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INTERIM REPORT

Data Driven Healthcare in 2030: Transformation Requirements of the NHS Digital Technology and Health Informatics Workforce

Full Report

HEE Digital Readiness Programme

March 2021

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Interim Report

Data Driven Healthcare in 2030: Transformation Requirements of the NHS Digital Technology and Health Informatics Workforce - Full Report

HEE Digital Readiness Programme, March 2021

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Foreword

Our healthcare leaders are faced with the challenges and opportunities that emerging digital technologies can provide. The Topol Review highlighted that these technologies will require the clinical workforce to profoundly change their approach to education and training, so that they can harness the potential for improving patient services and create more time to provide direct patient care. The digital transformation of our healthcare services and the confident use of such technologies can only occur with a highly skilled, capable and adaptable workforce that includes everyone.

This report provides an analysis of the NHS digital technology and health informatics workforce, which is at the heart of building and supporting the technology, data and knowledge infrastructure and ecosystem. Our modelling and demand forecast projection for an ambitious technological and data-driven NHS shows an estimated 78,000 staff members in supporting, professional, managerial and senior leadership roles will be needed in this workforce by 2030.

The COVID-19 pandemic in 2020 has forced people to work from home and deliver services, and also think differently about how they can sustain remote service models to deliver care to patients safely. This has required a cultural step change in the thoughts, behaviours and attitudes of workforce and patients alike, in adopting and adapting to digital innovation. Embedding innovation around digital technology in healthcare, as was seen during the pandemic, and ensuring future sustainability will require ongoing funding, the necessary technical infrastructure, and a digital and data-literate healthcare workforce. It also requires investment in – and professional recognition of – a staff group whose area of work is primarily focused on digital technology and health informatics. This report aims to help understand the demand for this staff group and how the NHS

can invest in the necessary job roles and skills to build and sustain a digitised NHS.

It is important to note that with any workforce model and demand forecast projection there are flaws and limitations and wide error bars, so this report provides the HEE Digital Readiness programme, stakeholders and partners with a direction of travel and not a destination. The model has enabled the project team behind this report to provide a set of recommendations for the Digital Readiness programme to review and assess investment priorities to ensure the NHS can plan, professionalise and provide the digital workforce it needs.

Foundational principles to develop the future workforce include, first of all, implementing structural, system-wide changes to the workforce in terms of terminology and job architecture, as advances in technology and increasingly sophisticated usage of data will require more highly skilled staff in professional posts. Secondly, the principles address the urgent need for clearly defined career pathways mapped to skill levelling in an agreed occupational framework, and to continue creating an established professional 'home' for the highly skilled staff in question. Realising these two underpinning principles, as well as the recommendations made in this report, will help the NHS to attract, retain and develop our current and future digital technology and health informatics workforce, and to fulfil the true potential that a digital and data-driven healthcare system can provide for clinicians and patients.

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Contents

1. Executive summary

The networks, communities and organisations that will benefit from reading this report include, but are not limited to, the following:

Academic Health Science Networks
Department for Education
Faculty of Clinical Informatics
Federation of Informatics Professionals
Government Digital Service
Higher education institutes
Health Data Research UK
Health Education England
Health Informatics Connected Communities – including Skills Development Networks
Institute for Apprentices
NHSX
NHS Digital
NHS Employers
NHS England and Improvement
NHS Pay Review Body
NHS Providers
NHS-R Community
NHS organisations – in particular

- Chief Information Officers
- Chief Digital Transformation Officers
- Chief Nursing Information Officers
- Directors of Human Resources
- Organisational Development Leads

Realising the data-driven healthcare, digital transformation and technology-supported organisational change ambitions of the NHS requires a workforce with the right job roles, and specialist skills in health informatics and data, digital, information technology and knowledge management services. This is one of the main findings of a project focussing on acute secondary care but can be applicable to other health and care sectors.

An increase in staffing levels and changes in the composition of the NHS digital technology and health informatics workforce (the 'digital workforce') between 2020 and 2030 will be needed if the digital transformation ambitions set out in the Topol Review[1] and NHS Long Term Plan[2] are to be accomplished.

Some of this increase and accompanying changes will come about as NHS organisations employ the right people in seeking a high level of organisational digital maturity. Direction, however, will still need to come from policymakers in arms-length bodies such as HEE and NHSX, as they can affect the policy levers around the supply of staff into this workforce. The intention of this report is to inform policymakers as to their decision-making in regard to the NHS digital technology and health informatics sector. For the first time, the extent of changes and required size of the NHS workforce in different areas of digital technology and informatics have been quantified to provide an indication of the challenges facing policymakers if the NHS is to realise its digital transformation ambitions. Two of the main findings of this report are:

- The projected NHS digital workforce demand for an ambitious future indicates that a significant increase in the overall number of staff will be required. The increase is in the region of 69 per cent, or an additional 32,000 whole-time equivalents (WTEs) in the workforce, from its current size of 46,000 WTEs in 2020 to the forecasted required size of 78,000 WTEs in 2030.

- The projected supply for the digital workforce, based on trends observed for 2016-17 to 2018-19 and the assumption that no significant policy or related actions are taken, indicates that the overall number of staff will increase from its current size by 31 per cent to 60,250 WTEs in 2030. This increase is not sufficient to the meet the projected demand for this workforce. By 2030, there will be a shortfall of around 17,750 WTE members of staff.

The ambitious future envisaged for the NHS digital technology and health informatics sector will see an increased professionalisation of the digital workforce and is one where a new cadre of managers and senior leaders will emerge.

Meeting the priorities placed on NHS trusts relating to digital transformation and the ambitions of data-driven healthcare will determine the in-demand, emerging and new job roles and skills needed over the next 10 years. Many of these job roles are professional posts requiring staff with advanced qualifications and knowledge of the clinical or organisational domains in which technology and data are being applied. Specialists in areas such as IT systems architecture and cybersecurity are needed in the implementation and operation of digital technology, as are delivery managers and implementation facilitators to manage the adaptive elements in technology-supported organisational change. As digital technology and data analytics become more central to the operations of NHS trusts, these functions will require managers and senior leaders. Chief clinical information officers and chief nursing information officers, together with newer roles in the C (chief) suite such as chief analytical officers and chief data officers, will have a vital role in managing and setting the strategic direction for digital technology and health informatics in NHS organisations.

The greatest growth in demand for the digital workforce in the next 10 years will be for professionals and specialists in the areas of information management and clinical informatics.

These areas of work are at the early stages of becoming essential and important functions in NHS trusts. An additional 7,850 staff members in information management are required by 2030. Managers together with professionals, such as data and enterprise architects and information governance officers, will be required in growing numbers to put into place and maintain the necessary data architecture frameworks for trusts if they are to become data-driven healthcare providers. In clinical informatics, an additional 11,950 staff members are required by 2030. Professionals such as health data analysts, data scientists, clinician bioinformaticians and biostatisticians will be essential in providing advanced analytics of data and developing AI and machine learning capability in the use of data. They will have a crucial role in facilitating the integration of genomics in medicine, which is critically dependent on expert computational analysis of genomic and biological datasets. The hybrid role of clinician-informatician is also expected to become more prominent in the NHS, especially when standardised job roles for multi-professional clinicians are developed, recognising their expertise in both clinical practice and digital technology.

Investment in the NHS digital workforce will need to be made if the NHS is to realise its ambitions around digital transformation.

Investment in the digital workforce is required in terms of building capacity. The salary and employment on-costs for the workforce of 46,000 WTEs in 2020 is estimated to be around £2.05 billion. If this workforce is to increase to a projected size of 78,000 WTEs in 2030 and its composition remains the same, the costs will be around £5.2 billion. The level of investment required to develop the digital workforce should not be underestimated. To help policymakers make informed decisions around investment, a set of recommendations focussing on workforce planning, workforce development, and professionalisation and workforce supply planning can be found in the next section of this report.

In building capacity, particular attention should be paid to those job roles and skills that are most in-demand, or new or emerging in the health and care sector.

This requires consideration of the investments needed to develop or enhance education and training pipelines into some areas of the workforce, as well as the creation of opportunities and career pathways for existing staff to upgrade their skills and take on professional, specialist, managerial or senior leadership roles. Recruitment into the NHS is another possibility when building capacity. The NHS, however, faces significant challenges in a competitive labour market where people with digital and data analytical skills are required by all sectors of the economy. Consideration therefore needs to be given to the monetary, as well as non-monetary, reward factors driving recruitment and retention.

2. Recommendations and next steps

The Building our Future Digital Workforce workstream, as part of the HEE Digital Readiness programme, has produced a set of recommendations for policymakers to consider. These recommendations are the outcomes of a project focussing on acute secondary care in the NHS, but can be applicable to other health and care sectors. The project looked at future demand for the digital technology and health informatics workforce (the 'digital workforce') and required job roles and skills, on the basis that the NHS is seeking to realise the digital transformation, technology-supported organisational change and healthcare data-driven ambitions set out in the Topol Review[1] and NHS Long Term Plan[2]. The principles underpinning these recommendations are:

A. The digital transformation and data-driven ambitions of the NHS will have an effect on the workforce in terms of its required capacity and capability.

B. There is a need to implement system-wide terminology and job architecture that reflects advances in technology, such as AI, machine learning, and the use of genomic data, with the associated need for highly skilled and specialist staff in professional, managerial and senior leadership roles.

C. There is an urgent need for clearly defined career pathways mapped to skill levels in an agreed framework, and to ensure there is an established professional 'home' for staff in the digital workforce.

The recommendations made in this report have been categorised according to three areas where change will be needed the most: workforce planning, workforce development and professionalisation, and workforce supply. Some of the recommendations will span these categories. Policymakers will need to consider and prioritise these recommendations to inform further investment in – and further action by – the HEE Digital Readiness programme and its workstreams.

A summary of the recommendations, together with possible action points and timelines, is provided in Table 2.1.

Areas of change: workforce planning

Recommendation 1: Develop and sustain an agreed digital technology and health informatics occupational framework in the health and care sector.
There is the need to develop an agreed occupational framework that reflects a modern job architecture for the digital workforce, so that NHS organisations can employ professionals with the right skills in the right place and at the right time. The framework should complement those that exist for well-established professional groups, such as knowledge and library specialists. The work commissioned by the HEE Digital Readiness programme to align the Government Digital Service (GDS) Digital, Data and Technology (DDaT) Capability Framework[4] to the health and care sector should be done with end users in the NHS in mind, and the framework embedded and sustained to reflect changes and be inclusive of new and emerging job roles. Ownership and responsibility of maintaining the framework in the health

and care sector will be key to ensuring job roles in digital technology and health informatics are visible in the NHS, and can be suitably planned for and invested in. The next step will be to standardise job descriptions for these roles and link them to the professional competence criteria set out by the Federation for Informatics Professionals (FEDIP).

Related to this recommendation is incorporating the main parts of the GDS DDaT Capability Framework into the NHS Electronic Staff Record (ESR) system. The framework's specified job families and roles, when incorporated into ESR, will allow for a greater degree of certainty in any future planning of the NHS digital workforce. Stakeholders, including HEE, NHSX and professional bodies, should work with those responsible for data standards in ESR, including the Workforce Information Reference Group and Data Coordination Board at NHS Digital.

Recommendation 2: Focus on the supply factors affecting the NHS digital technology and health informatics workforce, and develop an action plan to address the need for an increase in staffing levels.

Supply factors which fall into the remit and organisational responsibility of HEE should be considered in developing an action plan in 2021, to help address the need for an increase in staffing levels in the NHS digital workforce over the next 10 years. The action plan will need to account for the education and training supply pipeline into the workforce, as well as the policy levers and monetary and non-monetary pull and push factors around staff recruitment and retention. Non-monetary factors to examine include perceived status of professional roles, workforce diversity, flexible working and return to work arrangements, and opportunities for training, continuing professional development (CPD) and career progression.

Recommendation 3: To review the financial reward structures for the NHS digital technology and health informatics workforce, with particular attention given to the competitiveness of the labour market in affecting recruitment and retention of staff in the NHS.

Financial reward and monetary incentives are factors particularly pertinent to the recruitment and retention of in-demand staff in some areas of digital technology and data analytics. A review of financial reward structures will need take into account the existing NHS Agenda for Change pay arrangements for the digital workforce, including for example senior data analysts who do not wish to progress into a managerial post, in consultation with key stakeholders such as NHSX, NHS Employers and NHS Providers. A labour market analysis commissioned by HEE in 2020 contained details of median salary rates for digital technology professionals working across different sectors of the economy, and forms the basis for reviewing comparative financial reward for these professionals in the NHS[5]. Any recommendations made in light of this review will need to be subject to a full economic assessment. The NHS Pay Review Body should be informed of any work being carried out in this area in regard to the NHS digital workforce. The work should complement that undertaken by NHS Providers on total reward packages for IT staff which has been highlighted in their 2019/20 written submission to the NHS Pay Review Body.

Areas of change: workforce development and professionalisation

Recommendation 4: Develop standardised job roles for multi-professional clinicians, including clinician-informaticians, to address the workforce demand anticipated across the depth and breadth of clinical informatics.
Working with other professional bodies including the medical royal colleges and NHS arm-length organisations and relevant professional organisation service leads, educationalists and chief professional officers, the Faculty of Clinical Informatics should scope and develop standardised specialist job roles for multi-professional clinicians to meet the anticipated workforce demand in clinical informatics in a future where health and care will be increasingly driven by data. These job roles should incorporate hybrid clinician-informatician positions at the relevant skill levels, recognising their clinical practice and role as data, digital and technology specialists. Examples of these positions include clinical product owners, digital service managers, chief clinical information officers, chief nursing information officers and any other roles in the C (chief) suite that incorporates the multi-professional clinical workforce. This is not an exhaustive list of potential roles. The roles should reflect the appropriate skill levels required by clinicians to practise as digital health professionals during their careers.

Recommendation 5: Commission a postgraduate-level programme to develop chief analytical officers and chief data officers, commensurate with the NHS Digital Academy programme of developing the next generation of digital leaders.
To support the demand in the NHS for senior leaders in the fields of information management and clinical informatics, a development programme should be commissioned to bring through a cadre of chief analytical officers and chief data officers. The NHS requires leaders responsible for advancing the management of information and effective usage of data in delivering healthcare, who are capable of providing the technical- and domain-level leadership and guidance at board level. Work also needs to be undertaken in developing standardised job roles for chief analytical officers and chief data officers, and establishing clearly defined career pathways to provide direction for NHS data professionals looking to progress towards these senior roles. The development programme for chief analytical officers and chief data officers should be commensurate with that of the NHS Digital Academy in developing the next generation of digital leaders. Some 300 clinicians and health managers have already or are due to complete the NHS Digital Academy learning programme.

Recommendation 6: Develop a cadre of chief knowledge officers via a commissioned learning programme to meet the demand for senior leadership roles in the knowledge management function of NHS trusts.
The role of chief knowledge officer should be scoped and developed as the first phase in ensuring that the senior leaders forecasted in this report can be developed and retained in the NHS. A suitable educational programme at postgraduate level should be commissioned to develop a cadre of skilled leaders for the NHS, as well as the wider health and care sector, to ensure an adequate cohort capacity is available at the level of integrated care systems.

Recommendation 7: Develop and commission a programme to develop professionals and managers in the field of IT education and training.
Good practice already exists in many NHS trusts in the provision of IT training and education, especially in the coverage of basic digital skills. However, there is a need to enhance the IT education and training function of trusts and integrated care systems through the professionalisation of staff and appointment of managers in this area. Working knowledge of the principles of adult education and learning will be required by those responsible for training NHS staff in the technical and non-technical aspects (for example communication, creativity, critical thinking and collaboration skills) around the adoption of digital technology in clinical settings. A programme to develop and professionalise the role of IT educators and trainers will lead to NHS trusts formulating effective training strategies and programmes for their clinical and non-clinical staff, and therefore more rapid uptake and embedding of advanced digital, data and information governance skills across functions and services. There is a need to map existing training opportunities for IT educators and trainers to identify gaps in provision. The development of training the trainer programmes may need to be considered as ways to professionalise the IT education and training function of NHS trusts, similar to the use of Practical Skills for Professional Education and Leadership in Healthcare Science programme (commissioned by the NHS Leadership Academy, National School of Healthcare Science and NHS England and Improvement) and commissioning of university accredited postgraduate-level programmes to develop educationalists.

Areas of change: workforce supply

Recommendation 8: Health Education England to further work with Health Data Research UK (HDRUK) and expand on a programme of under- and postgraduate education in universities, to deliver a supply of health data analysts and data scientists into the health and care sector.
A significant increase in the data analytical capacity of NHS trusts is required over the next 10 years to enable healthcare services to be fully data driven, and provide the skills to realise the benefits of AI in healthcare pathways and service models. An expansion in the number and size of degree-level courses delivered by universities in health data analytics and data science, through possible commissioning initiatives, will increase the supply of health data analysts and data scientists into the NHS. The programme of courses should be developed to support the infrastructure of the health data analytics profession, and therefore requires input from stakeholders including: the Analytics Board, chaired by NHSX and NHS England and Improvement and networks; informatics skill-development networks (ISDNs); communities such as the NHS-R Community and Academic Health Science Network and industry partners; professional bodies and chief professional officers. Universities delivering health data analytics and data science courses should collaborate with employers to provide students with work placement opportunities in healthcare settings and use their sustainable funding mechanisms, such as the apprentice levy, for education provision. Another option worth exploring is working with educational providers in developing specialist health modules for students registered on generic data analytics and related courses.

Specialist job roles in data analytics and data science emerging in or new to healthcare should be scoped, developed and standardised to reflect the skills-clustering required in these roles. This should be undertaken as part of the work in developing the supply route into the NHS of health data analysts and data scientists, so that new entrants can be employed as machine learning and AI engineers, knowledge engineers, advanced health data analysts and in other specialist roles.

Recommendation 9: Support the development and retention of ICT professionals in the NHS by setting up a collaborative knowledge and skills transfer programme with public, academic, research and private sector bodies and employers.

The programme should centre on learning and knowledge as well as skill transfer partnerships, whereby ICT professionals are able to undertake commissioned, time-limited placements in different work settings outside of the NHS. This should be part of an overall strategy to develop and retain in-demand ICT professionals in the NHS, including cybersecurity specialists, development operations engineers, product managers and IT system analysts. Consideration will need to be given as to whether the programme should be structured, possibly leading to a qualification, or if it should be a framework in which learning is facilitated. The programme should be collaborative and have a dual purpose. Placements in the NHS for ICT professionals from other sectors will facilitate the transfer of knowledge and skills into the healthcare sector along with new ideas, and help address digital challenges at local or regional level, such as integrated care systems. An NHS placement model will provide the structure, allowing ICT professionals seconded into the NHS to work in 'hackathon' huddles focussing on digital transformation problems, with caveats around NHS intellectual property, and enable the growth of knowledge and skill transfer partnerships. Robust checks by human resource departments on those seconded into the NHS will need to be undertaken, and arrangements made in regard to their supervision, induction and mandatory training in data security, protection and so on. The potential to set up shared pools of skills, resources and services among NHS and non-NHS partners should also be investigated.

Recommendation 10: Continue to expand, evaluate and roll-out the HEE Digital Readiness programme commissioned NHS Graduate Digital, Data and Technology Scheme.

To meet the immediate and near-future shortages for professionals with skills in information management, clinical informatics and ICT, and particularly the demand for critical roles in software development, IT systems architecture and data analytics, NHS organisations should utilise the NHS Graduate Digital, Data and Technology Scheme as a way to fill current and expected vacancies[3]. Human resource directors and organisational development leads can ensure that they are developing high-quality graduates with the necessary skills with a scheme designed for and by the NHS. Expansion of the scheme should be undertaken over the next 10 years to meet increasing demand in the NHS for professionals in information management, clinical informatics and ICT. The London pilot of the scheme has recruited 28 graduates since 2018 and plans are currently in place for a national roll-out with the support of the regional informatics skill development networks (ISDNs). The scheme must work alongside, and not in competition, with the NHS Graduate Management Training Scheme.

Recommendation 11: Develop key roles and a supply of professionals in the area of managing programmes and projects relating to the implementation of digital technology, and introduction of new technology-supported clinical and organisational processes in NHS trusts.

Many individuals operating in NHS digital technology implementation roles currently have generic job titles, such as programme manager or project manager, and job descriptions that potentially mask the specialist technical and non-technical skills required in digital change and transformation. A need exists to develop the roles of implementation facilitators, organisational development leads and specialists, digital transformation leads, knowledge engineers and other specialists, many of whom are working on a programme or project basis implementing digital technology and technology-supported change in clinical processes. Implementation must be done safely and effectively, and with the outcomes continually and robustly evaluated. The development of these job roles, and the task of fully scoping and standardising job descriptions, will need to take into account the professional competency criteria set out by the Federation for Informatics Professionals (FEDIP) and guidance issued by the NHS Staff Council's Job Evaluation Group (JEG). The intention of developing and standardising these job roles and descriptions is to help NHS trusts plan for the skills required in addressing the technical and adaptive complexities around managing digital change and transformation. Standardised job roles and descriptions and a clearly defined career pathway will help arms-length bodies such as HEE and NHSX plan for the supply of these specialists into the NHS workforce. Individuals suitable for these roles could come from a clinical background, such as nursing, or a non-clinical data science or informatics background. The new implementation facilitator role, for example, is highly context-dependent and will dictate the required domain expertise and core skills while clearly overlapping with the skillsets of product owners or managers and knowledge engineers. Preparing a suitable pipeline of implementation facilitators is therefore about understanding the context-dependent expertise and skills required for each role.

Table 2.1: Summary of recommendations to inform future investment planning in the HEE Digital Readiness programme

Recommendation	Action required	Action status	Digital readiness programme workstream
Change area: Workforce planning			
1. Develop and sustain an agreed digital technology and health informatics occupational framework.	Pilot	In delivery	Building our Future Digital Workforce
2. Focus on the supply factors affecting the NHS digital technology and health informatics workforce and develop an action plan to address the need for an increase in staffing levels.	Develop plan Q4 –2020/21		Building our Future Digital Workforce

3. Review the financial reward structures for the workforce, with particular attention given to labour market competition affecting recruitment and retention of NHS staff.	Develop plan Q1 – 2021		Building our Future Digital Workforce
Change area: Workforce development and professionalisation			
4. Develop standardised job roles for multi-professional clinicians, including clinician-informaticians across the depth and breadth of clinical informatics.	To develop proposal Q4 – 2020/21	Gap	Developing our Digital Experts
5. Commission a postgraduate-level programme to develop chief analytical officers and chief data officers, commensurate with the NHS Digital Academy programme.	To develop proposal to Q3/Q4 – 2021/22	Gap	Establishing the Digital Academy
6. Develop a cadre of chief knowledge officers via a commissioned programme.	Develop proposal 2021/22	Gap	To be confirmed
7. Develop and commission a programme to develop professionals and managers in the field of IT education and training.	Develop proposal Q1 – 2021/22	Gap	Establishing the Digital Academy
Change area: Workforce supply			
8. HEE to further work with HDRUK and expand on an educational programme to deliver a supply of health data analysts and data scientists into the health and care sector.	To develop proposal Q4 – 2020/21	Gap	Building our Future Digital Workforce
9. Support the development and retention of ICT professionals by setting up a collaborative knowledge and skills transfer programme with public, academic, research and private sector bodies.	To develop proposal Q4 – 2020/21	Gap	Building our Future Digital Workforce
10. Continue to expand, evaluate and roll out the NHS Graduate DDaT Scheme. *Note: High-level milestones – By December 2020, 20 graduates will have moved into vacant roles from the London pilot, and by April 2021, 72 graduates will have been recruited onto the scheme in three additional areas in England.*	Rolling out across four regions	In delivery	Building our Future Digital Workforce

11. Develop key roles and a supply of professionals in the area of managing programmes and projects relating to the implementation of digital technology and the introduction of new technology-clinical and organisation processes.	To develop proposal Q1 to Q2 – 2021/22	Gap	Building our Future Digital Workforce

Next steps

Policymakers in HEE and key stakeholder organisations (see Section 1) will need to consider and prioritise the above recommendations to inform decisions on investment in the HEE Digital Readiness programme and its workstreams, along with their subsequent actions, planning and project proposals. The responsibility will then be on the HEE Digital Readiness programme, in conjunction with NHSX as the commissioning body, to develop a number of costed delivery proposals and projects, which in some cases build upon existing work already underway in this area.

