NHS Highland	321,660	324,280	0.8%
NHS Lanarkshire	651,620	664,030	1.9%
NHS Lothian	836,610	916,310	9.5%
NHS Orkney	21,420	22,540	5.2%
NHS Shetland	23,240	22,940	-1.3%
NHS Tayside	410,250	417,650	1.8%
NHS Western Isles	27,690	26,640	-3.8%

Source: National Records of Scotland ¹¹

Table B2: Percentage of population in each Urban Rural category by Health Board

Area	Urban	Remote	Rural	Remote & Rural
Scotland	80.3	2.6	11.6	5.5
NHS A&A	77.9	1.9	15.5	4.7
NHS Borders	47	6	38.3	8.8
NHS D&G	49.9	5	25	20.1
NHS Fife	81.8	0	18.2	0
NHS Forth Valley	81.1	0	17.5	1.4
NHS Grampian	65.4	3.8	23.5	7.3
NHS GG&C	96.7	0	3.3	0
NHS Highland	29.5	22.9	7.4	40.1
NHS Lanarkshire	90.5	0	8.7	0.8
NHS Lothian	88.6	0	11.5	0
NHS Orkney	0	33.5	0	66.5
NHS Shetland	0	29.6	0	70.4
NHS Tayside	71.9	3.6	20.7	3.9
NHS Western Isles	0	27.5	0	72.5

6-Fold Category Definitions: Urban = combines Large Urban, Other Urban, and Accessible Small Towns; Remote = areas that are more than a 30-minute drive from a Settlement with a population of 10,000 or more; Rural = population less than 3,000; Remote AND Rural = population less than 3,000 AND more than a 30-minute drive from a Settlement with a population of 10,000 or more

Source: Scottish Government ¹²

Appendix C: Current Workforce Profile

Figure C1: Workforce trends for Consultant Clinical Radiologists, WTE as at 30-September each year

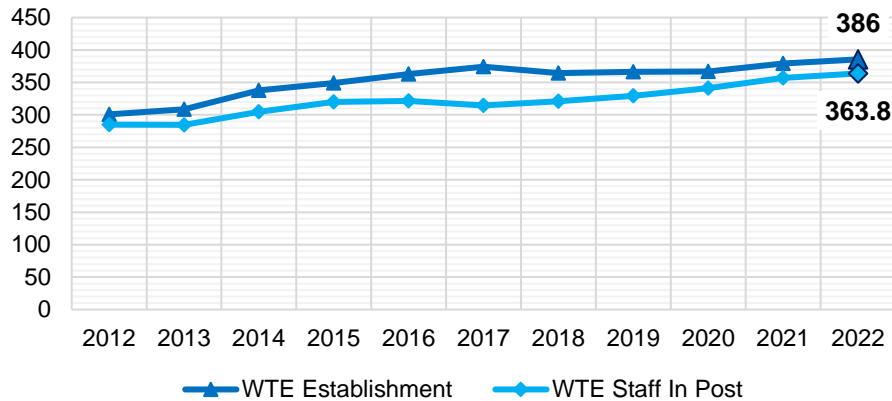


Figure C2: Workforce trends for Consultant Clinical Radiologists, Headcount as at 30-September each year