The aim is to develop a 10-year workforce plan around the supply factors – including education and training pipelines and staff recruitment and retention and professional development (re-skilling and upskilling) – for the health and care digital technology and health informatics sector. The workforce plan will need to consider planned service design (including how digital technology and data services will function within integrated care systems), the productivity of the digital workforce, and factors (including labour market conditions) affecting supply. Best practice around training, recruitment, retention and professional development will need to be identified or developed at the national level, with implementation of initiatives led by local employers.

The principles used to formulate the recommendations found in this report will also underpin the development of the workforce plan. In addition, planning for supply will use the long-term (10-year) demand projections set out in this report, rather than track short-term demand based on fiscal cycles. Long-term planning will be critical if the digital workforce is to expand its capacity and capability to the levels set out by this report. This will require collaborative working and alignment with those involved with organisational health and care service design and financial planning.

3. Main findings

The Building our Future Digital Workforce workstream project, as part of the HEE Digital Readiness programme, has identified a number of capacity and capability challenges facing the NHS digital technology and health informatics workforce (the 'digital workforce') in the next 10 years leading up to 2030. These challenges have been drawn out through a set of methodological steps focussing on the NHS acute secondary care sector, and will exist if the NHS is to realise the digital transformation, technology-supported organisational change, and healthcare data-driven ambitions set out in the Topol Review[1] and NHS Long Term Plan[2]. Capacity challenges refer to the size and composition of the digital workforce required, while capability centres on the job roles and skills needed between now and 2030. The main conclusions to emerge from this project are:

1. An increase in staffing levels and embedding of new job roles and skills and capabilities in the digital workforce is required for NHS trusts progressing through the levels or stages of digital transformation. The composition of the workforce in terms of job roles and skills will be quite different in 2030, compared to what is seen today. Some existing job roles and skills may be made redundant by advances in technology such as AI, or superseded by new roles and skills as the result of the digital or organisational transformation of trusts.

2. Managing the adaptive barriers and enablers of technology and data-driven clinical and organisational transformation can be challenging, due to human factor complexities. This increases the need for staff in clinician-informatician hybrid roles, as well as professionals, managers and leaders with skills in change management, optimising processes and workflows, and organisational development and design.

3. The Covid-19 pandemic has created an innovative environment whereby the NHS actively sought digital technology and data-driven solutions to strengthen the way healthcare should be delivered. Innovation on this scale in the future will be dependent on the capacity and capability of the NHS digital workforce.

Looking ahead to 2030

The main conclusions have been drawn out through a set of methodological steps aimed at looking ahead to 2030. Central to the methodology were the development of scenarios describing what the future could hold for the NHS digital workforce, and a demand-forecasting exercise whereby senior NHS digital leads were asked to estimate the workforce size and provide details of the skills required in the context of these scenarios. Information was sought in each of the role families and nine areas of work that comprise the digital workforce. Details of a 'typical' NHS trust were provided at the beginning of the exercise, outlining the number of staff in each area of work and by job level. Participants in the exercise were then asked if these numbers should increase or decrease, and to what extent, or if they should remain the same by 2025 and 2030.

Information from the exercise was then used to model projected demand, and data from the NHS Electronic Staff Record (ESR) was used to model projected supply for the digital workforce for the period 2020 to 2030. Particular attention was paid to workforce demand and the job roles and skills needed in a scenario called the Data Driven Future. This scenario reflects the digital transformation ambitions of the NHS because it envisaged a ubiquitous flow of data around the health and social care system, and the extensive use of IT, machine-learning technologies and AI in the NHS. An alternative scenario, called the Data Desert Future, was also used in the forecasting exercise to obtain estimates of workforce demand where there has been a cautious and cost-conscious approach in the development of digital technology in the NHS.

Strengths and limitations of the project

The projected demand forecast for a Data Driven Future highlights to policymakers the direction – and for the first time quantifies the extent of changes and size of the NHS digital workforce – required if the NHS is to realise the digital transformation ambitions set out by the Topol Review[1] and NHS Long Term Plan[2]. Limitations in the methodology used to make these estimates do, however, exist:

- The Data Driven Future scenario focuses on an ambitious uptake of digital technology and sophisticated use of data in the NHS. Little indication is given to the financial investments that are required. It could be argued that any employment forecast should recognise the economic climate in which the NHS is or will be operating.

- Another limitation concerns bias on the part of those who provided estimates as to future workforce demand. Participants in the demand-forecasting exercise who were from an organisation that is already digitally mature may have been more inclined to make a judgement calling for a smaller increase in the workforce, compared to those from organisations that are not so digitally mature. The majority of participants had a technical background (only one participant was a clinician) and this may have skewed the demand estimates and feedback given towards the technical roles in the workforce, at the expense of non-technical roles including clinicians specialising in clinical informatics.

- The main parts of the project were undertaken during the early stages of the Covid-19 pandemic in the UK. The NHS response to the pandemic, including the application of digital technology and data in supporting healthcare services, may have unduly influenced the development of the scenarios and how they are described, as well as the estimates of workforce demand over the next 10 years.

- A final limitation concerns the mapping of job roles. Estimates of demand for certain job roles may be stated in a particular area of work by one participant but in another area by another participant. The NHS digital technology and health informatics sector lacks a standardised occupational framework and a set of defined and agreed job roles. An individual in one job role may have a very different skillset to someone with the same job role in another

Figure 3.1: Supply projection and demand forecasts for the NHS digital technology and health informatics workforce in a Data Driven Future and Data Desert Future – 2020/21 to 2029/30

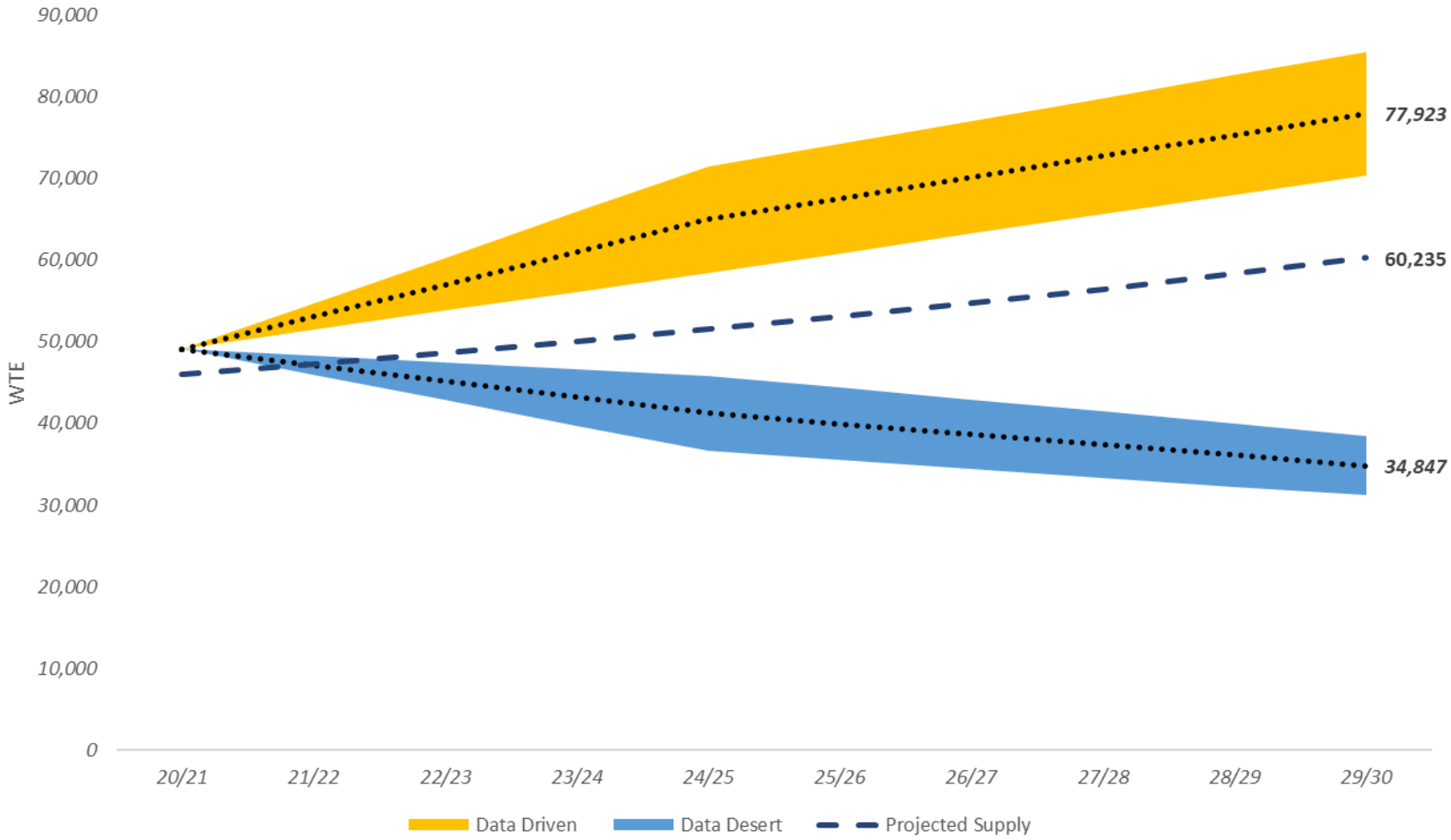


Table 3.1: 10-year increase or decrease in workforce size required by area of work, based on demand projections in a Data Driven Future

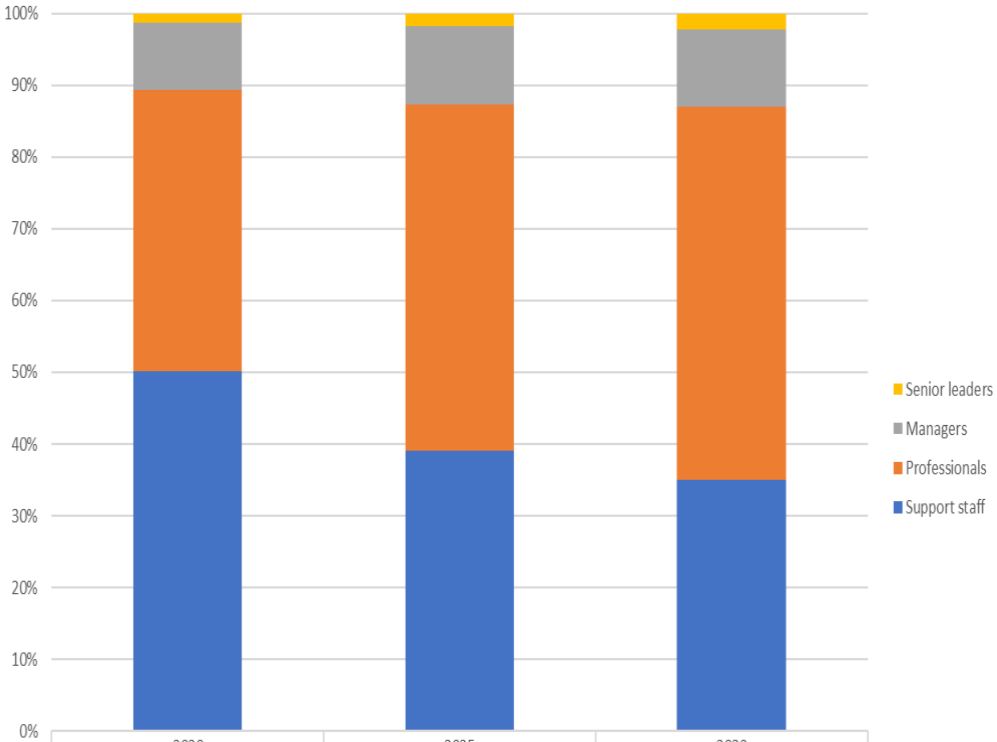
Role family	Area of work	Workforce size in 2020 – WTEs	Projected demand in 2030 – WTEs	10-year decrease (-) or increase (+) required – WTEs	10-year decrease (-) or increase (+) required – %
Data architecture	Clinical coding	3,560	3,101	-459	-13%
	Health records	12,610	12,315	-295	-2%
	Information management	8,113	15,961	+7,848	+97%
Technical infrastructure	Information and communications technology	16,407	21,963	+5,556	+34%
Application	Clinical informatics	1,778	13,731	+11,953	+672%
	Knowledge management	788	2,199	+1,411	+179%
Organisational transformation	IT programmes and project management	1,741	4,859	+3,118	+179%
	IT strategy and development	801	3,407	+2,606	+325%
	IT education and training	212	387	+175	+83%
	Total workforce	**46,009**	**77,923**	**31,914**	**+69%**

organisation, and this situation could lead to some staff being labelled incorrectly, resulting in inflated or exaggerated supply and demand growth rates for some job roles. Developing an occupational framework and standardised job roles for the digital workforce is one of the recommendations made in this report.

Projected demand forecast – 2020 to 2030

The projected demand forecast for a Data Driven Future indicates that the NHS digital technology and health informatics sector will need to increase the overall number of staff significantly, by around 69 per cent or 32,000 WTEs between 2020 and 2030, from its current size of 46,000 WTEs to the forecasted required size of 78,000 WTEs (Figure 3.1). These figures relate to the digital workforce overall but, when examining each of the nine areas of work that comprise this workforce, there are differences in the extent of the increase required and in some areas a reduction in staff numbers will be needed by 2030 (Table 3.1). The need to reduce the number of staff in one area offers the opportunity for redeploying or upskilling staff to take on roles where there is a demand.

Figure 3.2: Composition of the NHS digital technology and health informatics workforce leading up to 2030 in a Data Driven Future



	2020	2025	2030
Senior leaders	1%	2%	2%
Managers	9%	11%	11%
Professionals	39%	48%	52%
Support staff	50%	39%	35%

Digital transformation in the NHS over the next 10 years will require a change in the composition of the digital workforce in terms of its support, professional, managerial and senior leadership staff. The Data Driven Future is one where the digital workforce will become increasingly professionalised. The proportion of professionals is projected to increase from 39 per cent to 52 per cent between 2020 and 2030 (Figure 3.2). The number of managers will need to more than double to 8,650 WTEs, while a significant increase in senior leaders is also required so that by 2030 there will be around 1,825 WTEs at this level.

Projected supply forecast – 2020 to 2030

The current size of the NHS digital workforce in 2020 is estimated to be around 46,000 WTEs. An estimate of the size, or supply, of the workforce over the next 10 years (2020 to 2030) has been made based upon flow analysis of data held in the ESR system for the periods 2016-17, 2017-18 and 2018-19. Underlying the estimation of future supply between 2020 and 2030 is the assumption that the workforce will continue to grow at a similar rate as it has previously without further intervention.

Table 3.2: Projected supply and demand, and estimated shortfalls or excesses in workforce size, by area of work in 2030 in a Data Driven Future

Role family	Area of work	Projected supply in 2030 – WTEs	Projected demand in 2030 – WTEs	Shortfall (-) or excess (+) in 2030 – WTEs
Data architecture	Clinical coding	5,169	3,101	+2,068
	Health records	13,199	12,315	+884
	Information management	8,173	15,961	-7,788
Technical infrastructure	Information and communications technology	24,701	21,963	+2,738
Application	Clinical informatics	3,088	13,731	-10,643
	Knowledge management	545	2,199	-1,654
Organisational transformation	IT programmes and project management	4,105	4,859	-754
	IT strategy and development	988	3,407	-2,419
	IT education and training	267	387	-120
	Total workforce	**60,235**	**77,923**	**-17,688**

The projected supply forecast, which is the same for both the Data Driven Future and Data Desert Future scenarios, indicates that the NHS digital workforce will increase in size by around 31 per cent, or 14,225 WTEs, between 2020 and 2030, from its current size of 46,000 WTEs to the forecasted size of 60,250 WTEs (Figure 3.1). This increase, however, is not sufficient to meet the workforce demand required

in a Data Driven Future. It is projected that a shortfall of around 17,700 WTEs will exist in 2030 in the absence of any policy interventions and required investments made in the areas of building capacity, training and CPD, and recruitment and retention (Table 3.2). The two areas of work most affected by this shortfall are the information management and clinical informatics functions of NHS trusts. These areas are relatively immature or at early stages of development, but are functions that are expected to become much more prominent in the next 10 years and have a central role in the delivery of healthcare services.

Data Desert Future

The demand-forecasting exercise also used an alternative scenario, called the Data Desert Future, to estimate the size of the NHS digital workforce required in 2030. This scenario envisages a future where there has been a lack of investment made by the NHS in developing new IT infrastructure and data solutions, and emphasises cost-saving strategies in this sector. Participants in the exercise generally felt that this scenario would result in a cautious and cost-conscious approach in the development of the digital workforce. The projected demand forecast for a Data Desert Future indicates that the workforce will need to reduce the overall number of staff by around 24 per cent, or 11,150 WTEs, between 2020 and 2030, from its current size of 46,000 WTEs to the forecasted required size of 34,850 WTEs (Figure 3.1).

A reduction in workforce size was projected in all areas of work except those in the application role family. An increase in demand of 115 per cent, or 2,050 WTEs, has been projected for the clinical informatics staff group, along with a 44 per cent demand increase or additional 325 WTEs for the knowledge-management group. The projected decrease in information management is minimal: around 1,000 fewer WTE staff or a 12 per cent decrease. These figures reflect the importance of data, knowledge and information in supporting the work of clinicians, and shaping and delivering healthcare services. Those taking part in the demand-forecasting exercise highlighted that investment in these areas should continue as a way to help drive healthcare service efficiency and productivity gains in a financially constrained NHS. Clinical informatics will need to become more efficient and productive along with knowledge and information management functions, for example through merger and central provision of services across different NHS trusts.

Changes in a Data Driven Future

The Data Driven Future scenario reflects the digital transformation and data-driven ambitions of the NHS. Particular attention was therefore paid to this scenario and its potential employment effects in each of the nine areas of work that comprise the NHS digital workforce. These employment effects mainly stem from the priorities relating to digital transformation and technology-supported organisational change being placed on each area of work, which determines not only the capacity and composition of the workforce but also the in-demand, emerging and new job roles and skills required over the next 10 years between 2020 and 2030. Many of these job roles will be professional posts requiring staff with advanced or specialist qualifications, as well as IT, computer coding and emotional intelligence skills, and

knowledge of the domains in which technology and data are being applied. It is worth considering each of the areas of work within the role family they sit in, as there are overlaps between these areas and by 2030 they may merge to a great extent.

Role family: data architecture

Clinical coding

The demand projection shows a 13 per cent decrease, or 460 fewer WTE staff, required in clinical coding between 2020 and 2030, and support staff will account for most of this reduction. However, a significant increase in professional staff and managers (nearly all will need to have professional expertise) is required in the next 10 years, in part due to the priorities placed on clinical coding teams in NHS trusts. These teams must handle the adoption of computer-assisted and automated coding systems and the quality assurance of automated coding processes, while addressing the implementation and maintenance of data standards in a digital environment, supporting developments in machine learning algorithms, and contributing to quality improvements in clinical care and population health. Professionals with the ability, for example, to audit and quality assure the automated coding of clinical-patient interactions will be required, as well as specialists who can work confidently with AI-assisted coding technologies.

Health records

A two per cent decrease, or around 300 fewer WTE staff, is needed in the health record function of NHS trusts, and support staff will largely account for this reduction. A significant increase in professional and managerial staff, however, will be required in the next 10 years. The digital transformation of health records management and the adoption of electronic systems, together with integrating genomic data into electronic health records (EHRs) and supporting developments in healthcare AI and machine learning technologies, are all priorities for NHS trusts. Meeting these priorities will require, for example, EHR supervisors, auditors and managers responsible for ensuring the accuracy, completeness, confidentiality and security of health records in a digital environment, and the ability to apply and integrate genomic data. Specific digital skills and knowledge relating to cloud engineering, mobile technology and AI-assisted technologies will also be required in some job roles in a healthcare environment where EHRs have a central role.

Information management

The projected demand for staff in information management roles shows an increase of 97 per cent, or an additional 7,850 WTEs, between 2020 and 2030. If NHS trusts are to become data-driven organisations, managers will be required in growing numbers along with professionals such as: data and enterprise architects; data, knowledge and robotic engineers; database managers; performance and business analysts; and information governance officers. These professionals will put into place and maintain data architecture frameworks and structures. Data architecture encompasses the standards, tools, infrastructure and governance arrangements around the collection, storage, security and future use of health data and information.

Having a robust data architecture framework in place will allow NHS trusts to meet the priority areas of protecting and securing data, information and systems, enabling secondary use of patient data, managing data sharing arrangements with external partners, and supporting the application of digital and medical technologies. Senior roles, including chief data officers and chief analytical officers, will need to be introduced in NHS trusts to provide leadership in information management and other related functions such as clinical informatics.

Role family: technical infrastructure

Information and communications technology

An increase of 34 per cent, or an additional 5,550 WTE members of staff, is required in the ICT departments of NHS trusts between 2020 and 2030. The ICT staff group is currently the largest in the NHS digital workforce and will need to remain as such to meet the technology implementation and operational requirements of NHS trusts in a Data Driven Future. Priority areas for ICT departments in the next 10 years will be ensuring organisational technical capability and interoperability of information systems, protecting information systems and data, and working with commercial sector partners on the implementation of technology. Meeting these priorities will require an increase in professional and specialist staff to implement cloud computing and mobile, telehealth and AI technologies. The operational requirements of maintaining the technical infrastructure of NHS trusts and ensuring the ongoing interoperability of systems are dependent on the availability of both support (including service desk) and professional staff. Specialists in areas such as cyber-security, software development and engineering, IT systems architecture, development operations (DevOps) engineering, and network management are required to meet the implementation and operational requirements made on ICT departments.

Role family: application

Clinical informatics

It is projected that between 2020 and 2030 a 672 per cent increase, or an additional 11,950 WTE members of staff, will be required by the NHS in the area of clinical informatics. This represents the greatest increase in projected demand seen in the NHS digital workforce. A substantial growth in the number of professionals, such as health data analysts, data scientists, clinical bioinformaticians and bioinformatic scientists, statisticians and biostatisticians, health economists and clinical digital service owners, will be required. This increase is driven by the following priority areas for NHS trusts: providing advanced analytics of health data, applying new technologies in this field, integrating informaticians within multidisciplinary clinical teams, and developing AI and machine learning capability in the use of data. There will be a growing emphasis on the secondary use of patient data and the practical field of health data analytics and, alongside this, greater integration of genomics in medicine, which is critically dependent on expert computational analysis of genomic and biological datasets, complemented by AI technologies. These developments allude to the data-driven ambitions of the NHS whereby the hybrid role of clinician-

informatician is expected to grow, and there will be an important role for managers and senior leaders such as chief clinical information officers, chief nursing information officers, chief analytical officers and chief data officers.

Knowledge management

The knowledge management function of NHS trusts is also recognised as an important component of the Data Driven Future. As well as being data-driven, organisations should also be knowledge-driven. A required 179 per cent increase or an additional 1,400 WTE members of staff working in NHS library and knowledge management services has been projected between 2020 and 2030. Increases are needed across all job levels, including those in supporting, professional, managerial and senior leadership roles.

Role family: organisational transformation

IT programmes and project management

A required 179 per cent increase or an additional 3,100 WTE members of staff in IT programmes and project management is projected between 2020 and 2030. Specialists such as IT project managers are needed, as well as those working on a project management basis, including change managers, data integration specialists, delivery managers, implementation facilitators, knowledge engineers, product and clinical digital service owners and managers, service managers, solution architects, system designers, user-centred designers (interaction, service and content), and user experience researchers. Adopting Agile project management methodology and skills will be a priority for staff over the next 10 years, as will working collaboratively with clinicians in the design, introduction and embedding of new technology and digital solutions in NHS trusts and, in some cases, managing external IT suppliers and contractors. Some staff will need to take on a digital-technical translator role, fully understanding the end-user needs of clinicians in the development of digital products and solutions.

IT strategy and development

Digital transformation and technology-supported organisational change are complex processes, affecting multiple layers and parts of an organisation, and therefore requiring strategic direction and effective management. Managing this complexity and planning for the adaptive (human behaviour) elements of digital change, including stakeholder engagement and communications, are priority areas for NHS trusts. The demand for staff in IT strategy and development roles is projected to increase in a Data Driven Future. An increase of 325 per cent, or an additional 2,600 WTE members of staff, is required between 2020 and 2030. Accounting for this increase will be IT business analysts and content strategists, and also those in senior leadership roles including chief information officers, chief technology officers, chief data officers, chief analytical officers, and directors of transformation. These senior leaders will need to provide strategic direction in NHS trusts if digital transformation and technology-supported organisational change are to be successful.

IT education and training

The IT education and training staff group is the smallest in the NHS digital workforce. However, it is critically important in enabling NHS staff to make full use of available digital technologies and health data. Product owners and managers, along with implementation facilitators, will have an education and training role in enabling the end-users of technology and data products. An increase of 83 per cent, or an additional 175 WTE members of staff, is required in the IT education and training staff group between 2020 and 2030. Priority areas for this staff group in the next 10 years are related to the digital literacy agenda of the NHS, and realising the benefits of digital technology through clinicians having skills and knowledge in data management, governance and analytics. The IT education and training function of NHS trusts needs the ability to support a wide range of training needs, meet the training needs of clinicians in advanced data analytics, and focus on human factor elements. Some of this training may be organised or delivered through the new regional informatics skills development networks (ISDNs). These networks are being rolled out in 2021, with support and funding from the HEE Digital Readiness programme, based on the model for the already established ISDN in North West England. The training of clinicians in their areas of professional practice will increasingly be delivered online. Technology-enhanced learning specialists will be required with the ability to develop online courses on advances in augmented reality, virtual reality and AI.

Investment in the NHS digital technology and health informatics workforce

Investment in the digital workforce is required in terms of building capacity and particular attention should be paid to those job roles that are in-demand, new or emerging in the health and care sector. The specialist skills and knowledge underpinning these job roles will require the development or enhancement of education and training pipelines into the workforce, and the creation of opportunities and pathways for existing staff to upgrade their skills and knowledge to take on professional and specialist roles. Recommendations focusing on workforce supply, and workforce development and professionalisation, have been made in this report.

The recruitment of already skilled individuals into the NHS is another possibility. However, challenges exist around recruiting and retaining staff in the NHS digital workforce. Research commissioned by the UK government's Department for Digital, Culture, Media and Sports showed that digital skills are near universal requirements and in demand across all sectors of the economy. Digital skills are required by at least 82 per cent of online advertised openings across the UK, but the precise skills demanded are not uniform across the country[6]. The NHS may also face regional challenges in recruiting staff. A recent analysis of the labour market, commissioned by HEE and undertaken by Adzuna and Tech Nation, indicates that Greater London has the largest market share of digital, data and technology roles (19 per cent) and the highest median salary (£55,000), while North East England has the lowest market share (16 per cent) and lowest median salary (£32,500). However, the cost of living index shows that living in Newcastle and North East England offers the most

spending power, indicating that in a world shifting to home working, the demand variation powered by regions could diminish[5].

A fundamental challenge for NHS recruitment efforts is that baseline digital skills can be thought of as the productivity tools commonly required in jobs across all levels and a ticket entry to the labour market. Specific digital skills, found in specialist roles, promote more career progression opportunities and can reduce risk of automation. This is because these specific digital skills complement the very distinct human skills, such as design, creative writing, critical thinking, evaluating, and communication, which in combination with digital skills are difficult to automate and essential to any organisation's success. This is even more so in the health sector, where creating time to care for clinicians and improving health outcomes for patients are the ultimate benefits.

Building capacity, and change in salary and employment on-costs

The current salary and employment on-costs for the NHS digital workforce of 46,000 WTEs in 2020 is estimated to be around £2.05 billion. If this workforce is to increase to 78,000 WTEs, as projected in the demand forecast for a Data Driven Future scenario, the costs will be in the region of £5.2 billion by 2030 (Figure 3.3). This calculation is based on a mean salary pay point corresponding to the top of NHS Agenda for Change band 5 and the assumption that salaries will increase by 2.7 per cent per annum, and employment on-cost at 34.9 per cent (21 per cent for the NHS pension and 13.9 per cent National Insurance contribution). Table 3.3 provides a breakdown by areas of work covering the workforce using different NHS Agenda for Change banding in determining baseline mean salary pay points. The projected salary and employment on-costs for a Data Driven Future do not factor in any changes by job level to the composition of the workforce. Therefore, the overall figure of £5.2 billion should be regarded as the minimum estimate for 2030. It is worth contrasting the figure of £5.2 billion with the £2.7 billion (baseline costs) that represents the salary and employment on-costs of a workforce remaining at 46,000 WTEs in 2030.

Figure 3.3: Change in salary and employment on-costs in a Data Driven Future for the NHS digital technology and health informatics workforce

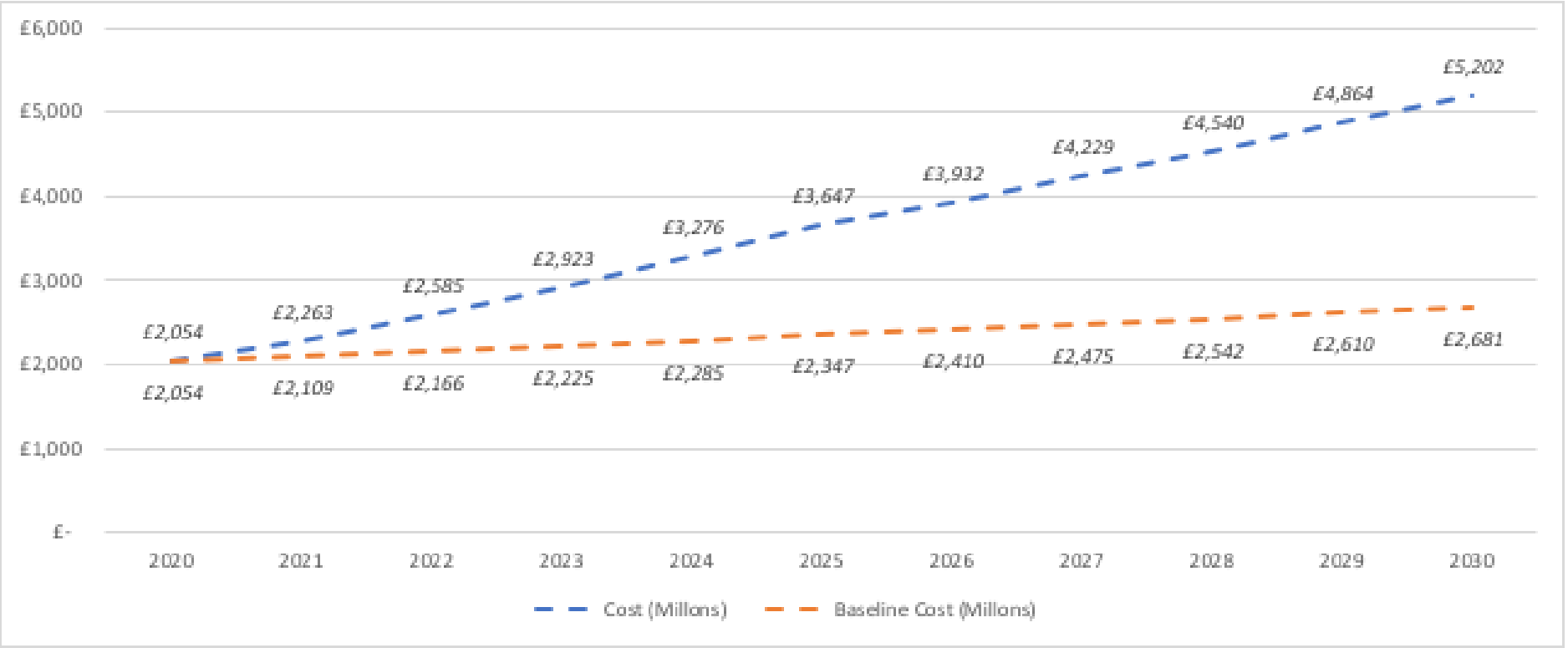


Table 3.3: Change in salary and employment on-costs in a Data Driven Future – by area of work

Role family	Area of work	NHS Agenda for Change banding*	Workforce size in 2020 – WTEs	Estimated salary and employment on-costs in 2020 – £millions	Projected demand in 2030 – WTEs	Projected salary and employment on-costs in 2030 – £millions
Data architecture	Clinical coding	Band 4	3,560	£116	3,101	£132
	Health records	Band 4	12,610	£411	12,315	£524
	Information management	Band 5	8,113	£335	15,961	£860
Technical infrastructure	Information and communications technology	Band 6	16,407	£839	21,963	£1,465
Application	Clinical informatics	Band 8a	1,778	£124	13,731	£1,249
	Knowledge management	Band 5	788	£33	2,199	£119
Organisational transformation	IT programmes and project management	Band 7	1,741	£105	4,859	£381
	IT strategy and development	Band 8c	801	£80	3,407	£442
	IT education and training	Band 7	212	£13	387	£30
	Total workforce	**Band 5**	**46,009**	**£2,054**	**77,923**	**£5,220**

*Top of each band indicated was used as the mean salary pay point in calculating salary and employment on-costs for each area of work.

4. Background and conceptual framework

This report is the outcome of a project looking at demand and supply for, and job roles and skills required in, the NHS digital technology and health informatics workforce (the 'digital workforce') for the period 2020 to 2030. The project was undertaken in 2020 within the Building our Future Digital Workforce workstream that is part of the HEE Digital Readiness programme.

Digital Readiness programme

The overarching aim of the HEE Digital Readiness programme is to create an uplift of digital skills, knowledge, understanding and awareness across the health and care workforce[7]. The programme is being delivered through six work streams and is commissioned and majority funded by NHSX, for delivery by HEE. It builds upon the work started by the Building a Digital Ready Workforce programme, established in 2016/17, to deliver upon the UK Government's Personalised Health and Care 2020 data and technology action framework[8] and NHS England's Five Year Forward View[9]. Subsequent reports, including the Wachter Review[10], Topol Review[1], NHS Long Term Plan[2] and NHS People Plan[11], have continued to shape the Digital Readiness programme.

Figure 4.1: Workstreams of the HEE Digital Readiness programme

Workstream 3: Building our Future Digital Workforce

Building our Future Digital Workforce is workstream 3 of the HEE Digital Readiness Programme. This workstream has been tasked to develop a 10-year workforce plan for the NHS digital technology and health informatics sector. The HEE Workforce Planning and Intelligence Directorate was asked to take part in a project to develop this plan. Phase 1 of the project was undertaken in 2019, resulting in the publication

of a report on the current supply, size and capacity of the workforce, based on data held in the NHS Electronic Staff Record (ESR) system[12]. The report highlighted that the NHS digital workforce has been growing by around 3.4 per cent each year since 2014. However, continuation of this growth may not be sufficient to meet the possible demand for this workforce from NHS trusts with ambitions of digital transformation, technology-supported organisational change and data-driven healthcare services.

Phase 2 of the project, and therefore this report, looked at possible demand for the NHS digital workforce over the next 10 years leading up to 2030. Understanding demand and comparing it with supply will highlight possible future shortfalls or excesses in capacity in different areas of the workforce. Alerting policymakers of these possible shortfalls and excesses will help them make informed decisions as to investments needed in this sector.

The project team was also asked to focus on the job roles and specialist skills needed in the digital workforce between now and 2030. This is important, as a workforce shortage always deepens the problem of a role or skills shortage, but a job role or skills shortage can exist even when there is a 'right' number of staff in the workforce. This can happen when staff have not been developed to take on those roles or acquire skills needed to make the best use of the available technology and data. It is important to make the distinction between workforce shortage and role or skill shortage, as addressing them will require consideration of different policy levers and separate streams of investment.

Scope of the digital workforce planning project

The World Health Organization defines health technology as the application of organised knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve the quality of lives[13]. This project is concerned with the digital aspects of health technology, including electronic data, and in particular the workforce with the knowledge and skills required for its application in the NHS. The project focused on how the digital transformation and data-driven ambitions set out for the NHS by the Topol Review[1] and NHS Long Term Plan[2] can be delivered through this workforce. Digital technologies and products are seen by HEE as potentially having a major impact on the prevention, diagnosis, monitoring and treatment of disease, through innovations and advances made in telemedicine, wearable sensors used by patients, bionanotechnology, and AI and immersive technologies such as virtual and augmented reality[14].

Definition of the digital workforce

We use the term digital technology and health informatics workforce (shortened to 'digital workforce') in presenting the findings of this project. Definitions of this term abound in the literature, although as many share similar meaning and attributes there is no single and widely agreed definition. It is also challenging to define this workforce succinctly because the area of digital technology and health informatics is constantly changing, especially in an environment of digital transformation, and any definition is likely to change as new technologies and ways of working with data

emerge. Definitions can also be contentious, especially when some individuals, for example those working in data analytics, do not identify themselves as being in a workforce termed health informatics. This was highlighted in an HEE-commissioned survey of the NHS health informatics workforce, undertaken by the NHS South, Central and West Commissioning Support Unit[15]. The results of the survey also highlighted a large number and inconsistent use of job titles in this workforce. Around 350 different job titles have been identified in the NHS Electronic Staff Record (ESR) system that are used by staff whose primary role is in the field of digital technology and health informatics. The number and diversity of job titles currently being used adds further challenge to defining this workforce.

Digital workforce in the NHS acute secondary care sector

The scope of this project is limited to the digital workforce in the NHS acute secondary care sector, although its findings and recommendations can be applicable to other health and care sectors. Information is readily available in ESR enabling the identification of the historical and current size of the NHS digital workforce, and this allows for modelling as to its future supply and size. The Covid-19 pandemic during 2020 placed pressures on health and care services, and this limited the ability of the project team to collect data on the workforce in the primary care, social care, public health and independent healthcare sectors. These sectors also do not have a platform equivalent to ESR for centralised line-level workforce data, including information held on an individual's time in post, age and so on, making it challenging to undertake any workforce supply modelling and planning.

Scope of the digital workforce

Attempts to scope the digital workforce by identifying its occupational and staff groups, job roles or areas of work have been reported in the literature. Knowing the composition of the workforce in this way will set the boundaries for any workforce-planning project. It will also help planners understand how the workforce is organised in terms of distinct occupations, job roles or areas of work, and allow for the separate consideration of each when examining issues around workforce capacity, capability and skill mix. Setting the boundaries and understanding the composition of the digital workforce is also important for discussing issues and policies around training and CPD, and recruitment and retention. It will help to avoid different occupational groups being treated as completely separate entities, for example ICT professionals and health data analysts, or clinical coders and those managing health records. This is important because digital transformation in the NHS will require individuals with different skillsets from across the digital workforce to work in teams, and it will also see a convergence of skills whereby new hybrid roles will emerge in one occupational group and replace roles in another group.

Setting boundaries for the digital workforce is therefore useful but they must be flexible to accommodate developments in digital technology and the resulting emergence of new roles. Attempts have been made to distinguish digital technologies from medical technologies[16]. Magnetic resonance imaging (MRI) scanners used for diagnostic purposes and linear accelerators used for treating cancers are medical rather than digital technologies. However, digital and medical

technologies are converging and becoming more integral to each other. This is seen in the field of genomics and robotic surgery, where new roles will emerge and require planning in the NHS digital workforce. Planning for these new roles is important because the fusion, for example, of digital technology and AI with genomics or robotics could transform how healthcare is delivered. Surgical robots will include digital systems to capture patient data when undertaking a procedure, and this data allows for the auditing and quality improvement of surgical techniques[17].

Workforce planning

The scoping approach to defining the digital workforce is therefore useful from a workforce-planning perspective. To this end, the project adopted an existing framework consisting of nine categories or areas of work to define the NHS digital workforce. This framework was developed by NHS Digital and is set out in their Informatics Area of Work Guidance[18]. The framework has been approved for use in the National Workforce Dataset by the Information Standards Board. The advantage of adopting this framework is that the nine areas of work are used in ESR to categorise the NHS digital workforce. It is therefore possible to determine with some confidence the historical and current size of the workforce in each area, and project supply lines between now and 2030. These supply lines represent the expected size of the workforce in an area of work and show whether they are increasing or decreasing, allowing for comparison with projected demand lines between now and 2030.

It should also be noted that the HEE Digital Readiness programme has commissioned a project to work with NHS Digital, examining whether the framework used in ESR could be made more granular through adopting some or all of the Government Digital Service's Digital, Data and Technology (DDaT) Capability Framework[4]. The DDaT Framework consists of six job families, each defined by different job roles, and applying this level of detailed categorisation to ESR will allow for more granular workforce planning in the coming years.

Area of work categories for the digital technology and health informatics workforce used in the NHS Electronic Staff Record (ESR) system:

- Clinical coding
- Health records
- Information management
- Information and communications technology (ICT)
- Clinical informatics
- Knowledge management
- IT programmes and project management
- IT strategy and development
- IT education and training

Conceptual framework for the Building our Future Digital workstream

Digital technology and data will have an increasingly important, integrated and central role in healthcare. This is the ambition and future vision set out in the Topol Review[1], NHS Long Term Plan[2] and many other reports in this area. A vast array of opportunities and possibilities exist to positively transform digital technology in the NHS, as well as organisational and clinical processes, with the support of technology. The response of the NHS to the Covid-19 pandemic in 2020 demonstrated that digital and organisational transformation can be both rapid and achievable.

The positivity in the thinking and ambition around digital technology and data provided the overarching conceptual framework for the Building our Future Digital Workforce workstream, and for this project and report. Technology has often been cautiously introduced in health services to deliver small improvements and sit within existing work structures and processes[21], but this cautious approach to change has not guided the direction of this project. The focus has instead been on the wide, in-depth transformation of digital technology and of clinical and organisational structures and processes in the NHS. The extent of transformation should be at such a scale that the clinical and organisational processes of all NHS trusts will be fully digitised in the next 10 years, and not just those of high-profile secondary and tertiary acute care providers. The depth of transformative change is about the ongoing application of newer, advanced digital technologies to existing systems, and about digital complementing emerging medical and advancing technologies such as genomics, molecular biology, diagnostics and robotics. Depth is also about fundamentally changing organisational and clinical processes, including ways of working and workflows, with the support of technology to improve healthcare quality and patient outcomes across a wide range of disease areas.

There is remarkable potential for digital healthcare technologies to improve accuracy of diagnoses and treatments, the efficiency of care, and work now for healthcare professionals, but implementation must only be carried out when there has been robust clinical validation.

The Topol Review (2019)[1]

Digitally enabled primary and secondary care will go mainstream across the NHS.

NHS Long Term Plan (2019)[2]

Unlocking the potential of data collection and analysis at an individual and population level will be of great importance to better prevent and predict disease.

The Royal College of Surgeons of England (2019)[17]

For AI to truly flourish, not only must IT be overhauled and made inter-operable, but the quality and extent of health data must be radically improved too.

Academy of Medical Royal Colleges (2019)[19]

New technology is promising to transform a health and social care sector that is increasingly struggling with the need to do more with less funding.

The King's Fund (2018)[20]

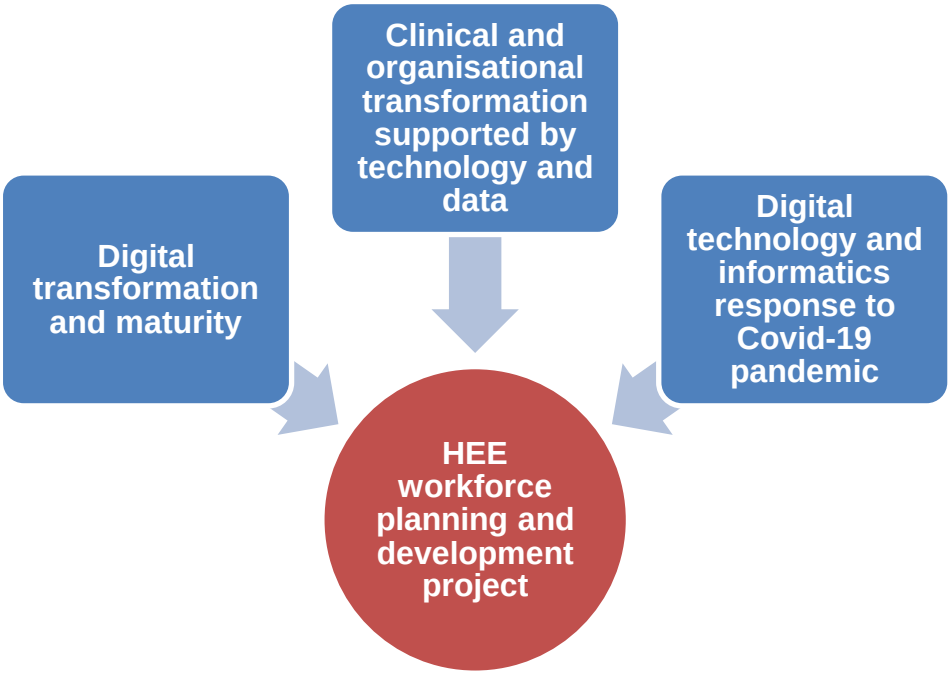
Employment effects

This project is about identifying and understanding the employment effects of transformative change. These effects are seen in the size of workforce, the job roles and skills required, and the investment needed in the workforce over the next 10 years. To this end, a conceptual framework focussing on transformation was developed at the beginning of the project and used to guide the project team, building understanding of the employment effects of transformative change.

Domains of the conceptual framework

The conceptual framework consists of three domains. The first domain, digital transformation and maturity, and the second domain, clinical and organisational transformation supported by technology, both encapsulate the high-level aims, priorities, values and preferences of an ambitious future for digital technology and health informatics in the NHS. The project was undertaken during the Covid-19 pandemic in 2020. The NHS brought the use of technology and data to the forefront in its response to the pandemic. This also shaped the thinking of the project team and forms the third domain of the conceptual framework.