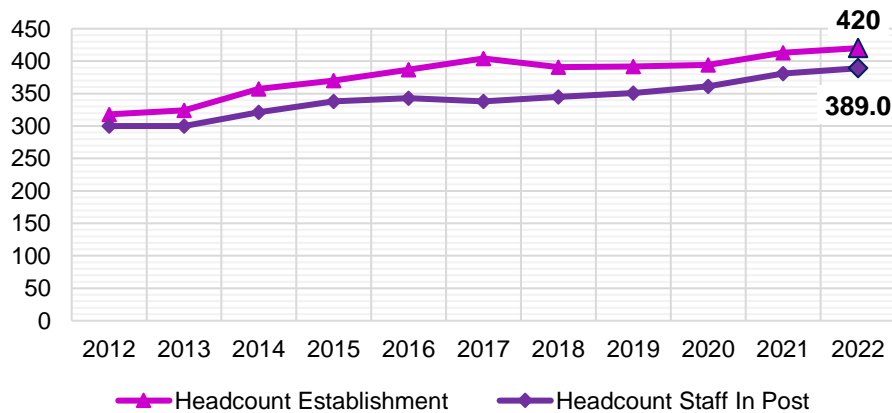
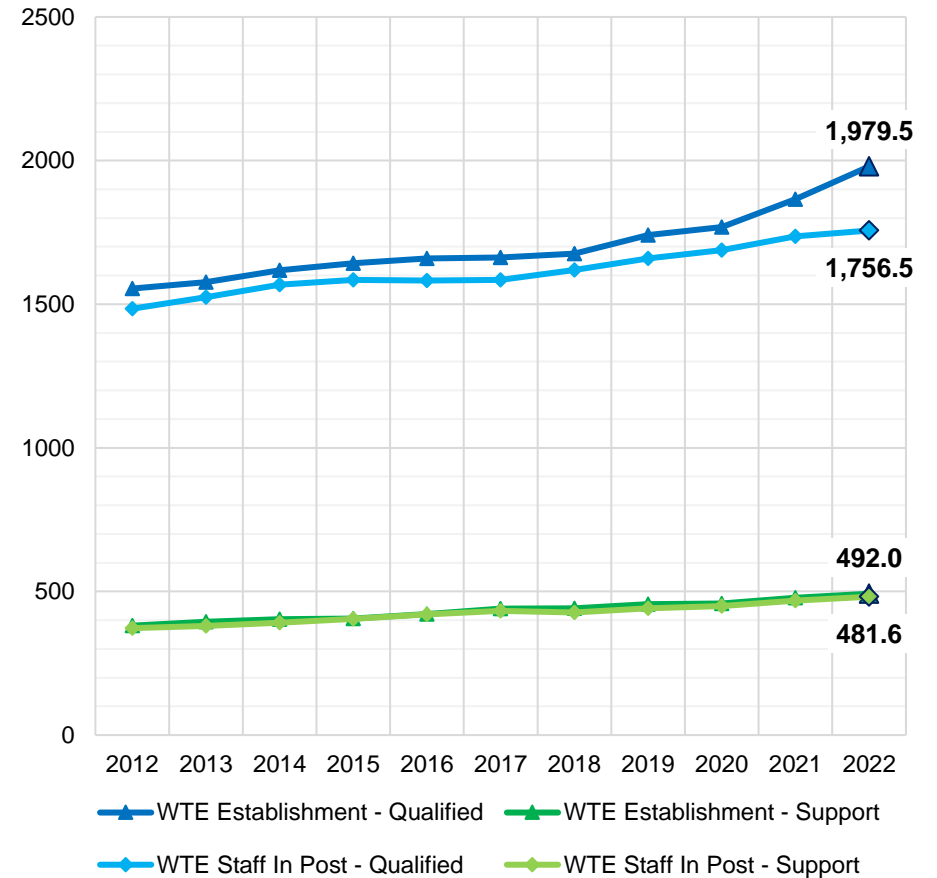


Figure C3: Workforce trends for Diagnostic Radiography, WTE as at 30-September each year



Source: NHS Education for Scotland ²⁴

Table C1: WTE Consultant Clinical Radiologists as at 30 September 2022

Area	Current Establishment	Current Staff In Post	Staff In Post Ratio per 100,000 Population **
Scotland	385.5	363.8	6.6
NHS A&A	22.1	19.1	5.2
NHS Borders	5.8	5.8	5.0
NHS D&G	7.3	7.3	4.9
NHS Fife	4.7	4.7	1.2
NHS Forth Valley	14.2	12.2	4.0
NHS Grampian *	33.3	29.3	4.6
NHS GG&C	125.7	121.7	10.3
NHS Highland	16.3	13.3	4.1
NHS Lanarkshire	43.3	40.6	6.1
NHS Lothian	75.7	75.7	8.3
NHS Orkney	0.0	N/A	N/A
NHS Shetland	0.0	N/A	N/A
NHS Tayside	34.9	31.9	7.6
NHS Western Isles	1.0	1.0	3.8
Golden Jubilee	1.4	1.4	N/A

Sources: NHS Education for Scotland²⁴, NRS¹¹

* NHS Grampian ratio is calculated to include provision of Consultant Clinical Radiologist cover for the populations of NHS Orkney and NHS Shetland

** European average is 12.8 Consultant Clinical Radiologists per 100,000 population¹

Table C2: WTE Consultant Clinical Radiologists with a primary or secondary area of practice in interventional radiology, Scotland trend

Area	2012	2017	2021
Total	47	46	47
Neuro IR	3	3	5
Non-vascular IR	3	5	9
Paediatric IR	0	0	0
Vascular IR	41	38	33

Sources: RCR¹

The RCR guidelines state a minimum requirement of 6 WTE Interventional Radiology (IR) Consultants per NHS Board to provide a fully staffed 24/7 rota, or a minimum requirement of 8 WTE to serve populations greater than 1 million. NHS Borders and the islands Boards have formal arrangements in place with another Board to provide IR cover. NHS Greater Glasgow & Clyde and NHS Lothian both cover populations greater than 1 million.