Figure 4.2: Conceptual framework for workforce planning and development in the NHS digital technology and informatics sector



Domain 1: Digital transformation and maturity

Ambitions for a fully digital NHS or digitally enabled care suggests there is a level or stage to be reached through a process of transformation[22]. This thinking is reflected in the Digital Maturity Assessment (DMA), developed by NHS England and linked to their Global Digital Exemplar (GDE) programme. The DMA allowed trusts, from 2015 to 2017, to self-assess and rate their digital technology capability, technical

infrastructure and readiness to deploy digital services. Those trusts ranked with a high DMA score in the capability domain could be identified as GDEs, receive funding to support their digital activities, and partner with and share their knowhow with other trusts seeking this status. The DMA and GDE programmes have both been regarded as the main policy tools for NHS digitalisation in recent years[23]. The DMA self-assessment tools allowed trusts to consider what is a low, medium or high level of digital maturity and, most importantly, think about their digital transformation journey. Achieving a high level of maturity would be recognised through the securing of GDE status, which confirmed a trust's world-class use of digital technologies[24].

An alternative model to the DMA has been proposed whereby the aims for digital maturity, rather than being imposed nationally by NHS England, are set locally by individual trusts. These aims would be based on a trust's own unique priorities and desired outcomes, and progress toward these aims will be assessed periodically[25]. This approach recognises digital transformation as an ongoing process of continued improvement based on formative evaluation in reaching a set endpoint. This proposal has been taken up by NHSX, who are working with NHS trusts and other healthcare organisations to develop digital maturity standards and define 'what good looks like' for a digitised health system[26].

Domain 2: Clinical and organisational transformation supported by technology and data

The National Audit Office defines digital transformation in the NHS as a step-change improvement of operations and services through the use of digital technology[27]. This definition suggests that transformation or changes in clinical and organisational structures and processes are either required or desired due to the possibilities offered by technology and data. It has been argued that the primary focus should be on clinical and organisational transformation and how it can be supported by technology[20]. It is this understanding that forms the second domain of the conceptual framework shaping the Building our Future Digital Workforce workstream, and therefore this project and report.

The possibilities offered by digital technology and data are often discussed as benefits to clinicians and patients on one hand, and on the other as a route to efficiency and productivity gains in organisations. A transformed clinical service supported by technology would, for example, result in more joined-up healthcare and improved clinical performance, allow for new treatment opportunities and personalised medicine, and better support preventive and population-based healthcare initiatives. With the application of AI, routine tasks can be learned by software agents that recognise patterns of behaviour and outcomes, which can then be embedded into decision-support tools to help manage, predict or prevent diseases. NHS trusts striving to make significant efficiency and productivity gains can use technology and data to transform their structures and processes with the aim of reducing wastage, allowing for better planning of services and so on. The possibilities, clinically and organisationally, are many and well covered by the Topol Review and reports from think tanks such as The Health Foundation, Nuffield Trust and The King's Fund. It is not the intention of this report to repeat these possibilities, but instead to focus on their employment effects relating to the NHS digital workforce.

Clinical and organisational transformation in the NHS has been framed as anticipating and addressing the barriers to and enablers of technology. These barriers and enablers can be technical and financial, and also organisational and cultural. The Wachter Review has highlighted the importance of both technical and adaptive (human factors) elements in digital change[10]. The GDE programme encourages digitally mature NHS trusts to share their knowhow with other trusts, by creating blueprints covering not just technical issues but also guidance on organisational leadership and culture, clinical and staff engagement, and processes to deliver the benefits of technology.

Domain 3: Response to the Covid-19 pandemic by the NHS digital technology and health informatics sector

The third conceptual domain that has shaped the Building our Future Digital Workforce workstream, and therefore this project and report, is the response from the NHS digital technology and informatics sector to the Covid-19 pandemic. The pandemic has brought to the forefront how digital technology and data can or should be part of a health service's core capacity during a health crisis. The response has encouraged public debate on issues relating to the ethics and acceptability of technology and data usage in healthcare. It became clear just a few months into the pandemic that Covid-19 will change medical practice in many ways and the delivery of healthcare services will be transformed by digital technology[28]. It has been observed that responding to the pandemic has resulted in the rapid adoption of digital technology in the NHS and some of these changes, for example due to fast-track procurement frameworks, have happened at incredible pace[29].

An online workshop was organised for project stakeholders in May 2020 to develop scenarios for the workforce demand forecasting exercise (see Section 5). An opportunity was taken to discuss how the pandemic has or will impact the NHS digital workforce, whether the impact will be felt in the long term, and how it will influence policy and planning for this workforce. A post-workshop survey was also undertaken, giving stakeholders the opportunity to expand on their thinking. Five key themes emerged from the discussion and survey:

Acceleration in the adoption of digital technology
The pandemic has provided the impetus for a wide-scale rollout of certain forms of digital technology in the NHS. This has been done at a rapid pace and over a relatively short period of time. The rollout of technology can often take years, but with the pandemic the timescale has been accelerated and reduced to a matter of weeks. Most noticeable has been the rapid implementation of technology in supporting remote healthcare monitoring, consultations and interventions.

Further integration of technology in the delivery of healthcare services
The pandemic has created an innovative environment whereby the NHS actively sought digital solutions to strengthen how healthcare services can be delivered. More importantly, the idea of a fully digitised service has shifted from being an aspiration to one that is essential and necessary in managing and delivering healthcare. This, in turn, has highlighted the importance of senior leaders in NHS trusts with in-depth awareness of the possibilities and the limitations of digital

technology. At the same, the pandemic has raised questions about how the NHS, through its digital capacity, should respond to an increasingly digitally literate patient body who are taking more responsibilities for their own care and well-being with the help of digital devices such as apps and wearable technologies. Primary care has seen significant changes, as clinicians have had to respond innovatively to the pandemic through the use of technology. The next step is to carry out robust research and evaluation of the clinical impact and experiences of patients and clinicians in the rapid shift towards digital technology. Evidence is currently limited, so more work is needed in order to learn from patients and clinicians to determine how to proceed.

Remote working is possible and becoming more accepted
Prevention of the spread of the coronavirus has required people to work remotely and avoid face-to-face contact with their colleagues and/or patients. The pandemic has forced people to work online with colleagues, with healthcare professionals speaking to or seeing patients via dedicated and secure online platforms. The pandemic has helped to further highlight that remote working with colleagues and patients is very much possible (although not in every situation) and, even if it does not become the new norm, it is an accepted – and for some people a more productive – way of working.

Professional and public recognition of the importance of health data and knowledge
In the early stages of the pandemic, mass media accentuated the importance of health data and knowledge in making evidence-based decisions to manage the crisis. Dealing with the pandemic has highlighted issues concerning the quality and application of health data, such as in the representation of the current and future effects of diseases, and has sparked public debates about the accessibility, sharing, governance and sensitivity of data. The focus on data will encourage the aspiration that the NHS should be a data-driven organisation and invest appropriately in the technology and skills required.

Data skills will be important for all healthcare professionals
The importance placed on data in making evidence-based decisions during the pandemic will require healthcare professionals – and not just those working primarily in the digital technology and informatics sector – to be competent and skilled to some degree in working with data and knowledge. Merger of clinical practice with data science is already happening. In the future, the expectation is a growth in the number of clinicians in hybrid clinician-informatician roles in the NHS. Currently, these hybrid roles are not very well understood or described and the career pathways they inhabit are poorly described and professionalised. Creating roles and career pathways that clearly define the digital, data and technology skills that clinicians require will therefore be of benefit. Clinicians with skills in health informatics will be in demand, especially if they are capable of using advanced tools and methods in managing and applying health data to clinical situations.

5. Methodology

Project aims and stages

This project looks ahead to the NHS digital technology and health informatics workforce (the 'digital workforce') of 2030. This foresight was achieved through the following stages of the project:

- Stage 1: Developing future scenarios.
  Develop, with project stakeholders, scenarios of what 2030 could look like for this workforce.

- Stage 2: Undertake a workforce demand forecasting exercise.
  Develop a workforce demand forecasting exercise toolkit and engage senior NHS digital leads to take part in the exercise.

- Stage 3: Demand forecasting – modelling and projecting demand.
  Obtain estimates from senior NHS digital leads as to the future demand (required size of the workforce) for each of the nine areas of work, covering digital technology and health informatics in the context of the 2030 scenarios. Model and project future demand based on these estimates.

- Stage 4: Supply forecasting – modelling and projecting supply.
  Model and project supply, in each of the nine areas of work covering digital technology and health informatics, by estimating the current (2020) and future size of the workforce leading up to 2030, based on observed workforce inflows and outflows in the three years (2016-17 to 2018-19) preceding this analysis.

- Stage 5: Project 10-year demand and supply and identify possible shortages or excesses in workforce capacity.
  Compare projected demand and supply estimates to identify whether there will be a shortage or excess in workforce capacity across the different areas of work in the years leading up to 2030.

- Stage 6: Identify structural shifts in the workforce.
  Determine whether the composition of the workforce, in terms of skill mix and support, professional, managerial and leadership staff, will need to change in the context of the 2030 scenarios.

- Stage 7: Highlight in-demand, emerging and critical job roles and skills.
  Highlight job roles and skills needed, and investments required, in this workforce by 2030 based on discussions with project stakeholders and those taking part in the demand-forecasting exercise, and on a review of key reports in this area.

Stage 1: Development of future scenarios

The use of scenarios provides a framework for discussions about the future. These scenarios should be based on credible, plausible and challenging intelligence to understand the demand for a workforce in different future environments. To develop scenarios of what the future could look like in 2030 for the NHS digital workforce, the project team engaged the expertise of the HEE National Strategy Team and sought the input of project stakeholders through online workshops and surveys.

Engagement with the HEE National Strategy Team

The HEE National Strategy Team was asked to develop future scenarios to help contextualise the process of estimating future demand for the NHS digital workforce. High-level scenarios already developed by the Royal Society for the Encouragement of Arts, Manufactures and Commerce (RSA), and set out in their Four Futures of Work report, were considered[30]. The four scenarios – the Big Tech, Precision, Exodus and Empathy economies – set out in the RSA report are derived from a strong evidence base and concentrate on the use of technology and human resources in the workplace. Extensive analysis and discussions of the RSA scenarios were undertaken by stakeholders engaging in the HEE Future Doctor programme, resulting in the development of four healthcare futures[31]. These futures were then used during workshops held for a separate set of stakeholders at the scenario-development stage of the Building our Future Digital Workforce workstream project.

Run workshops with project stakeholders

Stakeholders representing 26 organisations attended two online workshops, held in May and June 2020, to contribute to the development of scenarios describing what the future could look like for the NHS digital workforce (see Appendix for a list of organisations represented). The healthcare future scenarios developed by the HEE Future Doctor programme were used as the basis to discuss key drivers that are likely to influence how the NHS digital technology workforce will develop between 2020 and 2030. Post-workshop surveys were also issued to further capture the thoughts and perceptions of stakeholders. The intention was to develop scenarios in the form of descriptive narratives relevant and applicable to the workforce leading up to 2030. Analysis of the key drivers discussed during the workshops, and perceptions captured through the surveys, resulted in the development of two alternative but plausible scenarios to help contextualise the process of estimating future demand for the NHS digital workforce: the Data Driven Future and Data Desert Future (see Tables 5.1 and 5.2).

Strengths and limitations of scenarios

The Data Driven Future and Data Desert Future scenarios are very different but not mutually exclusive. They have been used to examine the possible employment effects resulting from the uptake – rapid and progressive in the Data Driven Future, and limited and cautious in the Data Desert Future – of digital technology and usage of data in the NHS. Workforce demand expressed in this report is therefore based on

projected uptake of digital technology and use of data in the NHS. This was deliberate given the digital transformation and technology-supported organisational change ambitions of the NHS, which are conceptually shaping this project.

A limitation of these scenarios, especially the Data Driven Future, is that little indication is given to the financial investment the government and/or NHS is prepared to make in the digital workforce. It could be argued that any employment forecast should recognise the economic climate in which the NHS is operating. The fiscal position of the government could deteriorate resulting in financial restraint or reduced spending in the public sector including the NHS, or in areas deemed less of a priority. As with the development of any future scenario, there is a degree of uncertainty. Long-term processes of change required in reaching a described future are themselves subject to uncertainties and possible disruptive influences that were disregarded or not even considered at the scenario-development stage. Those taking part in the scenario-development workshops may have had their own professional bias and agenda in shaping the scenarios, which may be a limitation or not. It must also be noted that the workshops were held during the early stages (May and June 2020) of the Covid-19 pandemic in the UK, and the NHS response – including the application of digital technology and data in supporting healthcare services – may have unduly influenced the view of participants as to what the future could hold. Developing scenarios to forecast workforce demand is therefore challenging due to gaps in our knowledge about the future and uncertainties, including those around finances and the adoption of new technology and innovations in healthcare.

Stage 2: Workforce demand forecasting exercise

The Data Driven Future and Data Desert Future scenarios (see Tables 5.1 and 5.2) were embedded in a workforce demand forecasting exercise toolkit issued to senior NHS digital leads. These individuals were asked to estimate and quantify the future demand for this workforce in the context of both scenarios, and to highlight any critical or new jobs or skills they see emerging along with required changes in the workforce and the way work will be undertaken.

Workforce demand forecasting toolkit

An Excel-based toolkit was developed by the project team to capture workforce demand estimates from senior NHS digital leads. The toolkit comprised:

- Descriptions of the Data Driven Future and Data Desert Future (Tables 5.1 and 5.2).

- Description of a typical NHS acute trust (Table 5.3).
  Details of the current (2020) size of the workforce in a typical NHS trust were provided in the nine areas of work covering digital technology and health informatics. The workforce figures given for a ‘typical’ organisation were based on an analysis of data held on individual trusts in the NHS Electronic Staff Record (ESR) system.

- Details of the workforce taxonomy shaping the composition of this workforce (Tables 5.4 and 5.5).
  The taxonomy covers four job levels (senior leaders, managers, professional and support staff) and nine areas of work covering the NHS digital workforce. The areas of work are grouped into four role families: data architecture, technical infrastructure, application and organisational transformation. The intention of the taxonomy was to allow participants in the demand-forecasting exercise to consider the skill mix of the workforce in a typical trust. It would also allow the project team to determine, based on the demand forecasts, if structural shifts in the workforce needed to happen, for example through the employment of fewer support staff and more professional staff.

- Workforce demand forecasting templates.
  Separate templates for the Data Driven Future and Data Desert Future were provided for participants to enter their workforce demand forecasts.

- Free-text fields.
  For each area of work, in both the Data Driven Future and Data Desert Future, participants were asked to comment on any critical or new jobs or skills they see emerging, along with significant changes in the workforce they envisaged and how work will be undertaken in the next 10 years.

Demand-forecasting exercise

Senior NHS digital leads, including Chief Information Officers (CIOs), Chief Clinical Information Officers (CCIOs) and Chief Nursing Information Officers (CNIOs), were approached in July and August 2020 to take part in the workforce demand forecasting exercise. Presentations were made to those who attended a Digital Health (www.digitalhealth.net) webinar on 31 July and CIO, CCIO and CNIO regional network meetings during August. An email was also subsequently sent to all delegates by event organisers. A total of 53 digital leads registered an interest in taking part in the exercise and were sent the toolkit and further instructions. Of those registering an interest, the exercise was completed by digital leads from eight organisations by the deadline of 31 October 2020. Many of those who did not take part cited reasons of workload and were unable to commit the time to participate. Organisations taking part (see Appendix for named representatives):

- Bolton NHS Foundation Trust
- Countess of Chester Hospital NHS Foundation Trust
- Health Education England
- Imperial College Healthcare NHS Trust
- Salisbury NHS Foundation Trust
- Surrey and Borders Partnership NHS Foundation Trust
- The NHS Health Informatics Service
- University Hospitals Plymouth NHS Trust

Participants in the exercise were advised to work or consult with colleagues when making judgements and estimating workforce demand. Some participants organised a half-day workshop in their own organisation to discuss the implications of the Data

Table 5.1: Description of the Data Driven Future 2030 used in the workforce demand forecasting exercise

Scenario A: Data Driven Future 2030
Key Drivers:
Proliferation of sensors; Internet of Things; artificial intelligence; collaboration with industry; genomics and precision medicine; integration of health and social care; patient digital literacy.
Description:
The Data Driven Future of 2030 is characterised by the ubiquitous flow of data around the health and care system, which has become increasingly integrated under the NHS. Over the previous 10 years these data flows have been facilitated by the proliferation of sensors that are used by the majority of the population, who keep track of their own health and wellbeing while sharing that data with the NHS in exchange for bespoke services. For those unable to afford their own devices, the NHS provides basic models that offer the required minimum functionality as they are proven to be self-funding in terms of reduced morbidity. However, some are still unwilling to share their data and are in danger of being left behind, creating some significant inequalities in health for those groups. Cybersecurity concerns remain an issue, but the NHS employs specialists to mitigate risks and manage threats. Organisational barriers have reduced significantly through appropriate sharing of information around the system within safeguards. The increasing professionalisation of the informatics function, including robust collaboration with industry and academia, and the growing influence of senior informaticians at board level within health and care organisations, have supported the NHS to make robust, evidence-based investments in technology, supported by government funding that has been protected through a turbulent economic period for the country. Alongside the deployment of sensors, there is an increased connectivity between devices via the internet of things supported by artificial intelligence (AI), which has also grown exponentially in recent years to link data together across multiple systems. A huge increase in the use and understanding of genomic information means that analysts are working with much larger and more complex datasets than ever before. AI has proved a powerful ally for clinical informaticians throughout the NHS, and it has helped to deal with the rising demands made upon them rather than taking over their roles in most cases. AI and other sophisticated ways of managing data have encouraged the development of the bioinformatics field and the hybridisation of clinical practice and informatics. However, some data input roles and roles such as clinical coding have been impacted by the proliferation of sensors and AI. Patients are increasingly digitally and health literate, and this generates much larger data sets that clinical informaticians can access and analyse. Technical infrastructure roles are increasingly important to develop and maintain complete IT solutions as technology develops, although the breaking down of organisational barriers allows for roles to be shared across organisations, increasing efficiency and acting as a brake on demand. As technology develops, NHS organisations are transformed by those with the right skills to strategically plan for and translate health service needs into digital requirements and products, and project manage their implementation and ensure successful uptake through training and education.

Table 5.2: Description of the Data Desert Future 2030 used in the workforce demand forecasting exercise

Scenario B: Data Desert Future 2030
Key Drivers:
Austerity; political instability; reduced healthcare investment; outsourcing to private contractors; increased self-care by patients; fragmentation of services; sharing of back office functions.
Description:
A long period of austerity hit England in the 2020s following the pandemic at the beginning of the decade and, despite government attempts to shelter the NHS, the health and care system has suffered from stifled investment in infrastructure and IT. The economic downturn has caused global technological progress to falter as tech companies have little incentive to invest in new product innovations, and organisations including the NHS have few funds available to them to invest in automation. Patients are increasingly managing their own care as trust in public services reduces, and waiting times for all but the most urgent of care needs grow as beds and services are cut. Local communities have had to build effective networks and the population has become skilled at self-care and providing others with support. Virtual group sessions, led by local practitioners, are held regularly and well attended, and 'social prescribing' is the norm. Prevention is now the key for healthcare in order to manage scarce resources and the emphasis is supporting people to keep themselves healthy, thus reduce the risk of developing disease and the need to access services. The much-heralded growth in genomics and related genetic treatments has also failed to materialise as investment in research was hit particularly hard by cuts in the early 2020s. Cybersecurity issues during the decade have also limited the public's trust in data sharing, which means that patients are unwilling to allow organisations to share data, and are also unwilling to allow their data to be captured through interactions with health services. Even the data captured on smart phones and linked devices is strictly controlled. In the face of public pressure and in an attempt to restore stability and public confidence in their authority, the governments of the 2020s brought in increasingly draconian legislation to limit the sharing of data. While there are some limited exemptions for healthcare, particularly in regard to urgent care, the flow of health data still remains at the levels seen immediately following the great Covid-19 pandemic of 2020. This all means that data is held locally on legacy systems with little new investment, and little appetite for investment in the education and recruitment of digital technology and health informatics staff to support health services. In an attempt to cut costs and create greater efficiencies, there has been a significant merging across healthcare organisations of 'backroom' functions such as IT and data management and application. Development and maintenance of technical infrastructure are largely outsourced to private contractors. Organisational digital transformation has also been held back as fewer IT programmes and projects are underway. In-house digital and IT education and training have been particularly badly hit by reduced investment.

Table 5.3: Description of a typical NHS acute trust used in the workforce demand forecasting exercise

Anycity University Hospital NHS Trust
Anycity University Hospital NHS Trust is a typical secondary, acute, healthcare provider based in a medium-size city in England. Services are offered by its accident and emergency and inpatient and outpatient medicine and surgery departments. Like many acute trusts Anycity University Hospital looks after patients with illnesses which require diagnostic tests, treatment and follow-up care. Data from the NHS Electronic Staff Record (ESR) shows a total of 6,500 whole-time equivalent (WTE) staff members in its workforce – of which 227 WTEs (or 3.5%) work primarily in one of the nine ESR work areas for digital technology and health informatics. Three members of staff work at a senior leadership level – the Chief Information Officer (CIO), Chief Clinical Information Officer (CCIO) and Chief Nursing Information Officer (CNIO). Anycity University Hospital scored highly, compared to other acute trusts, in the most recent Digital Maturity Self-Assessment exercise organised by NHS England.

Digital technology and health informatics workforce in 2020 – whole-time equivalents (WTEs)										
	Data Architecture			**Technical Infrastructure**	**Application**		**Organisational Transformation**			
	Clinical Coding	**Health Records**	**Information Management**	**ICT**	**Clinical Informatics**	**Knowledge Management**	**IT Programmes and Project Management**	**IT Strategy and Development**	**IT Education and Training**	**Total**
Senior leaders	0.00	0.00	1.00	2.00	0.00	0.00	0.00	0.00	0.00	**3.00**
Managers	0.00	1.00	5.00	9.00	2.00	1.00	1.00	0.00	0.00	**19.00**
Professionals	7.00	6.00	21.00	48.00	5.00	1.00	2.00	1.00	2.00	**93.00**
Support staff	10.00	66.00	12.00	18.00	2.00	2.00	0.00	0.00	2.00	**112.00**
Total	**17.00**	**73.00**	**39.00**	**77.00**	**9.00**	**4.00**	**3.00**	**1.00**	**4.00**	**227.00**

Table 5.4: Workforce taxonomy – job levels used in the workforce demand forecasting exercise

Job level	Description
Senior leaders	Working at a director or executive management level and providing strategic direction across an organisation. Has authority over all aspects of a significant area of work. Formulates and applies policy and strategy. Has an in-depth understanding of the business environment.
Managers	Responsible for managing departmental resources, budgets, and teams and relationships with external partners and suppliers. Often senior professional or practitioner in a management role.
Professionals	Exercises autonomy within defined parameters. Performs a range of often-complex work using specialist standards, tools and methods. Professional practitioner requires a higher-level qualification or experience specific to a job role. Registration with or membership of a professional body required or encouraged.
Support staff	Entry-level worker or in a support role as assistant, administrator, technician, or assistant or trainee practitioner. Performs a range of work under guidance and direction from professional staff and managers.

Table 5.5: Workforce taxonomy – role families and areas of work used in the workforce demand forecasting exercise

Role family: 1. Data architecture
Description of role family: Data-driven healthcare organisations are dependent on staff to collect, collate and appropriately organise and add value to electronic data relating to patients and their healthcare. Processes must also be in place to ensure that data is secured, and its usage governed according to current regulations and legislation. Those working in clinical coding, health records and information management are vital in developing and maintaining the data architecture for organisations.

Area of work	Description of area of work
1.1. Clinical coding	Translating diagnoses and treatment into alphanumeric codes. Making a full and accurate computer record of a patient's stay in hospital. Reviewing codes captured in patient records.
1.2. Health records	Organising, updating and storing records. Working with patients and healthcare staff to make sure that details of patients and their care are recorded and stored.
1.3. Information management	Designing, building and maintaining organisational data and analytical infrastructure. Ensuring information systems are properly governed and comply with agreed standards and regulations.

Role family: 2. Technical infrastructure
Description of role family: Ensuring the necessary IT systems, including hardware and software, are in place and maintained allowing healthcare providers to function as digital and data-driven organisations. Those working in information and communications technology will be central in developing and maintaining the digital infrastructure required by organisations.

Area of work	Description of area of work
2.1. Information and communications technology	Developing, implementing and maintaining complete IT solutions, including their hardware infrastructure (such as servers and networks) and software (such as operating systems, middleware and applications).

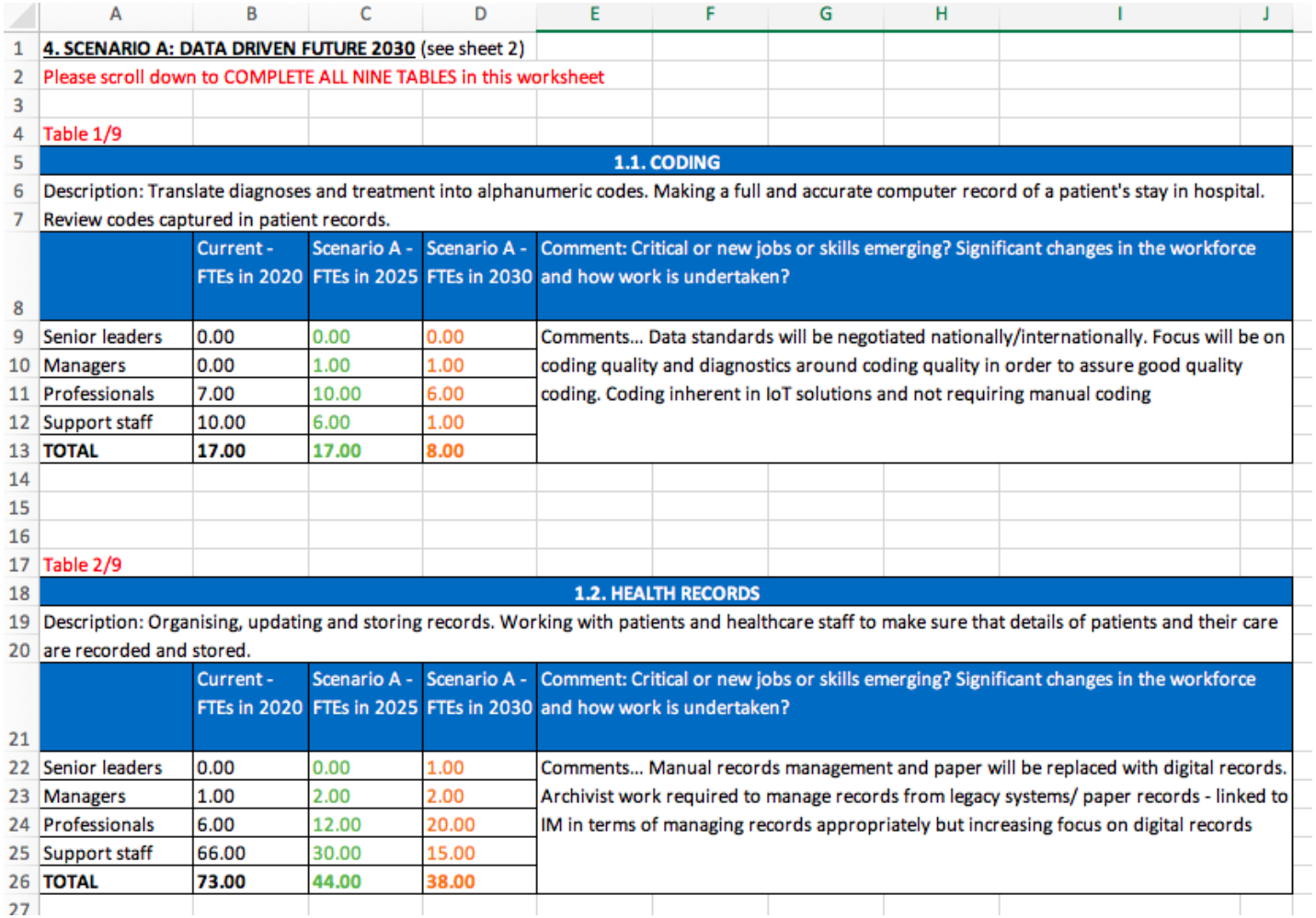
Role family: 3. Application
Description of role family: Using accepted methods and practices to analyse and/or apply internally derived health data and external knowledge in the provision of evidence and data to support the management of patients and healthcare systems. Those working in artificial intelligence, clinical informatics, data science, knowledge management and information science will be essential in creating this evidence and data support base in organisations.

Area of work	Description of area of work
3.1. Clinical informatics	Leveraging health and biological data analysis and modelling techniques to solve problems and glean insight across functional domains. Creating sophisticated analytical models used to build new datasets and derive new insights from data.
3.2. Knowledge management	Managing library services and making knowledge and evidence available to healthcare professionals though managing information, literature searches and information skills training.

Role family: 4. Organisational transformation
Description of role family: Transforming healthcare organisations with staff capable of leading, managing and/or facilitating the implementation of digital technology and data systems, as well as the necessary changes in working practices and processes. Vital to transforming organisations in this way are those involved in technology and in data strategy and development, translating health service needs into digital requirements, project and programme management, and education and training.

Area of work	Description of area of work
4.1. Programme and project management	Implementing technology and data solutions, improving the way information is shared across healthcare organisations, or developing a healthcare app. Ability to translate health service needs into digital and data product requirements.
4.2. IT strategy and development	Developing and implementing IT and data strategies, as well as managing change in an organisation.
4.3. IT education and training	Supporting the effective use of IT and software by staff, through applications and systems training.

Figure 5.1: Example of a template used to collect information in the workforce demand forecasting exercise toolkit



	A	B	C	D	E	F	G	H	I	J
1	**4. SCENARIO A: DATA DRIVEN FUTURE 2030** (see sheet 2)									
2	Please scroll down to COMPLETE ALL NINE TABLES in this worksheet									
3										
4	Table 1/9									
5	**1.1. CODING**									
6	Description: Translate diagnoses and treatment into alphanumeric codes. Making a full and accurate computer record of a patient's stay in hospital.									
7	Review codes captured in patient records.									
8		Current - FTEs in 2020	Scenario A - FTEs in 2025	Scenario A - FTEs in 2030	Comment: Critical or new jobs or skills emerging? Significant changes in the workforce and how work is undertaken?					
9	Senior leaders	0.00	0.00	0.00	Comments... Data standards will be negotiated nationally/internationally. Focus will be on coding quality and diagnostics around coding quality in order to assure good quality coding. Coding inherent in IoT solutions and not requiring manual coding					
10	Managers	0.00	1.00	1.00						
11	Professionals	7.00	10.00	6.00						
12	Support staff	10.00	6.00	1.00						
13	**TOTAL**	**17.00**	**17.00**	**8.00**						
14										
15										
16										
17	Table 2/9									
18	**1.2. HEALTH RECORDS**									
19	Description: Organising, updating and storing records. Working with patients and healthcare staff to make sure that details of patients and their care									
20	are recorded and stored.									
21		Current - FTEs in 2020	Scenario A - FTEs in 2025	Scenario A - FTEs in 2030	Comment: Critical or new jobs or skills emerging? Significant changes in the workforce and how work is undertaken?					
22	Senior leaders	0.00	0.00	1.00	Comments... Manual records management and paper will be replaced with digital records. Archivist work required to manage records from legacy systems/ paper records - linked to IM in terms of managing records appropriately but increasing focus on digital records					
23	Managers	1.00	2.00	2.00						
24	Professionals	6.00	12.00	20.00						
25	Support staff	66.00	30.00	15.00						
26	**TOTAL**	**73.00**	**44.00**	**38.00**						
27										

Driven Future and Data Desert Future scenarios on estimating workforce demand. The current (2020) workforce figures for the typical NHS trust were used as a standardised benchmark and participants were asked to estimate workforce demand for 2025 and 2030 by job level in each of the nine areas of work covering digital technology and health informatics. Free-text comments were also sought on critical or new jobs and skills arising in each area of work. Information was required for both the Data Driven Future and Data Desert Future scenarios and then entered into the relevant template found in the workforce demand forecasting toolkit. An example of a template used to collect this information can be seen in Figure 5.1. Once the exercise was completed, the senior digital lead was required to sign-off and return the toolkit to the project team at HEE.

Limitations of the demand-forecasting exercise

Bias of those taking part may have limited the reliability of the estimates provided as to future workforce demand. Participants in the demand-forecasting exercise from an organisation that is already digitally mature may be more inclined to make a judgement calling for a smaller increase in the workforce compared to those from organisations that are not so digitally mature. The majority of participants had a technical background (only one participant was a clinician) and this may have skewed the demand estimates and feedback given towards the technical roles in the workforce, at the expense of non-technical roles including clinicians specialising in clinical informatics. It must also be noted that the exercise took place during September and October 2020 – the early stages of the Covid-19 pandemic in the UK. The NHS response to the pandemic, including the application of digital technology and data in supporting healthcare services, may have unduly influenced participants when making their 10-year workforce demand forecasting estimates. A final limitation concerns the mapping of job roles. Estimates of demand for some job roles may be given in an area of work, used in the categorisation of the workforce and presentation of results in this report, by one participant but in another area by another participant.

Stage 3: Demand forecasting – modelling and projecting demand

An attempt was made to model and project future demand for the workforce overall and in each of the nine areas of work covering digital technology and health informatics, within the context of both the Data Driven Future and Data Desert Future scenarios. Two principle components underpin the methodology used to identify demand:

1. An estimation of current (2020) demand for the digital workforce in the NHS.

2. An estimation of future workforce demand and how this will change between 2020 and 2030, based on returns from the demand-forecasting exercise.

Estimation of current workforce demand – 2020

The estimate of current workforce demand is based on the conceptualisation of a desirable digital workforce in terms of size and composition, determined through the

examination of NHS trusts that scored highly in the Digital Maturity Assessment (DMA) exercises organised by NHS England between 2015 and 2017[32]. Statistical comparison of the size and composition of the workforce observed in ESR for the 30 highest-scoring, trusts on the DMA, suggests how these 'desirable' trusts differ from others. Making an extrapolation to represent the size and composition of the desirable workforce across all NHS trusts provides an estimation of current workforce demand. This approach assumes that the DMA is a meaningful measure of success of the digital technology and informatics function in an organisation.

Estimation of future workforce demand – 2020 to 2030

Estimation of future demand begins from the baseline estimate of current (2020) workforce demand. The returns of the demand-forecasting exercise from each of the participants provide an estimation as to how the workforce required to deliver services will change between 2020 to 2030 at an NHS trust level. The returns from the exercise are broadly congruent with each other and, as such, have been combined for each of the Data Driven Future and Data Desert Future scenarios to create a mean expected change. In addition, the mean change is presented in this report as a +/- standard deviation, to highlight areas of differing congruence. Proportionately applying these expected changes to the current (2020) workforce demand baseline creates a national estimate of how the demand for the digital workforce is likely to change leading up to 2030. This approach assumes that the organisational setting of the digital workforce will remain proportionally the same as at present.

Stage 4: Supply forecasting – modelling and projecting supply

An attempt was made to model and project supply for the workforce overall and in each of the nine areas of work covering digital technology and health informatics. Supply will be the same in both the Data Driven Future and Data Desert Future scenarios. Two principle components underpin the methodology used to identify supply:

1. An estimation as to the current (2020) size of the digital workforce in the NHS.

2. An estimation as to how this workforce will change in terms of size between 2020 and 2030. This estimation is presented on the presumption that no significant policy or related actions are taken to affect future workforce supply, and should be viewed as a counterfactual.

Estimating the current size of the workforce – 2020

An estimation of the current size of the NHS digital workforce has been made based on data from two sources:

1. North West Informatics Skills Development Network (NWISDN) 2013-18 censuses. The census offers a comprehensive dataset on this workforce but is limited to the North West England region only.

2. NHS Electronic Staff Record (ESR).

Most estimates of workforce size in the healthcare sector have focused their methodology on the relationship between population and the workforce. This is based on the assumption that population is the key determinant of healthcare demand, and that this demand and workforce supply should be correlated. This methodology has proved effective for workforces such as nursing, where a tangible link exists between role and operational service delivery. However, following tests of statistical association, the correlation between the size of the digital workforce identified by the NWISDN censuses and population in the North West was found to be weak, and this is likely to be due to the indirect relationship between this workforce and patient need. However, there was found to be a strong relationship between the size of an NHS organisation and the digital workforce observable within. This correlation is similar to those of many corporate workforces, such as human resources. It is therefore assumed that the digital workforce is proportionate to the overall size of the total NHS workforce. It was also possible to observe in the NWISDN census data a difference in the concentration of this workforce, depending on organisational function (Table 5.6).

Table 5.6: Digital technology and health informatics staff as a percentage of overall workforce in each type of NHS organisation in North West England (NWISDN 2013-18 census data)

Type of NHS organisation	Digital technology and informatics staff as a % of overall workforce
Clinical Commissioning Group/Commissioning Support Unit	6.5%
Community healthcare provider	2.8%
Mental health provider	1.9%
Ambulance service	1.3%
Acute healthcare provider	2.4%

For the purposes of estimating current workforce size it is assumed that the digital workforce appears in different concentrations dependent on organisational function. Producing an effective national estimation based on this assumption, and the assumption that the digital workforce is proportionate to the overall size of the NHS workforce, requires the differences that may exist between the national picture and the workforce within the North West to be accounted for. When reviewing the UK Tech Innovation Index, it is clear that technology-based activity in England is not evenly geographically distributed[33]. To account for this distribution, the creation of a composite index was required to estimate how the workforce will be represented in different regions proportionately to the North West. Included within this composite index were measures from the UK Tech Innovation Index such as research output, advertised jobs, number of technology enterprises, educational opportunities, and advertised events like conferences. These were combined with the observable workforce sample within ESR and NHS vacancy information, published by NHS Digital[34]. It is assumed that the NHS digital workforce shows similar variation in regional distribution compared to the total technology sector.

Estimating the size of the future workforce – 2020 to 2030

Estimating the future size of the NHS digital workforce begins with the baseline estimation of the current (2020) workforce. The process of estimating the future workforce is based upon flow analysis, derived from the workforce sample that is observable within ESR and interpreted using the HEE ESR Flow Tool. This tool identifies and categorises workforce behaviours and quantifies these into flow rates, such as the percentage of employees retired in any given year. These flows are aggregated individually for the nine areas of work covering digital technology and health informatics in the NHS, to give a single measure of the change for each staff group in each of the areas of work, for each year. Taking a mean of these single measures from the three years preceding this analysis, 2016-17, 2017-18 and 2018-19, and applying this to the baselines – estimate of current workforce size – produces an estimate of the future size of the staff groups in each of the nine areas of work. Underlying these estimations is the assumption that the NHS digital workforce will continue to grow at a similar rate as previously without further intervention.

Limitations of the supply-forecasting model

Making a credible estimation of workforce supply for this project has been challenging, in contrast to the usual availability of this information for other workforces in the NHS. When applying the nine areas of work set out by NHS Digital's Informatics Area of Work Guidance[18] to ESR, the observable workforce size was not recognisable in line with anecdotal expectations and the estimates of preceding work. Concerns around the comprehensiveness of the ESR observable sample led to the development of an alternative method of identifying workforce supply during this project, and this is described above. For example, the national NHS Knowledge and Library service team benefits from an annual collection of workforce data dating back decades. This long-established survey attracts a high level of response, with more than 90 per cent of trust library services submitting an annual return. The 2019-20 return identified 1,004 WTE staff, of which 55 per cent held knowledge and library qualifications at degree level or higher.

Stage 5: Project 10-year demand and supply, and identify possible shortages or excesses in workforce capacity

Projected demand and supply for the NHS digital workforce overall and for each area of work are shown in this report in the form of line graphs covering the period 2020 to 2030. There are two demand lines, one each for the Data Driven Future and Data Desert Future scenarios, and the shaded areas around each line show the variation, and also congruency, of responses from the demand-forecasting exercise on which these lines are based. The single supply line is applicable to both scenarios. As well as showing whether there will be a projected increase or decrease in demand and supply, the gap between the demand and supply lines will highlight the possibility of a shortage or excess in workforce capacity at any point leading up to 2030. It must be noted that the supply projection is based on rates of change observed in the

workforce between 2016-17 and 2018-19, and the assumption of no significant policy or related actions being taken to affect future workforce supply.

Stage 6: Identify structural shifts in the workforce

The proportion of staff by job level – senior leaders, managers, professionals and support staff – required in 2020, 2025 and 2030 is shown in this report as bar graphs for the workforce overall and for each area of work. Two sets of bar graphs are presented, one each for the Data Driven Future and Data Desert Future scenarios. The data for the 2020 bar graph is derived from ESR data, using NHS Agenda for Change banding as a guide to job level. Estimates from the demand-forecasting exercise provided the data for the 2025 and 2030 bar graphs. Comparison of these bar graphs for an area of work will show whether structural shifts in the composition of the workforce are needed in the future. These structural shifts may reflect the need for increased professionalisation and requirements for specialist skills, as well as management and senior leadership roles, in the workforce.

Stage 7: Highlight in-demand, emerging and critical job roles and skills

The demand-forecasting exercise and a review of key reports in this area have highlighted in-demand, emerging and critical job roles and skills needed in the NHS digital workforce in the next 10 years. Details of these job roles and skills have been provided in this report to help explain the future capacity and change in composition of the workforce needed by 2030.

Mapping of job roles

For clarity and consistency, the job roles detailed in this report have, where possible, been mapped to the terminology in the Government Digital Service (GDS) Digital, Data and Technology (DDaT) Capability Framework[4] or, in the case of new digital or informatics roles seen as emerging in importance, the Digital Health and Care Institute's occupational category framework developed in 2019[35]. The project team has also mapped the job roles described in this report to the professional standards framework developed by the Federation for Informatics Professionals (FEDIP)[36] to indicate the level of professionalism that will be in demand. This can help employers map to the current NHS Agenda for Change pay band structure. As an approximation: Practitioner – bands 4 and 5, Senior Practitioner – bands 6 and 7, Advanced Practitioner – bands 8a and 8b, and Leading Practitioner – band 8c and above and very senior management positions.

Mapping of skills

In detailing newly emerging digital and informatics skills in this report, again for reasons of clarity and consistency, the project team has referenced the 21st Century Skills Plus framework developed by the Digital Health and Care Institute[35]. Researchers in this organisation undertook an extensive review of different skill categorisations, including SFIA+ (Skills Framework for the Information Age)[37], with updates from the World Economic Forum's top 10 skills predictions for 2022[38] and

skills and capabilities that emerged from their extensive research, which involved workshops with representatives from government and the education sector, third sector, health and care sector, and private sectors. This resulted in the creation of an updated 21st Century Skills framework, which was named the 21st Century Skills Plus framework. This framework is intended to better reflect the pace of change imposed by technology in the workplace, and lists the capabilities that people will require to thrive in the information age. It includes a list of 22 skills that can be broken down into three main categories (Table 5.7).

Table 5.7: 21st Century Skills Plus framework – Digital Health and Care Institute[35]

Category and description	Skills
Core skills These are skills shared across all occupational categories, described as being important or crucial.	1. Communication 2. Active learning and learning strategies 3. Advanced information literacy 4. Advanced ICT literacy 5. Organisational skills (productivity and accountability, initiative) 6. Critical thinking, complex problem-solving and analysis 7. Creativity, originality, inventiveness and ideation 8. Collaboration 9. Project and programme management skills
Skills showing division between jobs at technical level and domain specialist level. These separate the different occupational categories in relation to their need for technical ability versus domain specialism.	10. Design 11. Systems analysis and evaluation, and quality improvement 12. Technical IT skills 13. Coding and programming languages 14. Emotional intelligence 15. Domain specialism 16. End user engagement 17. Cyber security (knowledge and skills) 18. Business skills and awareness.
Specialist skills These differentiate the various specialist orientations of the occupational categories.	19. Research, data analysis, analytical skills 20. Facilitation skills 21. Change management 22. Training skills

In the digital technology health sector, there is a clear division that emerges between job roles that require technical IT skills and computer or programme coding skills, and the categories that emphasise domain specialism and emotional intelligence. There are some roles that will require a cut across the divide where both skill sets are required. Examples would include machine learning or AI engineer specialists (aka knowledge engineers) and C (chief) suite roles, including CIOs and CCIOs. For the roles that have been mapped to the DDaT Capability Framework, we provide a link to the job role and various skill levels contained within each of the roles.

6A. Clinical coding

Requirements in the NHS

The interoperability of information systems and electronic exchange of data within and across NHS trusts is dependent on the use of common data standards. These standards cover how data should be structured and coded so that information systems can work together in a seamless way. Without these standards and their application, it will be a challenge to realise the ambition of a digitally transformed and data-driven NHS, and the potential of AI and machine learning in healthcare.

Data standards cover the codes and terminology used to describe the complexity of human physiology, disease and clinical interactions with patients. Clinical coding staff have an important role in maintaining and applying these standards within their organisations. They also work with clinicians to classify and code information derived from patient records. In 2018-19, around 21 million inpatient consultant episodes in the NHS required classification and coding. The utility of SNOMED-CT, a preferred clinical terminology data standard in the NHS, is dependent on trained clinical coders understanding its structure, conventions and rules, as well having a working knowledge of the medical and biological sciences, in order to undertake accurate and consistent coding of diagnostic findings, as well as healthcare procedures and interventions.

The sharing of electronic health and patient records across different health and care providers in a geographical area forms part of the NHS digital transformation agenda. Initiatives such as NHS England's Local Health and Care Record Exemplar programme aim to provide clinicians and care professionals with access to real-time patient records and care plans that have been linked, deduplicated and normalised to standard coding terminologies[39]. A standardised approach to coding will facilitate the aggregation of clinical and patient outcome data for a geographical area, or at a regional or national level, to guide decision making around the allocation of healthcare resources.

Clinical coding functionality in the NHS will develop in the next 10 years through the use of automated or computer-assisted coding systems. These systems employ natural language processing and machine learning to extract information from electronic patient records and other documentation, and allocate diagnostic and healthcare procedural and intervention codes. Market intelligence studies predict that the global market for these systems will grow by 12 per cent per year, indicating that their adoption is both rapid and widespread[40]. Attention is also turning to technology, again based on machine learning, allowing for direct, automated clinical coding of diagnostic images and audio-visual recordings of physiological phenomena. Current labour market dynamics indicate that clinical coder roles are in high demand among digital and informatics roles advertised in the NHS, peaking in 2019, but were not in demand in 2020, which may have been due to the impact of the Covid-19 pandemic[5].