This equates to a minimum requirement of 64 WTE IR Consultants to provide a fully staffed 24/7 rota within NHS Scotland, not accounting for any additional workforce required to meet IR demand above this capacity.

Table C3: WTE Qualified Diagnostic Radiographers as at 30 September 2022

Area	Current Establishment	Current Staff In Post	Staff In Post Ratio per 100,000 Population
Scotland	1979.5	1756.5	32.1
NHS A&A	128.6	128.6	34.9
NHS Borders	26.8	22.8	19.7
NHS D&G	34.8	34.8	23.4
NHS Fife	89.0	79.4	21.2
NHS Forth Valley	75.0	75.0	24.5
NHS Grampian	193.1	174.4	29.7
NHS GG&C	657.3	491.6	41.5
NHS Highland	101.2	94.6	29.2
NHS Lanarkshire	159.7	154.7	23.3
NHS Lothian	295.9	288.9	31.5
NHS Orkney	7.2	7.2	31.9
NHS Shetland	10.9	10.9	47.4
NHS Tayside	135.3	130.3	31.2
NHS Western Isles	8.7	7.3	27.6
Golden Jubilee	56.0	56.0	N/A

Sources: NHS Education for Scotland²⁴, NRS¹¹

Table C4: WTE Support Diagnostic Radiography workforce as at 30 September 2022

Area	Current Establishment	Current Staff In Post	Staff In Post Ratio per 100,000 Population
Scotland	492.0	481.6	8.8
NHS A&A	50.9	50.9	13.8
NHS Borders	8.2	8.2	7.1
NHS D&G	14.8	14.8	9.9
NHS Fife	38.5	35.5	9.5
NHS Forth Valley	26.2	26.2	8.6
NHS Grampian	17.4	15.5	2.6
NHS GG&C	129.9	129.9	11.0
NHS Highland	18.2	17.2	5.3
NHS Lanarkshire	36.5	36.5	5.5
NHS Lothian	81.8	79.8	8.7
NHS Orkney	1.0	1.0	4.4
NHS Shetland	0.8	0.8	3.5
NHS Tayside	48.8	48.8	11.7
NHS Western Isles	3.0	3.0	11.3
Golden Jubilee	16.0	13.5	N/A

Sources: NHS Education for Scotland²⁴, NRS¹¹

Table C5: WTE Reporting Radiographers

Area	Current Staff In Post (estimate)
Scotland	40.6
NHS A&A	3.2
NHS Borders	2.1
NHS D&G	2.1
NHS Fife	2.8
NHS Forth Valley	0.6
NHS Grampian	-
NHS GG&C	8.2
NHS Highland	4
NHS Lanarkshire	2.8
NHS Lothian	5.4
NHS Orkney	0
NHS Shetland	3
NHS Tayside	3.8
NHS Western Isles	0.6
Golden Jubilee	2

Source: Reporting Radiographers Interest Group Scotland

The above figures are not inclusive of any trainee reporters.

Table C6: WTE Sonographers as of 2021

Area	Staff In Post	Vacancies	Training at Present	Imminent Retirals
Scotland	129.7	18.7	15.5	16.3
NHS A&A	Data breakdown not available	-	-	0
NHS Borders		-	1.6	1.6
NHS D&G		-	1.2	1.2
NHS Fife		2	1	1
NHS Forth Valley		3.6	3	3
NHS Grampian		0.2	-	0
NHS GG&C		4	2	2
NHS Highland		1	1.2	1.2
NHS Lanarkshire		-	1	1
NHS Lothian		4	3.4	3.4
NHS Orkney		-	0.6	0.6
NHS Shetland		1	-	0
NHS Tayside		0.3	1	0.8
NHS Western Isles		1.5	0.5	0.5

Source: National Ultrasound Service Provision ²¹

Table C7: WTE Medical Physics Experts (MPE) for NM

Area	Recommended Support ²⁵	Current Establishment	Current Shortfall
Scotland	52	29.95	22.05
NHS A&A	3	3	0
NHS Borders	MPE cover provided by NHS Lothian		
NHS D&G	Limited or no NM diagnostic service		
NHS Fife	MPE cover provided by NHS Lothian		
NHS Forth Valley	MPE cover provided by NHS GG&C		
NHS Grampian	3	2	1
NHS GG&C	24	17.15	6.85
NHS Highland	2	1	1
NHS Lanarkshire	1.5	1	0.5
NHS Lothian	15	3	12
NHS Orkney	Limited or no NM diagnostic service		
NHS Shetland	Limited or no NM diagnostic service		
NHS Tayside	3.5	2.8	0.7
NHS Western Isles	Limited or no NM diagnostic service		

Sources: IPEM ²⁵, Scottish Nuclear Medicine Leads Group

6 WTE of the current staff in post in NHS Scotland are over 55 years of age and expected to retire within the next five years.

An additional 13.5 WTE other scientific staff are currently presumed in training for an MPE role, but these roles will need to be filled by other clinical scientists upon completion of MPE training.

Table C8: WTE Clinical Technologists for NM

Area	Current Establishment	Current Staff In Post *	Current Vacancy
Scotland	86.18	66.68	19.5
NHS A&A	4.6	4.6	0
NHS Borders	NM predominantly provided by Radiographers		
NHS D&G	Limited or no NM diagnostic service		
NHS Fife	NM predominantly provided by Radiographers		
NHS Forth Valley	NM predominantly provided by Radiographers		
NHS Grampian	8.5	8.5	0
NHS GG&C **	48.48	34.48	14
NHS Highland	5	4	1
NHS Lanarkshire	2.5	0	2.5
NHS Lothian ***	1.5	1.5	0
NHS Orkney	Limited or no NM diagnostic service		
NHS Shetland	Limited or no NM diagnostic service		
NHS Tayside	15.6	13.6	2
NHS Western Isles	Limited or no NM diagnostic service		

Source: Scottish Nuclear Medicine Leads Group

* Inclusive of 13 WTE in training who require supervision to work

** NHS GG&C figures exclude the Royal Hospital for Children whose service is predominantly provided by radiography staff

*** NHS Lothian primarily uses a Radiographer workforce to provide their NM service, which is why the clinical technologist figure is low

17.5 WTE of the current staff in post in NHS Scotland are over 55 years of age and expected to retire within the next five years.

Table C9: WTE Diagnostic Radiology MPE deficit by Radiation Protection Centre

Area	Current Shortfall from Recommended Support ²⁵
Scotland	16.37
NHS A&A	MPE cover provided by NHS GG&C
NHS Borders	MPE cover provided by NHS GG&C
NHS D&G	MPE cover provided by NHS GG&C
NHS Fife	MPE cover provided by NHS Lothian
NHS Forth Valley	MPE cover provided by NHS GG&C
NHS Grampian	1.8
NHS GG&C	10.17
NHS Highland	0.3
NHS Highland (A&B)	MPE cover provided by NHS GG&C
NHS Lanarkshire	MPE cover provided by NHS GG&C
NHS Lothian	2.5
NHS Orkney	MPE cover provided by NHS Grampian
NHS Shetland	MPE cover provided by NHS Grampian
NHS Tayside	1.6
NHS Western Isles	MPE cover provided by NHS Highland
Golden Jubilee	MPE cover provided by NHS GG&C
National Services	0

Sources: IPEM ²⁵, Scottish Radiation Protection Advisers Group

Appendix D: ARSAC Practitioner Licence Imaging Coverage

ARSAC Practitioner Licences are site-specific and require the licence holder to have sessional commitment to a service in order to cover that site. The below only details imaging certification, but similar challenges are faced with therapy and non-imaging coverage.

Succession planning is required to ensure a safe and sustainable nuclear medicine service can be provided within NHS Scotland. Licence holders need to be actively in post, and not on long-term sickness absence or maternity leave, for their cover to be valid.

There are a significant number of existing single points of failure, as demonstrated in [Table D2](#), and it is estimated that at least 20 of these current licence holders are over the age of 55 and therefore likely to retire within the next five years.

Acquiring partial certification can be unattractive to Radiologists due to the intensive additional training requirements and time taken away from other career progression. Funding to support the required training and evidence is also an issue, even more so with Nuclear Medicine Physicians who are more likely to hold the comprehensive certification.