Scenario A: Data Driven Future 2030

Projected demand forecast

The demand forecast for a Data Driven Future indicates that the clinical coding staff group will need to:

- (Figure 6A.1) Reduce the overall number of staff by around 13 per cent between now and 2030, from its estimated current size of 3,550 WTEs to the forecasted required size of 3,100 WTEs.

- (Figure 6A.2) Reduce the number of support staff by around 63 per cent to 725 WTEs by 2030, and the increase number of professional staff by around 28 per cent to 2,150 WTEs. Managerial roles will need to be introduced into this staff group so that 240 WTEs will be employed by 2030.

- (Figure 6A.3) The next 10 years will see an increased professionalisation of the clinical coding staff group. There will be a significant increase in the proportion of staff in a professional or managerial role, from 47 per cent to 77 per cent. The proportion of support and administrative staff will reduce from 53 per cent to 23 per cent.

Projected supply

The projected supply for the next 10 years indicates an increase of 45 per cent in the overall number of clinical coding staff, to around 5,175 WTEs by 2030 (Figure 6A.1). This will mean that in a Data Driven Future there will be an oversupply of around 2,075 WTEs by 2030, in the absence of any policy interventions around redeployment, recruitment and retention.

Viewpoints of participants

The overall size of the clinical coding staff group is set to decrease between now and 2030. The trend is non-linear, reflecting that the next 10 years will be a period of fluctuating change, as explained by one participant in the exercise:

> This is a significant change over the period, in taking a manual process and automating it. The expectation is that there will be a short-term increase in workload due to more data capture in semi-structured forms. This is followed by a longer-term decrease of support and transactional skills due to application of appropriate algorithms (KNN) and technologies. In 2025 we should be implementing technologies deployed by 2030.

The application of digital technology, and not just computer-assisted and automated clinical coding systems, in the NHS will have a substantial employment effect on the clinical coding staff group. The requirement for administrative staff supporting trained clinical coders will diminish as electronic health and patient record systems become

Figure 6A.1: Supply projection and demand forecasts for clinical coding staff in a Data Driven Future and Data Desert Future – 2020/21 to 2029/30

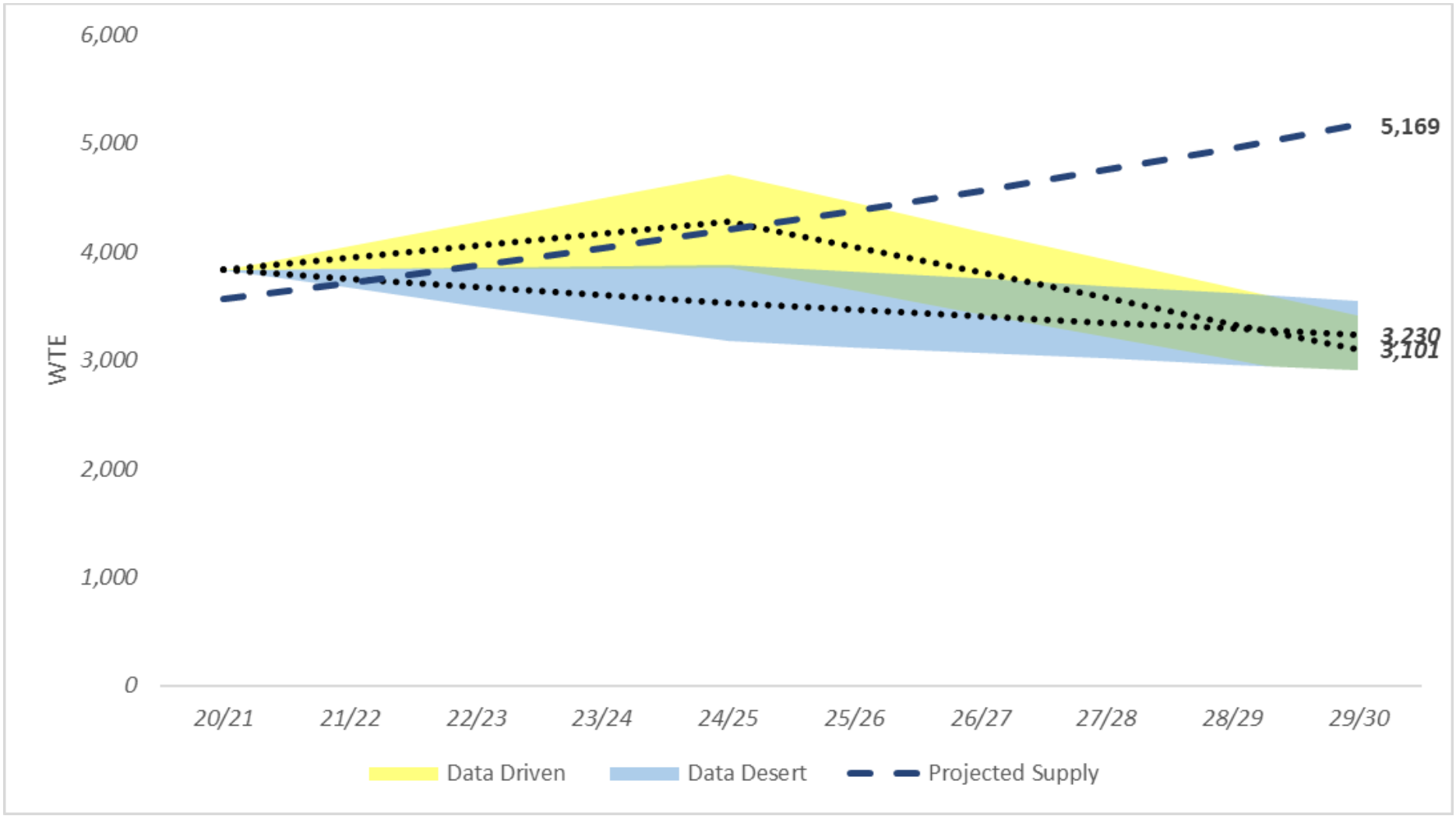


Figure 6A.2: Changes in staffing levels required in clinical coding for a Data Driven Future

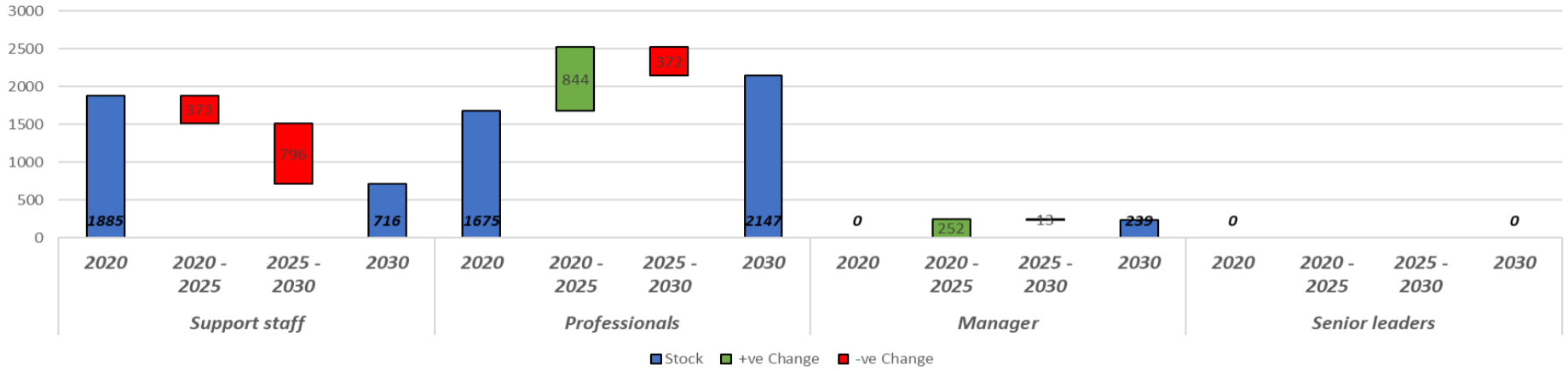
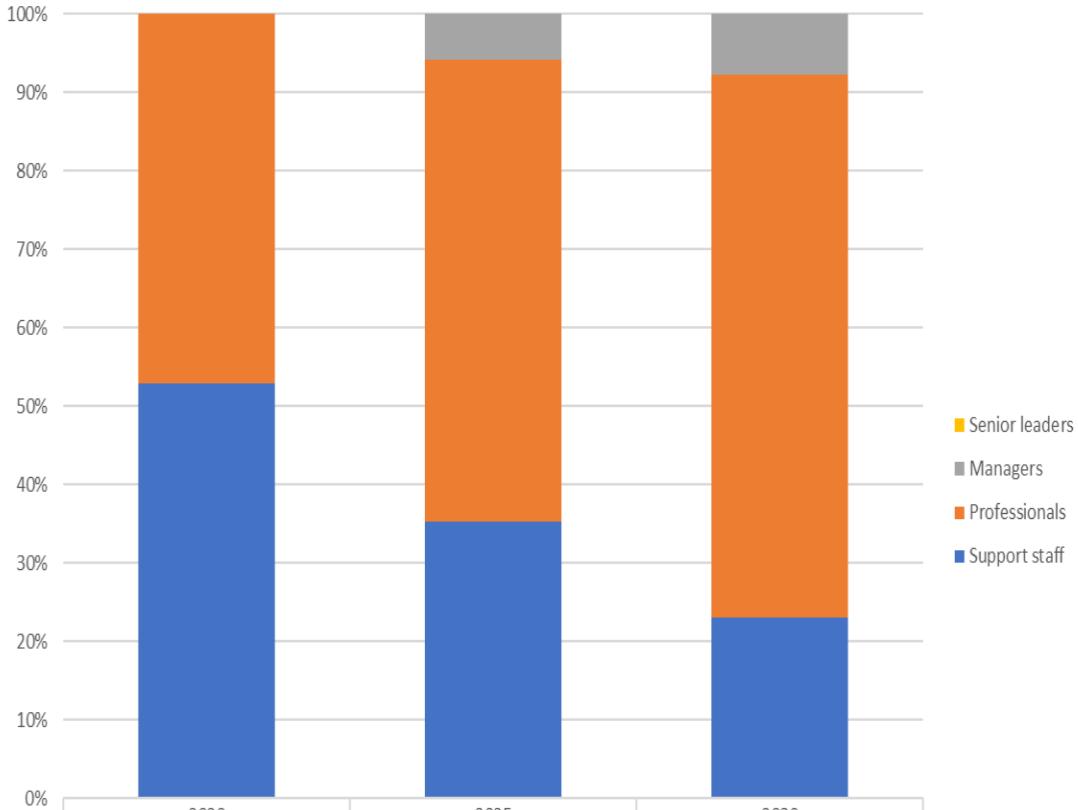


Figure 6A.3: Composition of the clinical coding staff group leading up to and in a Data Driven Future



	2020	2025	2030
Senior leaders	0%	0%	0%
Managers	0%	6%	8%
Professionals	47%	59%	69%
Support staff	53%	35%	23%

more integrated into healthcare services. As explained by one participant in the demand-forecasting exercise, the need to manually collect, process and code 500 sets of paper-based clinical case notes and return them to a multitude of locations around the trust will be superseded by the flow of digital information. The technology embedded in wearable sensors and other Internet of Things solutions used by patients allows for data to be automatically coded in the process of being sent to a healthcare provider. This again will lessen the need for support staff in a clinical coding department.

For some participants, the Data Driven Future is one where the clinical coding function in NHS trusts will be automated to a great extent. This again will reduce the requirement for support and administrative staff and could possibly lead to fewer trained clinical coders being employed. As explained by these participants in the exercise:

If there was a piece of software developed which could replicate the coder's knowledge and decision making in accordance with the national

rules around OPCS-4 and ICD-10, then this could possibly lead to a requirement for fewer coders, but I have no idea to what extent.

The rise of fidelity and accuracy of voice recognition and natural language processing has meant accurate coding of medical records is increasingly automated. In addition, sensors record unambiguous data directly, resulting in a lower need for clinical coders.

Much, however, will depend on the sophistication of software and automated systems being developed for clinical coders to be completely replaced. The change in staffing levels required for a Data Driven Future (Figure 6A.2) shows an increase in the number of professionals (trained clinical coders) between now and 2030. Computer-assisted and automated systems allow for increased productivity in the clinical coding function but realising this productivity relies on professionals with enhanced skills. These skills, rather than being in manual coding, will be in the area of quality assurance through the monitoring, validating and auditing of codes generated by automated systems. This focus on quality will require clinical coders to work closely with clinicians to ensure that clinical information is being accurately captured through an automated coding process.

The changes required in a Data Driven Future also show that managerial roles must be introduced into the clinical coding staff group. Managers will be needed to oversee the introduction and embedding of new automated systems, as well as the resulting changes in coding practice. One participant in the demand-forecasting exercise envisaged these managers driving clinicians forward in codifying information themselves as it is being entered onto electronic patient records, as they become more data-savvy and aware of data standards.

Scenario B: Data Desert Future 2030

Projected demand forecast

The demand forecast for a Data Desert Future indicates that the clinical coding staff group will need to:

- (Figure 6A.1) Reduce the number of staff by around nine per cent between now and 2030, from its estimated current size of 3,550 WTEs to the forecasted required size of 3,225 WTEs.

- (Figure 6A.4) Reduce the number of support staff by around 25 per cent to 1,425 WTEs by 2030, and increase the number of professional staff by around eight per cent to 1,825 WTEs.

- (Figure 6A.5) Adjustments to the composition of the clinical coding staff group will need to be made by 2030. There will be an increase in the proportion of staff in a professional role, from 47 per cent to 56 per cent. The proportion of support and administrative staff will reduce from 53 per cent to 44 per cent.

Figure 6A.4: Changes in staffing levels required in clinical coding for a Data Desert Future

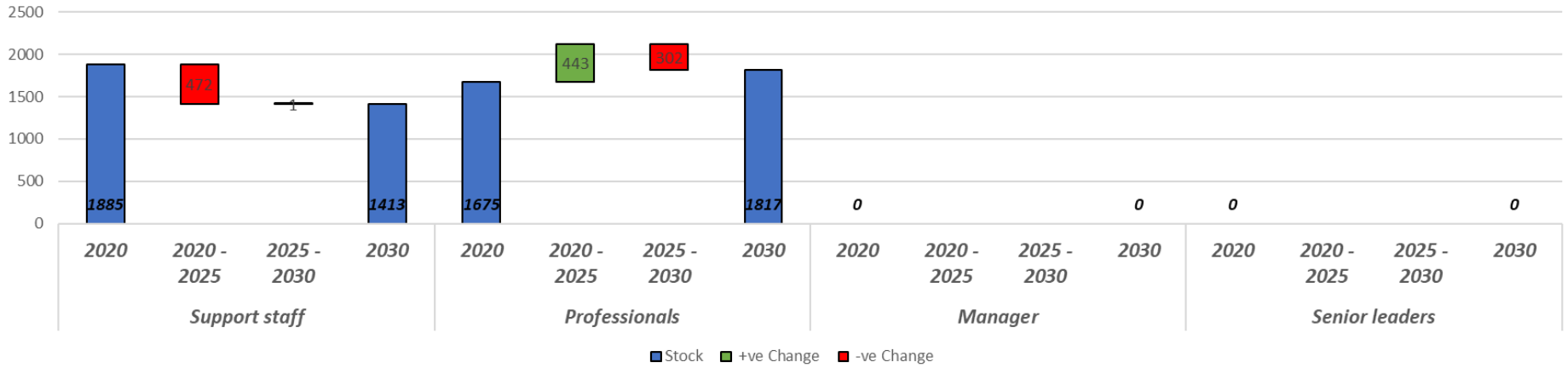
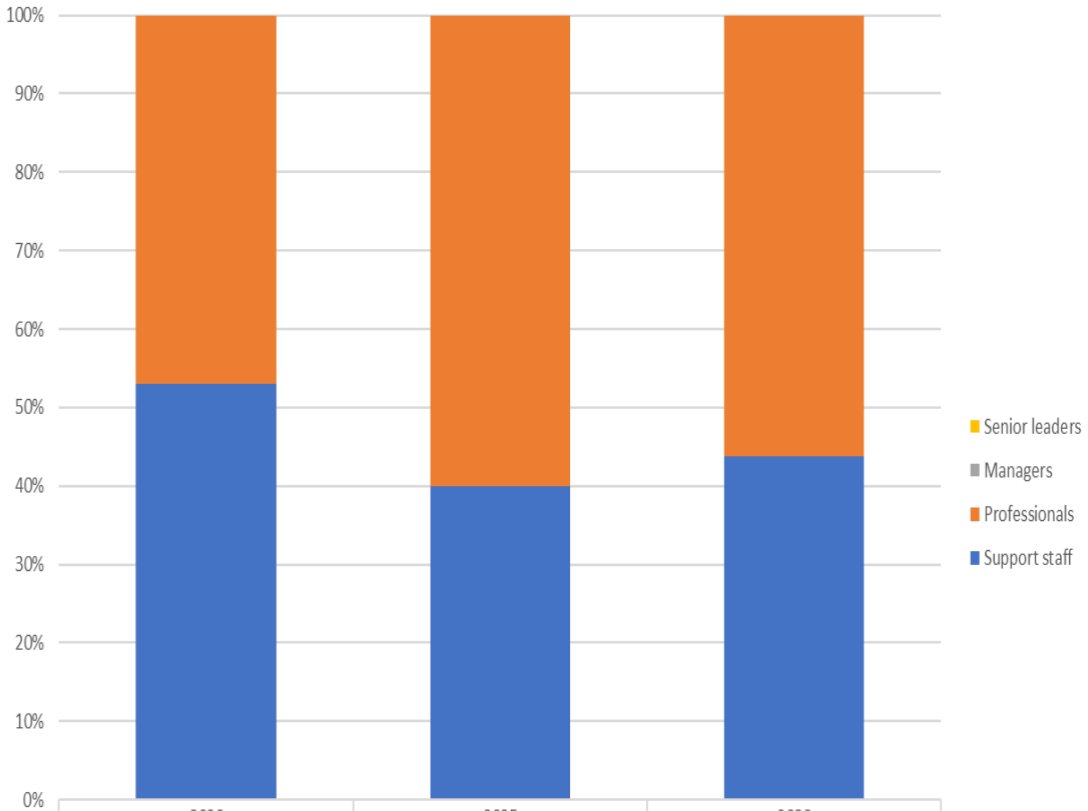


Figure 6A.5: Composition of the clinical coding staff group leading up to and in a Data Desert Future



	2020	2025	2030
Senior leaders	0%	0%	0%
Managers	0%	0%	0%
Professionals	47%	60%	56%
Support staff	53%	40%	44%

Projected supply

The projected supply for the next 10 years indicates an increase of 45 per cent in the overall number of clinical coding staff to around 5,175 WTEs by 2030 (Figure 6A.1). This will mean that in a Data Desert Future there will be an oversupply of around 1,950 WTEs by 2030 in the absence of any policy interventions around redeployment, recruitment and retention

Viewpoints of participants

A financially constrained Data Desert Future will impact on the clinical coding function of many NHS trusts. The function will still be required but limited investments will be made in supporting it, in terms of technology and human resources. A heavy burden will be placed on clinical coding staff as the demand for healthcare and coding of activity is unlikely to fall, and may well increase in a Data Desert Future. There will be limited implementation of automated clinical coding systems and continued reliance on paper-based systems, meaning the requirement

for administrative and support staff will exist in 2030 but in fewer numbers than what is seen today.

There will however be a growth, although small, in the number of professionally trained clinical coding staff in the Data Desert Future. The increase will not be to the same extent as seen in the Data Driven Future. Limiting this growth will be a narrowing in the range of healthcare services delivered in a financially constrained NHS, resulting in a contraction in the range of activities that will need to be coded. Interoperability of information systems and data sharing will not be a priority and therefore less value will be placed on trained clinical coders and their outputs.

The skills of clinical coders will still be required in the use of manual coding methods and paper-based systems. The pressure to make savings and reduce budgets will see the clinical coding departments of some NHS trusts merging to provide a centralised service. This will lessen the need for support staff and limit the growth in the number of trained clinical coders. The demand forecast for a Data Desert Future shows that managers are not required in the clinical coding staff group. The reasons for this include cuts in financial budgets and lack of opportunities to manage any significant changes in the clinical coding function of NHS trusts, due to the limited application of new technology. The management of clinical coding staff will instead fall to another part of the organisation, for example those working in information management.

Priorities for the clinical coding staff group – 2020 to 2030

Those taking part in the demand-forecasting exercise provided an indication of the priorities that will be placed on the clinical coding staff group over the next 10 years. These priorities are particularly relevant in a Data Driven Future. The suggestions made correspond with those found in reports looking at the future of digital technology and informatics in health services, nationally and internationally.

Adoption of computer-assisted and automated coding systems

The adoption and maintenance of automated systems require managers and trained clinical coders with enhanced skills to redesign and oversee the coding workflow, fully integrate the technology, and audit and assess its outputs for accuracy and reliability. The training and education of clinicians will be important when introducing any substantial changes to coding practices within an organisation.

Quality assurance of automated coding

The application of standardised clinical codes and terminology has traditionally been a manual process. However, the practice of clinical coding is changing. Frameworks and standards, such as the new ICD-11, will facilitate automated code from text by extracting data from electronic records, such as those covering patient consultations, medication and treatment, and laboratory activities, as well as voice-recognised, dictated digital reports. Such developments will have an employment effect on clinical coding staff. It will lessen the need for coding to be undertaken in person and increase the need for skills to monitor, validate, audit and assess the quality of

automated coding. One view is that clinical coders will become high-level data editors to assure the quality of data used in clinical information systems[41].

Supporting developments in machine learning

Highly qualified specialists with a background in clinical coding will be required to assist in the development of machine learning algorithms that allow for the automated coding of clinical data. Skills are required to refine and train algorithms to adapt to data standards and improve the accuracy and reliability of the coding of diseases, as well as healthcare procedures and interventions. One of the ambitions for digital transformation in the NHS is the automated coding of diagnostic images. It has been highlighted that AI could potentially process millions of images every day at very little cost[42]. Machine learning and AI also have the potential to help predict the possibility of disease in patients. Realising this potential will, in part, rely on the development, maintenance and application of coding standards for reporting suspected and impending conditions[40]. Data and coding standards that are currently widely used focus on diseases that have already been diagnosed by a clinician.

Implementing and maintaining data standards

The interoperability of information systems and sharing of health and patient records within and across NHS trusts require data to be normalised to standard coding terminologies. The application of standardised clinical terminology such as SNOMED-CT is important, yet the National Audit Officer has recently reported that only 15 per cent of NHS trusts are mostly compliant with this standard[27]. Implementing standards such SNOMED-CT and the new ICD-11, or transitioning to them from earlier versions, will require forward planning and organisational management skills. Ideally placed to do this, with their background knowledge in data architecture, are staff involved in the clinical coding, health records and information management functions of an NHS trust.