Table D1: ARSAC Practitioner Licence Holders

Health Board	Site	Headcount (estimate)
Scotland	All	31
NHS Ayrshire & Arran	University Hospitals Crosshouse and Ayr	2
NHS Borders	Borders General Hospital	Covered by RIE (2) and WGH (1)
NHS Fife		Covered by RIE (1)
NHS Forth Valley	Forth Valley Royal Hospital	1
NHS Grampian		3
NHS Greater Glasgow & Clyde	Glasgow Royal Infirmary	4
	Queen Elizabeth University Hospital	3
	Gartnavel General Hospital	4
	New Stobhill Hospital	2
	New Victoria Hospital	1
	Royal Hospital for Children Glasgow	1
	Royal Alexandra Hospital	1
NHS Highland	Raigmore Hospital	1
NHS Lanarkshire	University Hospital Monklands	2
NHS Lothian	Royal Infirmary of Edinburgh	2
	Western General Hospital	2
NHS Tayside	Ninewells Hospital	2

Source: Scottish NM Scientific Leads Group

Table D2: ARSAC Practitioner Licence Imaging Coverage by Health Board by Functional Group (Imaging Only)

Red cells denote existing single point of failure

Functional Group	NHS A&A	NHS Borders	NHS Fife	NHS FV	NHS Grampian
	UHC/UHA	BGH		FVRH	
Cardiac	1	NHS Lothian provide cover for what is required within NHS Borders using 2 Practitioners from RIE and 1 Practitioner from WGH	NHS Lothian provide cover for what is required within NHS Fife using 1 Practitioner from RIE	0	2
Vascular	2			1	1
Lung	2			1	2
Brain	2			0	1
Bone	2			1	2
GI	2			1	1
Hepatobiliary	2			1	2
Urinary	2			1	2
Infection	0			0	1
Haematology	1			0	1
Endocrine	2			1	2
Lacrimal	2			0	1
Tumour	2			1	1
Sentinel Node	1			1	2
PET	0	0	3		

Functional Group	NHS GG&C						
	GRI	QEUH	GGH	New Stobhill	New Victoria	RHCG	RAH
Cardiac	4	1	1	0	0	0	0
Vascular	3	1	1	1	1	1	0
Lung	3	1	1	2	1	1	0
Brain	3	3	1	2	1	1	0
Bone	3	1	1	2	1	1	0
GI	3	1	1	2	1	1	0
Hepatobiliary	3	1	1	1	1	1	0
Urinary	3	1	1	1	1	1	0
Infection	3	1	1	1	1	0	0
Haematology	3	1	1	2	1	0	0
Endocrine	3	1	1	1	1	1	0
Lacrimal	3	1	1	1	1	1	0
Tumour	3	1	1	1	1	1	0
Sentinel Node	3	1	1	2	1	0	1
PET	0	0	4	0	0	0	0

Source: Scottish NM Scientific Leads Group

Table D2: ARSAC Practitioner Licence Imaging Coverage by Health Board by Functional Group (Imaging Only) (continued)

Red cells denote existing single point of failure

Functional Group	NHS Highland	NHS Lanarkshire	NHS Lothian		NHS Tayside
	Raigmore	UHM	RIE	WGH	Ninewells
Cardiac	1	1	2	2	2
Vascular	1	1	2	2	2
Lung	1	2	2	2	2
Brain	1	1	2	2	2
Bone	1	2	2	2	2
GI	1	2	2	2	2
Hepatobiliary	1	2	2	2	2
Urinary	1	2	2	2	2
Infection	1	0	2	2	2
Haematology	1	1	2	1	2
Endocrine	1	2	2	2	2
Lacrimal	1	1	1	1	2
Tumour	1	1	2	2	2
Sentinel Node	1	1	2	2	2
PET	0	0	1	2	2

Source: Scottish NM Scientific Leads Group

Appendix E: NHS Scotland Employment Forecast

The forecast staff in post within NHS Scotland for Consultant Clinical Radiologists and Qualified (Bands 5 to 8) Diagnostic Radiographers, based on analysis of joiners and leavers, including training intakes and projected retireals.

Table E1: NHS Scotland Employment Forecast

Source: NHS Education for Scotland

Year	Consultant Clinical Radiologists (WTE)	Qualified Diagnostic Radiographers (Headcount)	Qualified Diagnostic Radiographers (WTE)
2009	268.192	1,893	1,661.493
2010	271.904	1,718	1,501.776
2011	284.87	1,707	1,489.957
2012	285.382	1,703	1,484.681
2013	285.24	1,749	1,524.277
2014	305.254	1,791	1,567.771
2015	320.412	1,809	1,584.134
2016	321.258	1,806	1,582.508
2017	314.722	1,820	1,584.686
2018	321.037	1,853	1,619.907
2019	329.437	1,894	1,659.839
2020	342.118	1,928	1,687.78
2021	358.526	1,985	1,736.656
2022	367.9422	1,988.968	1,750.472
2023	380.5873	2,003.577	1,772.152
2024	391.5863	2,025.712	1,802.049
2025	408.396	2,050.489	1,834.619
2026	426.2185	2,076.452	1,868.67
2027	443.9776	2,102.302	1,902.859
2028	460.0423	2,127.254	1,935.258
2029	475.1494	2,151.243	1,966.796
2030	489.0116	2,175.219	1,998.803
2031	464.2762	2,200.107	2,031.828

Glossary of Terms

Agenda for Change

The Agenda for Change (AfC) terms and conditions apply to all staff directly employed by NHS organisations, except very senior managers and staff within the remit of the Doctors' and Dentists' Review Body. Under Agenda for Change each NHS job has a band from 1 to 9 which indicates the pay scale through which staff will progress in their role, and the level of skills and education required at each level.

ARSAC

The Administration of Radioactive Substances Advisory Committee (ARSAC), part of the UK Health Security Agency, advises the licensing authority on the granting, amendment, and renewal of licences to employers and practitioners for the administration of radioactive substances. This is required under regulation 5 of IR(ME)R in Great Britain. Within imaging, ARSAC Practitioner Licence holders are typically Consultant Nuclear Medicine Physicians or Consultant Clinical Radiologists.

CoR

The College of Radiographers (CoR) works to ensure that all UK programmes of education and training related to the radiographic workforce are of a high standard. The college can accredit individuals at various levels of practice and promotes study and research in radiography.

CT

A computerised tomography (CT) scan makes use of computer-processed combinations of many X-ray measurements taken from different angles to produce cross-sectional digital images (slices) of specific areas of a scanned patient.

DCAQ

Demand, Capacity, Activity and Queue (DCAQ) information supports a quality improvement approach to sustainably reduce waiting times and improve flow.

DEXA

DEXA stands for dual energy X-ray absorptiometry. It uses low dose X-rays to measure bone density.

Establishment

Number of funded posts irrespective of whether the posts are filled or not. Establishment is calculated adding the number of staff in post and the number of vacancies at a point in time. It can be measured in WTE (whole time equivalent) or headcount.

Fluoroscopy

An imaging modality that uses multiple X-rays to allow real-time visualisation of body structures. During fluoroscopy, X-ray beams are continually emitted and captured on digital detectors, producing a real-time, dynamic image similar to an X-ray 'movie' and viewed directly on a monitor.

Headcount

Refers to the count of individuals. When converting WTE to headcount, decimals are rounded up to reflect that contribution will be delivered by one individual.

HCSW

Healthcare Support Workers (HCSW) are crucial cogs in the diagnosis and treatment of patients, and work closely with Diagnostic Radiographers. The role typically falls under AfC Band 2 or Band 3, and in some sites is classified instead as a Radiography Department Assistant (RDA).

Imaging

Medical imaging is the technique and process of creating visual representations of the interior of a body for clinical analysis and medical intervention, as well as visual representation of the function of some organs or tissues.

Insourcing

In this report, insourcing refers to an NHS employer paying radiology department staff to conduct activity such as reporting, outside of their NHS contracted hours. It is an alternative approach to outsourcing this activity to a third-party provider.

Interventional radiology

Interventional radiology (IR) refers to minimally invasive, image-guided medical treatments. Procedures use real-time imaging techniques, including X-rays and ultrasound, to guide the operator.

IPEM

The Institute of Physics and Engineering in Medicine (IPEM) is the UK professional body and learned society for physicists, engineers and technologists within the field of medicine.

IR(ME)R

The Ionising Radiation (Medical Exposure) Regulations 2017 provide safeguards for individuals exposed to ionising radiation from medical equipment for imaging, treatment, or research purposes.

IRR17

The Ionising Radiations Regulations 2017 (IRR17) requires employers to keep exposure to ionising radiations as low as reasonably practicable, and are enforced by the Health and Safety Executive.