Contributing to quality improvement in clinical care and population health

The availability of information systems capable of handling large quantities of data offers the opportunity for clinical coders to directly influence the quality of healthcare. Clinical coders, with their working knowledge of the medical and biological sciences and experience of applying data standards, are uniquely positioned to identify deviant coded data patterns relating to clinical activities and patient outcomes within and across NHS trusts. The ability to critically evaluate and report any deviant or aberrant data patterns are skills needed to make improvements in the quality of healthcare and population health. It is also very much about clinical coders becoming more analytical and proactive in predicting trends in healthcare and patient outcomes.

Job roles and skills

Those taking part in the demand-forecasting exercise provided an indication of clinical coding job roles and skills required in NHS organisations in the 10 years leading up to 2030. These requirements are particularly applicable in a Data Driven

Future. The suggestions made regarding these job roles and skills correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

In-demand, emerging and new job roles

The composition of the clinical coding staff group, in terms of job roles and skills required, will be quite different in 2030 compared to today. Some existing job roles and skills may be made redundant by advances in technology such as AI, or superseded by new roles and skills as the result of the digital or organisational transformation of NHS trusts. Based on an analysis of reports in this area, in-demand, emerging and new job roles are identified in Table 6A.1. Some of these job roles will also be found in other areas of the digital technology and informatics workforce in 2030.

Table 6A.1: In-demand, emerging and new job roles in clinical coding in a Data Driven Future – summary of roles and skills required and links to further information

Job role	Summary of role and skills required	Job role – link	Skills – link
Lead auditor and supervisor clinical coding (practitioner and senior practitioner)	Clinical coders analyse clinical statements and assign standard codes using a classification system. Coding roles will be enhanced with AI and require the ability to work confidently with AI-assisted coding technologies. Core, IT and coding skills are required[35] as well as those in information governance, coaching and project management, together with knowledge of key performance indicators[5].		DHCI Tech Nation

Investment in clinical coding

The demand-forecasting exercise and a review of reports on digital technology in healthcare have highlighted areas where investment is needed over the next 10 years in developing the capacity and capability of clinical coding staff in the NHS. These areas of investment are particularly required in a Data Driven Future.

Building capacity

The clinical coding function may increasingly be used as an entry point for staff to move into posts in information management, clinical informatics, IT programme and project management, and IT education and training. Experience gained through classification and coding of diseases and healthcare procedures and interventions, which to some extent involves working with clinicians, together with knowledge of data standards will provide the basis for this movement. Opportunities will need to be

created allowing clinical coders to obtain additional training and qualifications, and clearly defined career pathways would also help in this regard. These movements are part of an overall shift in the structure of the NHS digital technology and informatics workforce that will be seen in the next 10 years or so. Similar shifts have already been anticipated internationally in regard to other health systems. The results of a survey by the American Health Information Management Association in 2015 identified an anticipated decline in the need for skills in clinical coding and records management, and an increased need for skills in data integration, data analytics, clinical informatics, information governance and information system management[43].

Training and continuing professional development

A working knowledge of the medical and biological sciences and healthcare activities is the foundation of good practice in clinical coding. Those looking to enter this staff group will need to acquire some knowledge of these areas through training, and then keep up-to-date with important advances through their CPD. Standards such as SNOMED-CT are periodically updated to reflect developments in healthcare and, again, need to be covered by trained clinical coders through their CPD. Changes in digital and medical technologies will mean significant changes in hospital activities and ways of recording these activities through the clinical coding function.

Recruitment and retention

The adoption and improvement of computer-assisted technology should lead to many aspects and functions of clinical coding, including its administration, becoming automated in the near future. Productivity in clinical coding should also increase, especially if this technology continues to improve in terms of its reliability and accuracy. Automation and an increase in productivity will reduce the need for administrative and support staff, but will increase the need for managers and trained clinical coders with enhanced skills to work with and realise the potential of this technology.

One participant in the demand-forecasting exercise was keen to highlight the well-being of clinical coding staff in an increasingly digital environment. The shift from paper-based records to viewing and managing information predominantly on computer screens does leave staff fatigued, compromising their well-being and productivity. This could potentially affect retention rates for this staff group and is worth looking into as part of a package of workforce development policies.

Salary and employment on-costs

The current salary and employment on-costs for the clinical coding staff group of 3,550 WTEs in 2020 are estimated to be around £116 million. If the number of staff falls to 3,100 WTEs, as projected in the demand forecast for the Data Driven Future scenario, the costs will be in the region of £132 million in 2030 (Figure 6A.6). These calculations are based on a mean salary pay point corresponding to the top of NHS Agenda for Change band 4 and the assumption that salaries will increase by 2.7 per cent per annum, and employment on-cost at 34.9 per cent (21 per cent for the NHS pension and 13.9 per cent National Insurance contribution). The projected salary and

Figure 6A.6: Change in salary and employment on-costs in a Data Driven Future for the clinical coding staff group

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost (Millons)	£116	£122	£130	£139	£149	£159	£154	£149	£144	£138	£132
Baseline Cost (Millons)	£116	£119	£122	£126	£129	£133	£136	£140	£144	£147	£151

employment on-costs for a Data Driven Future do not factor in any changes by job level to the composition of the staff group. Therefore, the figure of £132 million should be regarded as the minimum estimate for 2030. It is worth contrasting the figure of £132 million with the £151 million (baseline costs) that represents the salary and employment on-costs of a workforce remaining at 3,550 WTEs in 2030.

6B. Health records

Requirements in the NHS

Health records are crucial to the delivery of healthcare as they contain information about a patient's health status and treatments and form the basis for decisions around ongoing care. Information contained in health records is also used for service planning and resource allocation purposes and important for carrying out disease surveillance and medical research. Clinical case notes, patient health records, diagnostic images and laboratory reports are examples of types of records used in healthcare. All NHS employees have legal and professional obligations in regard to handling patient records. Those employees working specifically in the field of health records management are responsible for developing and maintaining organisational policies and strategy in this area and organising and managing how records should be kept and disposed.

Paper-based records have predominated in the NHS but are being superseded by digital formats. NHS England is committed to supporting the usage of interoperable electronic health records in all primary and secondary healthcare providers. The aim is that the system of recording the health status of patients and healthcare received in the NHS will largely be a paperless one by the early 2020s. The implementation of electronic health and patient record systems is one of the main strands of the NHS digital transformation agenda. It is seen as the foundation to any digital strategy in the NHS[16].

Just over a quarter of the NHS digital technology and informatics workforce in 2020, or 12,600 WTEs, work in the area of health records. These figures show the importance of having well-resourced support in place for administering, organising and managing health records. The increasing implementation of electronic health records and digitised systems will have an employment effect on this staff group, and on those in clinical coding and information management, who are involved in the process around maintaining good quality health and patient records. The employment effect will mainly be seen in changes in the skills required from these staff groups and how their skills will be applied in a digital environment.

Scenario A: Data Driven Future 2030

Projected demand forecast

The demand forecast for a Data Driven Future indicates that the health records staff group will need to:

- (Figure 6B.1) Slightly reduce the overall number of staff by around two per cent between now and 2030, from its current size of 12,600 WTEs to the forecasted required size of 12,325 WTEs.

Figure 6B.1: Supply projection and demand forecasts for health records staff in a Data Driven Future and Data Desert Future – 2020/21 to 2029/30

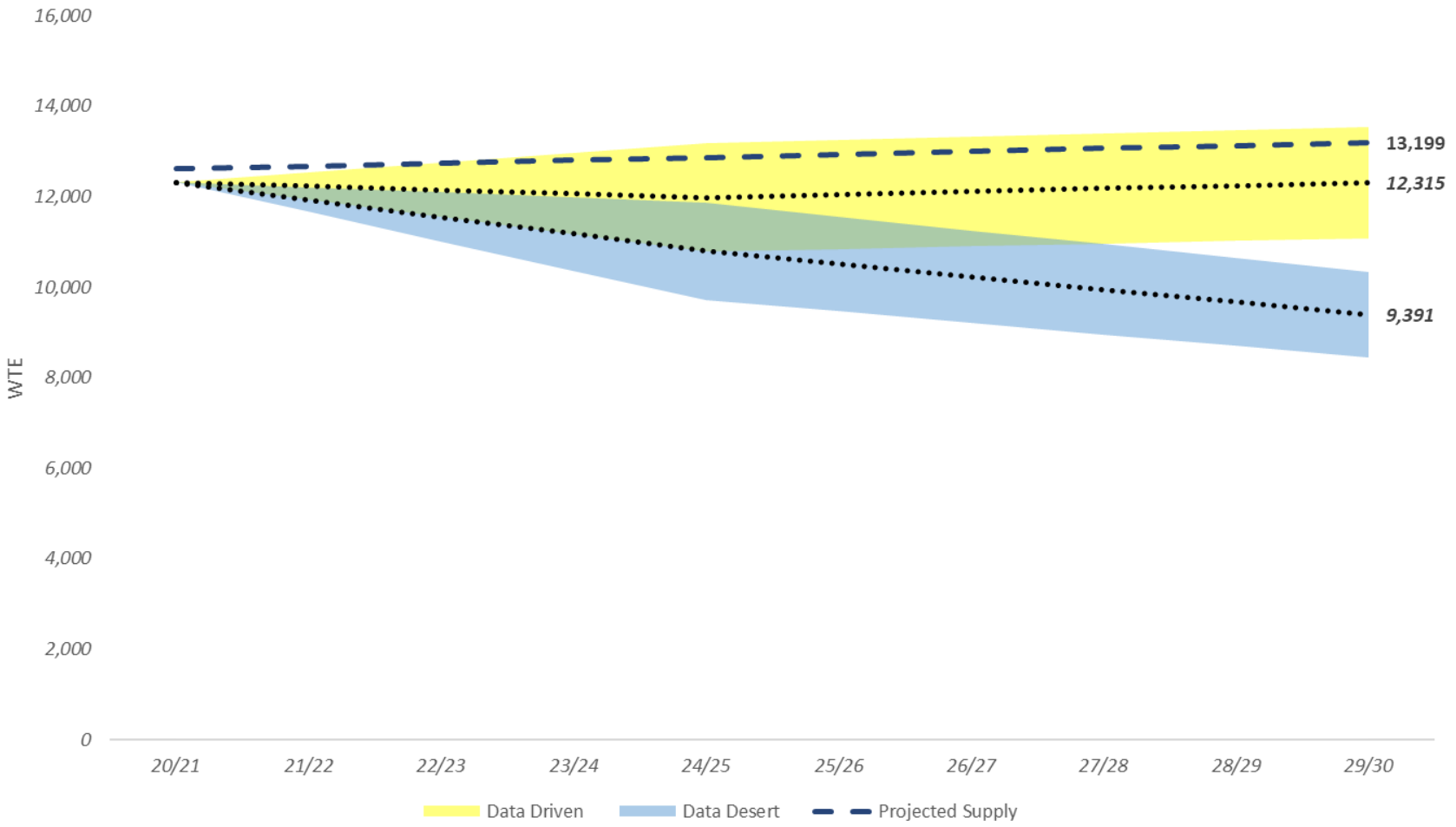


Figure 6B.2: Changes in staffing levels required in health records for a Data Driven Future

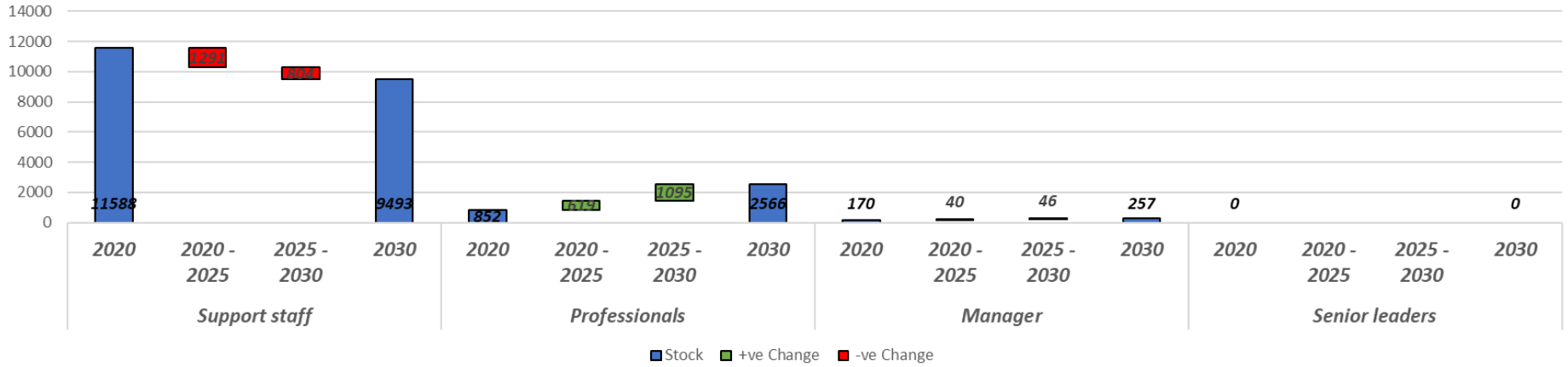
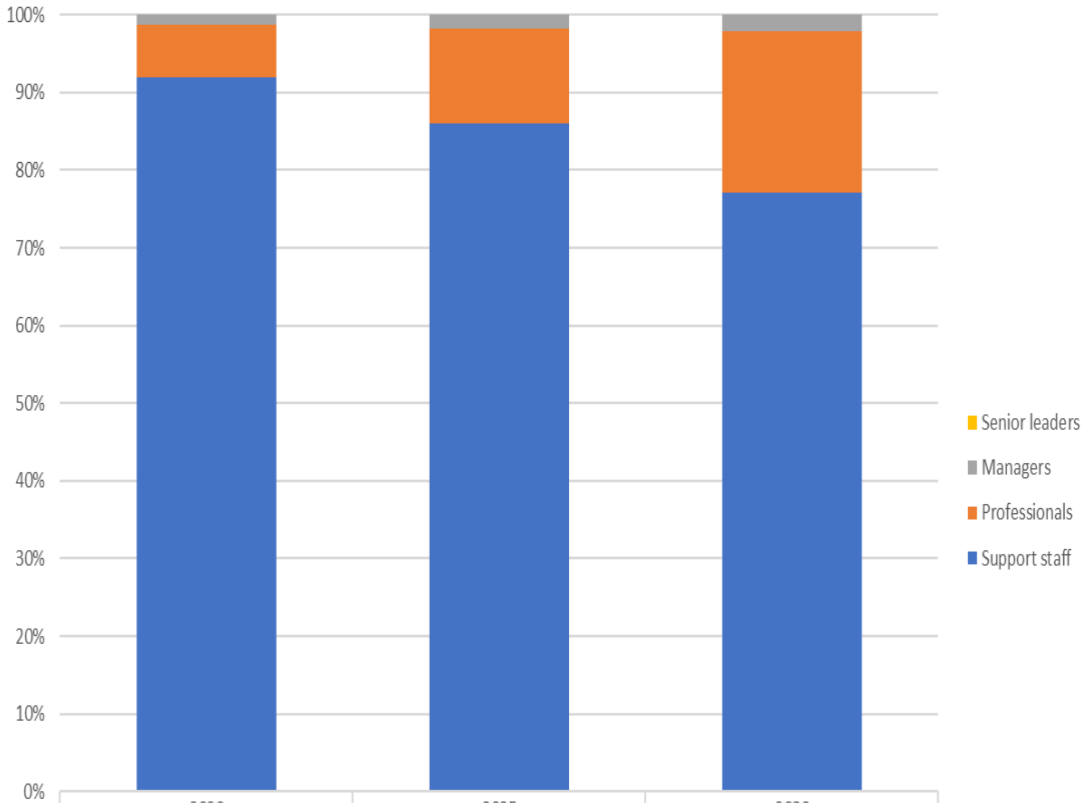


Figure 6B.3: Composition of the health records staff group leading up to and in a Data Driven Future



	2020	2025	2030
Senior leaders	0%	0%	0%
Managers	1%	2%	2%
Professionals	7%	12%	21%
Support staff	92%	86%	77%

- (Figure 6B.2) Reduce the number of support staff by around 18 per cent to 9,500 WTEs by 2030, and significantly increase number of professional staff by around 202 per cent to 2,575 WTEs. The number of staff in a management role will need to increase by around 51 per cent to 260 WTEs by 2030.

- (Figure 6B.3) Administrative and support staff will continue to make up the vast majority of those working in health records, although this majority will decline in the next 10 years from 92 per cent to 77 per cent. There will be a significant increase in the proportion of staff in a professional or managerial role, from 8 per cent to 23 per cent.

Projected supply

The projected supply for the next 10 years indicates an increase of five per cent in the overall number of health records staff to around 13,200 WTEs by 2030 (Figure 6B.1). This will mean that in a Data Driven Future there will be an oversupply of around 875 WTEs by 2030, in the absence of any policy interventions around redeployment, recruitment and retention.

Viewpoints of participants

Most participants in the demand-forecasting exercise felt that the Data Driven Future will be an era of electronic health and patient records and digitised systems. The period leading up to 2030 will, for many NHS trusts, be one of transitioning from manual methods of records management and paper-based systems to methods underpinned by digital technology. Support staff will still be required during the transitional period and afterwards, although 2,000 or so will be lost from the workforce between now and 2030. Those remaining will be required to archive, administer and manage paper records still in storage and unlikely to ever be digitised.

Although 2,000 fewer support staff will be in post by 2030 compared to 2020, there will be around 1,800 more professional and managerial staff in the health records staff group. Managers will be required to oversee the health records function of NHS trusts and liaise with clinical departments to embed and realise the potential of electronic health record systems in the delivery of healthcare. The NHS digital transformation agenda will place greater emphasis on electronic health records and the importance of managing and ensuring the quality and accessibility of information. The focus will also be on making full and strategic use of information held by organisations in the delivery and planning of healthcare services. Enhancing the quality, accessibility and usage of health records will be dependent on the availability of professionally trained staff in records management, with the skills to operate in a digital environment. The access of patients to their records will become the norm by 2030 and this will make demands on professionals in the health records field. As explain by one participant in the demand-forecasting exercise:

> In particular, this group of people manage the leadership of patient portals, allowing patients more access and control over the information about them, enabling linkage with third party apps that help them through lifestyle change, medication adherence or communication.

Scenario B: Data Desert Future 2030

Projected demand forecast

The demand forecast for a Data Desert Future indicates that the health records staff group will need to:

- (Figure 6B.1) Reduce the number of staff by around 26 per cent between now and 2030, from its estimated current size of 12,600 WTEs to the forecasted required size of 9,400 WTEs.

- (Figure 6B.4) Reduce the number of support staff by around 26 per cent to 8,625 WTEs by 2030, and the number of professional staff by around 28 per cent to 620 WTEs. The number of staff in a management role will need to decrease by around nine per cent to 150 WTEs.

Figure 6B.4: Changes in staffing levels required in health records for a Data Desert Future

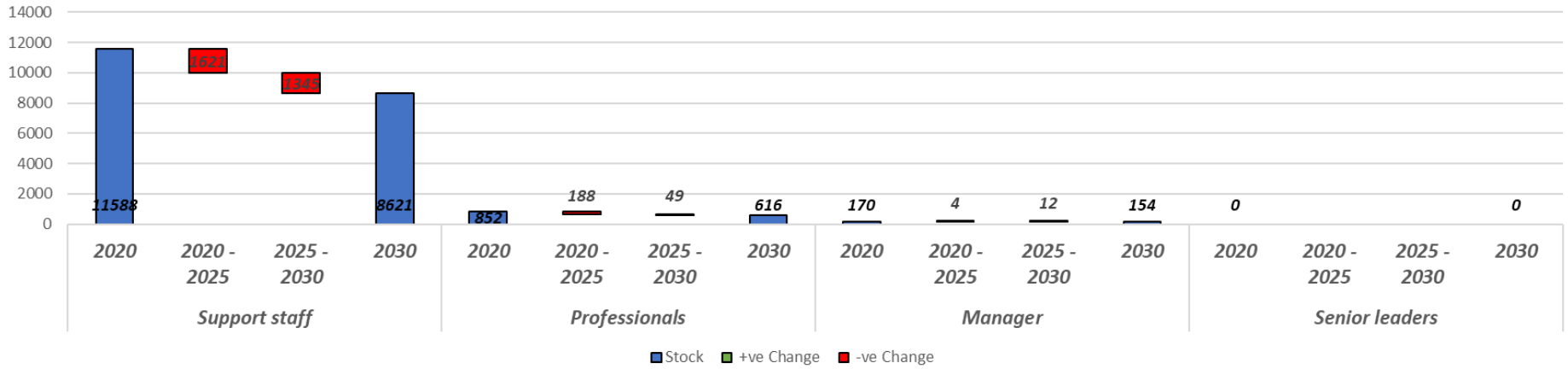
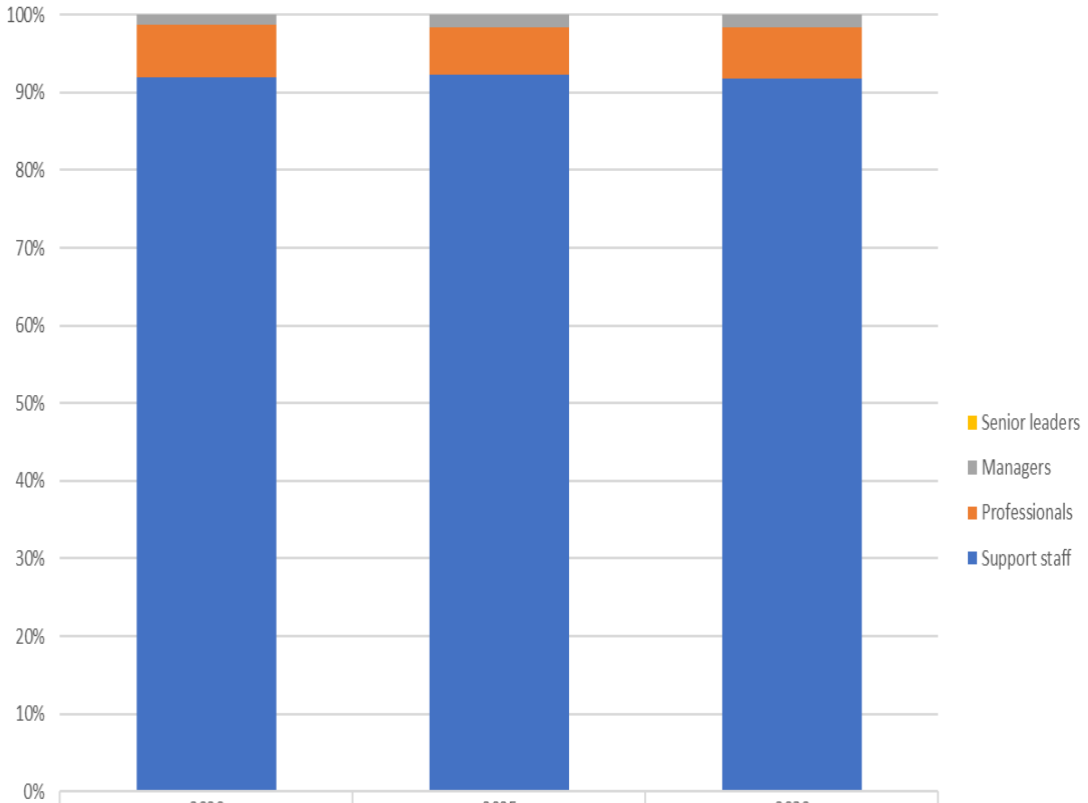


Figure 6B.5: Composition of the health records staff group leading up to and in a Data Desert Future



	2020	2025	2030
Senior leaders	0%	0%	0%
Managers	1%	2%	2%
Professionals	7%	6%	7%
Support staff	92%	92%	92%

- (Figure 6B.5) The proportion of those in support (92 per cent), professional (7 per cent) and managerial (2 per cent) roles will need to remain broadly the same between now and 2030.