MPE

IR(ME)R requires employers to appoint suitably qualified Medical Physics Experts (MPE) for all areas involving medical exposures, including nuclear medicine, and sets out the requirement for all MPEs to be formally accredited through a recognised scheme. In routine imaging the MPE involvement is generally around the optimisation of radiation exposures to patients, ensuring these are as low as practicable and compliant with appropriate legislation, and in the development of complex imaging processing and data analysis techniques.

MRI

Magnetic resonance imaging (MRI) uses strong magnetic fields, magnetic field gradients, and radio waves to generate cross-sectional images of the body. It is particularly good at looking at soft tissues such as the brain, ligaments, tendons, and the spinal cord.

MRSE

To ensure the safety of patients, staff and visitors, all MRI facilities are recommended to appoint one or more persons with advanced knowledge of MRI techniques and an appropriate understanding of the clinical applications of MRI – often a physicist with expertise in MRI - either from within their own organisation or as part of a service level agreement with an external organisation.

Clinical units should appoint a Magnetic Resonance Safety Expert (MRSE) who acts according to recognised standards – typically holding Health and Care Professions Council (HCPC) registration or General Medical Council (GMC) Specialist registration – and is in a position to adequately advise on the necessary engineering, scientific and administrative aspects of safe clinical use of MR devices including site planning, development of a safety framework, advising on monitoring the effectiveness of local safety procedures, procurement, adverse incident investigation and advising on specific patient examinations. Their knowledge of MR physics should enable them to advise on the

risks associated with individual procedures and on methods to mitigate these risks.

NICIP

The National Interim Clinical Imaging Procedure (NICIP) code set provides a common, consistent, and unambiguous representation of imaging procedures, for consistent recording and sharing of information in electronic systems in the NHS. NHS Scotland is transitioning to using SNOMED CT within electronic records as its national clinical terminology across all of health and care.

NMAHP

Nursing, Midwifery and Allied Health Professionals (NMAHP)

Nuclear medicine

Nuclear medicine (NM) uses small amounts of radioactive material to diagnose, determine the severity of or treat a variety of diseases, including many types of cancer and heart disease. PET-CT and SPECT are similar, but they combine the NM examination with a CT scan.

OECD

The Organisation for Economic Co-operation and Development (OECD) is an intergovernmental organisation with 38 member countries who work on establishing evidence-based international standards and finding solutions to a range of social, economic and environmental challenges.

Outsourcing

Outsourcing is an agreement in which one company hires another company to be responsible for a planned or existing activity that is or could be done internally, and sometimes involves transferring employees and assets from one firm to another. In this report, it refers to a Health Board hiring a third-party provider to conduct imaging and/or reporting on its behalf.

PACS

A picture archiving and communication system (PACS) is a medical imaging technology which provides economical storage and convenient access to images from multiple modalities. NHS Scotland employs a national PACS, and patients benefit from the cross-boundary communication this facilitates.

PET

Positron emission tomography (PET) scans use a mildly radioactive drug to produce detailed 3-dimensional images of the inside of the body, and can highlight how well certain functions of the body are working. PET scans are particularly helpful for investigating confirmed cases of cancer to determine how far the cancer has spread and how well it's responding to treatment.

PET-CT

Positron emission tomography – computed tomography (PET-CT) is a nuclear medicine technique which combines a PET scan and CT scan. Sequential images from both devices are acquired in the same session and combined into a single superimposed image, known as image fusion or co-registration. These combined scans help pinpoint abnormal metabolic activity and may provide more accurate diagnoses than the two scans performed separately.

Plain film

Plain film refers to standard X-rays, for example of a chest, abdomen, skull, hand, knee, or hip.

QSI

Developed by the RCR and CoR, the Quality Standard for Imaging (QSI) provides a framework for the NHS and private sector to provide consistently high-quality services delivered by competent staff working in safe environments. Services can apply for UKAS accreditation to

ensure that the standard's requirements are maintained through regular monitoring.

Radiographer (Diagnostic)

Radiographers are healthcare professionals who specialise in the imaging of human anatomy for the diagnosis and treatment of pathology. They are part of the Allied Health Professions (AHP) job family within the non-medical workforce, and roles typically begin at AfC Band 5. This report incorporates only Diagnostic Radiographers, as Therapeutic Radiographers are out of scope.

Radiologist

A Radiologist is a doctor who specialises in diagnosing and treating disease and injury, using medical imaging techniques. Upon completion of medical school and a two-year foundation programme, individuals can choose to undertake specialty training to become a Clinical Radiologist which will take a minimum of five years in the UK.

RDA

Radiography Department Assistants (RDA) are crucial in supporting the diagnosis and treatment of patients, and work closely with Diagnostic Radiographers. The role typically falls under AfC Band 2 or Band 3, and can instead be referred to as a Clinical Support Worker or HCSW.

Reporting

In radiology, reporting refers to the clinical evaluation and interpretation of diagnostic images, with a written report being provided to explain what the imaging indicates.

RIS

A radiological information system (RIS) is the core system for the electronic management of imaging departments. The major functions of the RIS can include patient scheduling, resource management, examination performance tracking, reporting, results distribution, and

procedure billing. The feasibility of deploying a functionally national RIS across NHS Scotland is due to be explored, to improve standardisation and interoperability.

RCR

The Royal College of Radiologists (RCR) leads, educates and supports doctors who are training and working in the specialties of clinical oncology and clinical radiology.

RPA

A Radiation Protection Adviser (RPA) is a title used in the UK given to those who are competent to advise employers on the safe and compliant use of Ionising Radiations. The post is a legally recognised position and is a requirement of IRR17.

RWA

A Radioactive Waste Adviser (RWA) is an appointed individual in the UK who is a recognised expert in radioactive waste accumulation and disposal. The role is complementary to, but not the same as, the RPA, and it is possible for one individual to take on both roles. The RWA role is required as a condition of holding environmental authorisations under The Environmental Authorisations (Scotland) Regulations 2018.

SNOMED CT

The Systematised Nomenclature of Medicine – Clinical Terms (SNOMED-CT) is a structured clinical vocabulary for use in an electronic health record. It gives clinical IT systems a single shared language, which makes exchanging information between systems easier, safer, and more accurate. It is the most comprehensive and precise terminology product in the world, with extensive adoption across the globe.

Sonographer

A Sonographer is a healthcare professional who specialises in the use of ultrasound to assist in providing a diagnosis or assessment.

SoR

The Society of Radiographers (SoR) is a professional body and trade union that represents more than 90% of the diagnostic imaging and therapeutic radiotherapy workforce in the United Kingdom. The SoR, along with its members, aims to shape policy and standards, and pioneer new ways of working in order to ensure safe and fair workplaces.

Ultrasound

Medical ultrasound (US) uses high-frequency sound waves to create an image of internal body structures such as tendons, muscles, joints, blood vessels, and internal organs. This report and modelling focus only on non-obstetric ultrasound.

WTE

Whole time equivalent (WTE) is a widely accepted method of counting staff based on contracted hours taking into account part time working. It is necessary to measure contribution in terms of contracted hours when evaluating the overall contribution of a team of individuals who have different terms and conditions.

X-ray

X-rays are a form of electromagnetic radiation that can pass through most objects, including the body. Medical X-rays are used to generate images of tissues and structures inside the body. They are good at looking for problems in bones, teeth, the chest and some soft tissue areas, such as the abdomen, and are usually the first (and sometimes only) diagnostic imaging used to diagnose a disease or condition.

Document Control Sheet

Key Information

Title:	Diagnostic Imaging Workforce Plan for NHS Scotland
Date Published / Issued:	31/05/2023
Version / Issue Number:	Version 1.0
Document Type:	Plan
Document Status:	Final Version
Author:	Amy Currie, Project Manager / Clinton Heseltine, Radiology Workforce Planning Clinical Lead
Owner:	Diagnostic Strategic Network TBC
Approver:	Imaging Executive Board
Contact:	Scottish Radiology Transformation Programme - nss.s.r.t.p@nhs.scot

Revision History

Version:	Date:	Summary of Changes:	Name:
Version 0.2	20/03/2023	Feedback incorporated and formatting revised	A Currie
Version 0.3	24/04/2023	Final draft completed for consultation	A Currie
Version 0.4	09/05/2023	Minor amendments to Acknowledgements and Glossary, addition of Statements of Support and T12 recommendation	A Currie
Version 1.0	31/05/2023	Final version	A Currie

Distribution

Title:	Date of Issue:	Version:
SRTP Workforce Planning Steering Group	13/03/2023	v0.1 (draft)
Imaging Executive Board and SRTP Workforce Planning Steering Group	26/04/2023	v0.3 (final draft)
Diagnostic Imaging Stakeholders	31/05/2023	V1.0 (final)