Projected supply

The projected supply for the next 10 years indicates an increase of five per cent in the overall number of health records staff to around 13,200 WTEs by 2030 (Figure 6B.1). This means that in a Data Desert Future there will be a surplus of around 3,800 WTEs by 2030 in the absence of any policy interventions around redeployment, recruitment and retention.

Viewpoints of participants

The Data Desert Future will see a much-reduced workforce responsible for the health records function in NHS trusts, with the overall number of staff in 2030 being some 3,200 (or 26 per cent) fewer than seen in 2020. Numbers will decline for all levels of staff – support, professional and managerial. Financial constraints and the

need for cost savings will lead to NHS trusts making cuts to what many see as backroom staff, including those in a supporting and administrative health records role. Some supporting and administrative functions may be outsourced if cost savings and efficiency gains can be made.

Professional staff with training in records management will still be required in keeping a predominantly paper-based system running, although in slightly reduced numbers than seen in 2020. The decline in the number of professional staff might be offset by productivity gains due to the introduction of small-scale technology such as radio-frequency identification (RFID) in the management of health records. Investment will not be made available for large-scale change projects. There will be only a limited introduction of electronic health records and systems, and much less priority given to data sharing. This will lessen the need for digital skills in record managers but their skills in working with paper-based systems will still be required.

The number of managerial staff in health records in 2030 will be the same as in 2020. These managers will be required to focus on providing a cost-efficient health records function and making cost savings where possible. This will be challenging, as demand for healthcare is likely to increase in a Data Desert Future, and therefore more clinical notes and health information will be in circulation in NHS trusts. An additional challenge for managers will be to provide a health records function without having the best digital tools and systems available to them.

Priorities for the health records staff group – 2020 to 2030

Those taking part in the demand forecasting exercise provided an indication of the priorities that will be placed on the health records staff group over the next 10 years. These priorities are particularly relevant in a Data Driven Future. The suggestions made correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

Health records management in a digital environment

The increasing application of digital technology will change the skills required from the health records staff group and how their skills will be applied. Making patient records secure and controlling access to information, for example, will be a priority in an online environment. Record managers will need to work with those in IT governance and IT development to ensure that systems are secure, and access is controlled. NHS trusts also have a responsibility to support the interoperability of information systems and can do this by customising their electronic health records and systems, and making sure interoperability standards are applied through the use, for example, of a patient's NHS number[16]. Some of this responsibility will fall to those working directly with health records.

A digitised NHS is about making data contained in health and patient records available online, to inform individuals involved in clinical and health service planning activities. This presents challenges for record managers in a digital environment. The formatting of health records will need to be considered when they are used across multiple systems and devices, and as these systems are upgraded over time. Using

metadata (data fields allowing for standardised ways to describe information) will help structure, organise and retrieve information held in records on different electronic systems. Records of healthcare activity are often held in different systems of an NHS trust and will need to be linked to provide clinicians with comprehensive information about a patient or situation. These linkages will require skilled staff to apply appropriate metadata and data standards when structuring information contained in health records.

Digital transformation in health records management

Electronic health and patient record systems are seen as the foundation to a digitised NHS. Trusts have the option of procuring a commercial system, developing a system in-house, or developing an existing system or systems and integrating them using interoperability standards. Good leadership and management will be required to implement a trust's preferred option. This is important as it has been noted that many systems in the NHS have been poorly designed, leading to duplication of work and additional time required on basic administrative tasks in managing patient records[16]. Record management staff should be involved in the implementation process and subsequent system upgrades, and will need to work closely with those in IT strategy and development and ICT in developing electronic solutions for their organisation.

Supporting developments in machine learning and artificial intelligence

The completeness and accuracy of information held in electronic health and patient records is also important for realising the potential of machine learning and AI in healthcare. Specialists involved in developing AI technology require access to large sets of health data held in patient records, but the outputs of AI run the risk of being biased or skewed if the data is incomplete or inaccurate[40]. The success of AI is therefore partly dependent on the work of those in health records management. Health data is diverse and at times ambiguous, and data curation skills are needed for record managers to standardise and improve the quality of information held in patient records for machine learning purposes. The Academy of Medical Royal Colleges has called for radical improvement in the quality and extent of health data for AI to make an impact in healthcare[19].

Integrating genomic data into electronic health records

Full genome sequences seem likely to become part of routine electronic health and patient records, especially if personalised medicine and preventive health emerges as a major area of activity in the NHS. Those working in the area of health records and information management will need to consider how genomic data can be incorporated into health records and integrated with other types of clinical data.

Job roles and skills

Those taking part in the demand-forecasting exercise provided an indication of job roles and skills required in health records management by NHS organisations in the next 10 years leading up to 2030. These requirements are particularly applicable in a

Data Driven Future. The suggestions made as to these job roles and skills correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

In-demand, emerging and new job roles

The composition of the health records staff group in terms of job roles and skills required will be quite different in 2030 compared to what is seen today. Some existing job roles and skills may be made redundant by advances in technology such as AI or superseded by new roles and skills as the result of digital or organisational transformation of NHS trusts. Based on an analysis of reports in this area, in-demand, emerging and new job roles are identified in Table 6B.1. Some of these job roles will also be found in other areas of the digital technology and informatics workforce in 2030.

Table 6B.1: In-demand, emerging and new job roles in clinical coding in a Data Driven Future – summary of roles and skills required and links to further information

Job role	Summary of role and skills required	Job role – link	Skills – link
Electronic health record supervisor, auditor and manager (practitioner, senior practitioner and advanced practitioner).	Electronic health records managers are responsible for the accuracy, completeness, confidentiality and security of all healthcare information. Core, IT and coding skills are required, as well as specific digital skills in cloud engineering, mobile technology, AI-assisted technologies, and knowledge of application and integration of genomic data into electronic health records.		DHCI Tech Nation

Investment in health records

The demand-forecasting exercise and a review of reports on digital technology in healthcare have highlighted areas where investment is needed over the next 10 years in developing the capacity and capability of health records staff in the NHS. Investment in these areas is particularly required in a Data Driven Future.

Training and continuing professional development

NHSX has recently published a records management code of practice that provides a framework for the knowledge that staff need generally, such as regulations around patient data, and the skills required in a digital environment[44]. Realising the potential of electronic patient records and their strategic use in the delivery of healthcare will, in part, require training of record managers to broaden their skills and take on specialist roles. This observation has been made internationally in other health systems. A study of information and records management staff in Canada identified

new job roles emerging in this sector, including e-health architects and e-health strategy developers[41]. In the United States, legislation around electronic health records has made provision for a more skilled workforce to enable adoption of this technology[45]. The health records staff group will need to understand the principles of machine learning and AI if they are to contribute to its development. Investment is required in their training and CPD in this area. Investment is also required to equip those working in information and records management with data curation skills, so that patient records are complete, accurate and made useful for AI and machine learning purposes.

Salary and employment on-costs

The current salary and employment on-costs for the health records staff group of 12,600 WTEs in 2020 are estimated to be around £411 million. If the number of staff falls to 12,325 WTEs, as projected in the demand forecast for the Data Driven Future scenario, the costs will be in the region of £524 million in 2030 (Figure 6B.6). These calculations are based on a mean salary pay point corresponding to the top of NHS Agenda for Change band 4, and the assumption that salaries will increase by 2.7 per cent per annum, and employment on-costs at 34.9 per cent (21 per cent for the NHS pension and 13.9 per cent National Insurance contribution). The projected salary and employment on-costs for a Data Driven Future does not factor in any changes by job level to the composition of the staff group. Therefore, the figure of £524 million should be regarded as the minimum estimate for 2030. It is worth contrasting the figure of £524 million with the £536 million (baseline costs) that represents the salary and employment on-costs of a workforce remaining at 12,600 WTEs in 2030.

Figure 6B.6: Change in salary and employment on-costs in a Data Driven Future for the health records staff group

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost (Millons)	£411	£412	£420	£429	£437	£446	£461	£476	£491	£507	£524
Baseline Cost (Millons)	£411	£422	£433	£445	£457	£469	£482	£495	£509	£522	£536

6C. Information management

Requirements in the NHS

The increasing application of digital and medical technologies in healthcare is creating ever-greater volumes of health and administrative data and at an ever-increasing pace. The term big data is now commonly used to describe the volume and dynamism of data and its potential impact on healthcare. Data, which could be in the form of numerical or textual information, images or audiovisual materials, needs to be managed so it can be used in making improvements to the clinical, administrative and business functions of health services, to increase their efficiency and productivity. This secondary use of data in this sense is dependent on NHS trusts having the appropriate data architecture and information governance structures in place. Designing, building and maintaining these structures will fall into the remit of those working in information management. These staff members could be in a variety of specialist roles, such as data and enterprise architects, information analysts, database managers, data warehouse developers and information governance officers.

Data architecture is the standards, tools and infrastructure used in collecting, storing and making further use of information. It also takes into account the skills and capabilities of staff working in the area of information management, and in particular the skills needed to enhance data and information through the maintenance and application of appropriate standards such as SNOMED-CT and ICD-10. For this reason, those in the information management staff group may also have a role in clinical coding and managing health records, and vice-versa. The use of data standards to structure and code data is required for the interoperability of information systems, which is one of the foundations of a digitised NHS.

Information governance is the way organisations efficiently and effectively manage and safeguard processes around the collection, security, integrity, usage and sharing of healthcare and patient information. It takes into account the regulations and protocols around data protection and patient confidentiality. Meeting the statutory regulations and protocols governing healthcare and patient data and information is a given for any NHS trust, and often falls into the remit of information management staff – especially those with an information governance role. Increasing emphasis is also being placed on information governance to be a proactive enabler and facilitator of secondary usage of patient data. This is important for a data-driven NHS, and also for medical research and the development of newer technologies such as machine learning and AI.

The establishment of the right data architecture and information governance structure is important in delivering information to clinicians at the right time and in the right place. These structures are also required if machine learning and AI-enabled technology are to be widely introduced in healthcare. Wearable sensors and Internet of Things devices used by patients will result in streams of coded data being sent in real time to healthcare providers for algorithms to monitor and process. The data streams will be continuous, requiring a different type of data architecture and information governance structure from those applying to time-based episodes of

Figure 6C.1: Supply projection and demand forecasts for information management staff in a Data Driven Future and Data Desert Future – 2020/21 to 2029/30

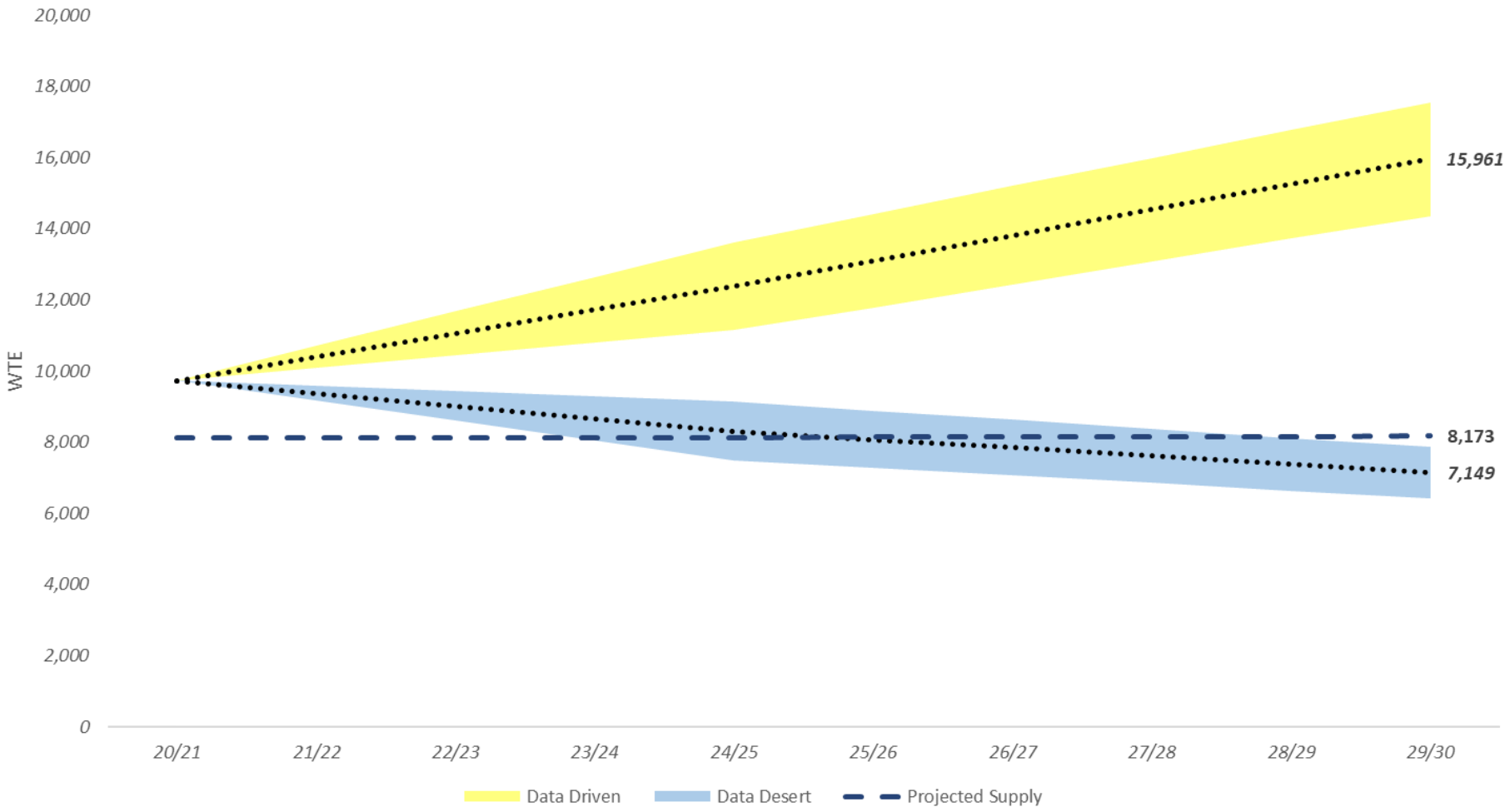
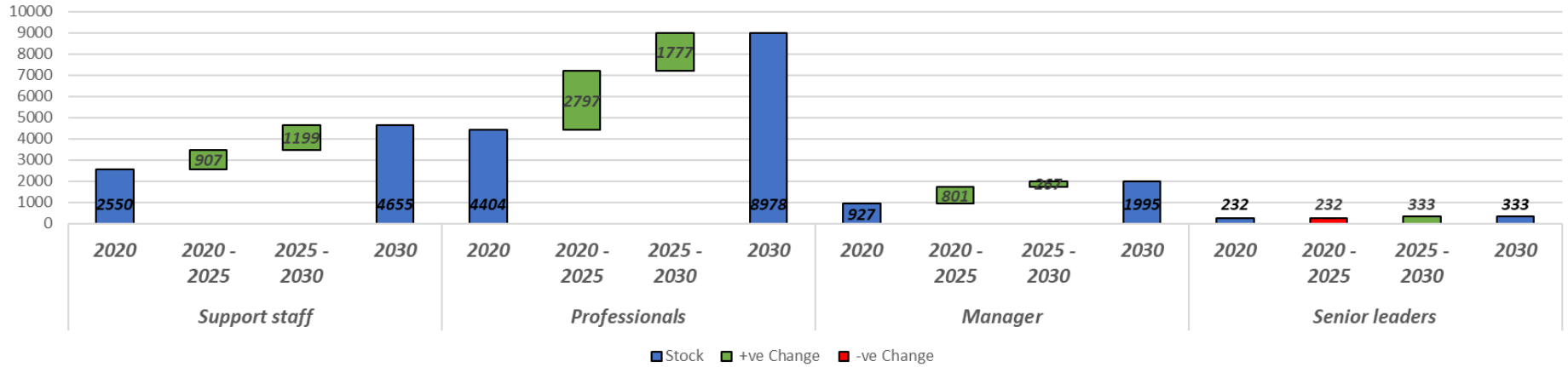


Figure 6C.2: Changes in staffing levels required in information management for a Data Driven Future



care[40]. Health information management staff will need to have a role in establishing these structures.

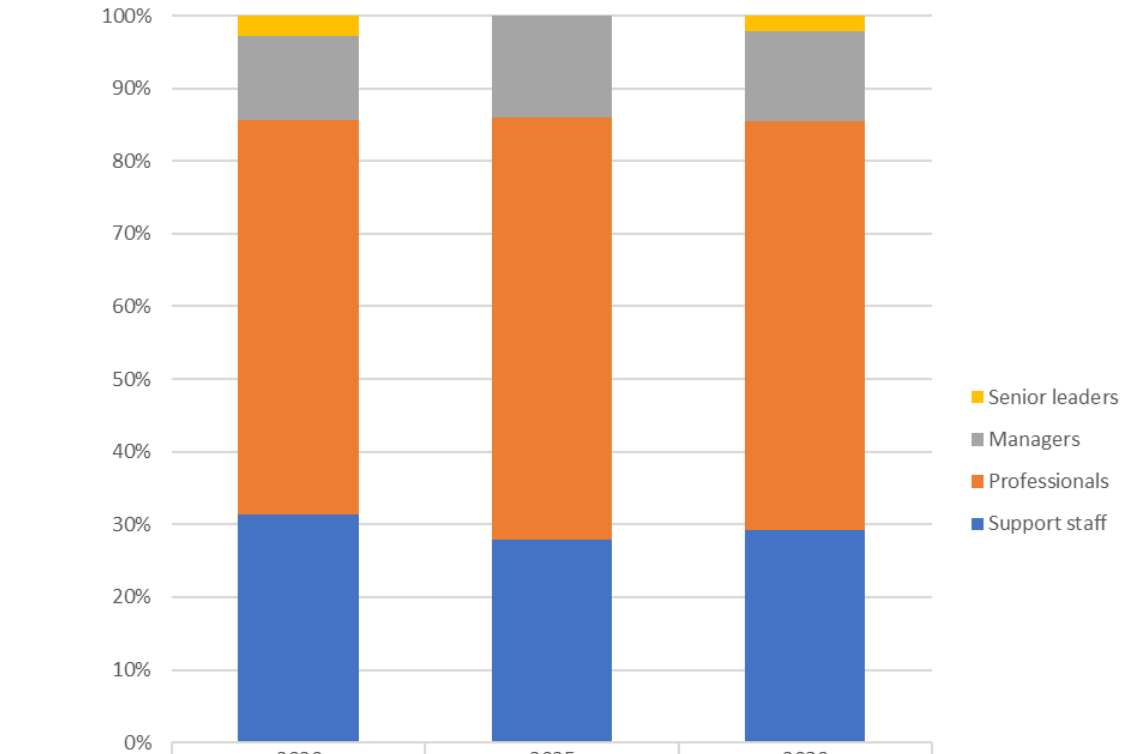
Scenario A: Data Driven Future 2030

Projected demand forecast

The demand forecast for a Data Driven Future indicates that the information management staff group will need to:

- (Figure 6C.1) Increase the overall number of staff by around 97 per cent between now and 2030, from its estimated current size of 8,125 WTEs to the forecasted required size of 15,950 WTEs.
- (Figure 6C.2) Increase the number of support staff by around 83 per cent to 4,650 WTEs by 2030, and the number of professional staff by around 104 per cent to 8,975 WTEs. The number of staff in a managerial role will need to increase by around 115 per cent to 2,000 WTEs and senior leaders by around 44 per cent to 330 WTEs.

Figure 6C.3: Composition of the information management staff group leading up to and in a Data Driven Future



	2020	2025	2030
Senior leaders	3%	0%	2%
Managers	11%	14%	13%
Professionals	54%	58%	56%
Support staff	31%	28%	29%

- (Figure 6C.3) The composition of this staff group in terms of the proportion of individuals in support (29 per cent), professional (56 per cent), managerial (13 per cent) and leadership (2 per cent) roles will need to remain broadly the same between now and 2030.

Projected supply

The projected supply for the next 10 years indicates a small increase of one per cent in the overall number of information management staff to around 8,175 WTEs by 2030 (Figure 6C.1). This means that in a Data Driven Future there will be a shortfall of around 7,800 WTEs by 2030, in the absence of any policy interventions and required investments made in the areas of building capacity, training and CPD, or recruitment and retention in the next 10 years.

Viewpoints of participants

The forecasted capacity and increases required in the information management staff group over the next 10 years reflects the need for their data architecture and information governance skills to underpin the digital transformation and data-driven ambitions of the NHS. This is the view of those taking part in the demand-forecasting exercise in the context of the Data Driven Future. As explained by one participant:

I have increased the information management requirement as over time I think the requirement for health records in this trust will be less, but the design and build of organisational data and analytical infrastructure requires more investment in terms of personnel.

Participants were also keen to highlight the changes in skillsets required from professional information management staff in the next 10 years. Skills will be needed for roles that will be more granular or intricate, and focussed on a specialist practice domain such as data protection, or an area of technology such as AI and machine learning. This is one of the main employment effects of digital and organisational transformation on the information management staff group.

Electronic data and information are seen as becoming the lifeblood of NHS organisations, with dedicated teams created to make sure clinical services are data-led while exploiting and effectively utilising the vast amount of data that has become available. Data will become more accessible and be shared more widely with external NHS partners thanks to a high level of interoperability of information systems and reduced single points of failure. The establishment and standardisation of data architecture and information governance structures in NHS trusts will, in part, make this possible.

Creating and sitting within these structures will be information management specialists such as the senior information risk owner (SIRO), Caldecott Guardian, data protection officer, and those involved in risk awareness and negotiating data-sharing agreements and contracts. More professionals and managers with relevant qualifications are needed to provide support in various areas, such as data protection impact assessments, recording of processing activities, and internal and

external data-sharing arrangements including with universities for medical research purposes. Some of these staff members will need to broaden their skillset to provide education and training, or to help raise awareness within NHS trusts of the importance of data protection regulations and protocols. Providing a corporate information management function for the organisation was seen by one participant as the key to the future of the information management staff group.

There will also be a significant shift over the next 10 years to real-time data flows and usage, allowing for predictive and prescriptive analytics in supporting the decision-making of clinicians. Enabling this shift will require support from technical specialists in the information management team, as suggested by one participant:

> Greater specialism around major clinical and operational systems. Integration and enterprise architects in order to facilitate data-sharing across the organisation and health-public service system. Increased focus on data protection compliance, solution design and cyber security – increased complexity in this space.

It was highlighted that staff in managerial or leadership roles will be needed if information management functions are to underpin the digital and data transformation of NHS trusts. One participant described a long-term information management strategy in his or her trust to facilitate the integration of services across healthcare providers in the local area:

> With integrated healthcare and the expansion of services (planned and urgent care) to meet demand, there will be an extensive increase in skills required for data management and information analysis. In the five-year plan, a drive to have more technical solutions through automated BI tools, which we are currently implementing and will need strong technical leadership (1 WTE manager). With integrated care becoming our business, we will provide advanced analytical support across the [named] health system as well, adding 1 WTE manager. With the model of driving automation and value-added analysis already in place, we will consolidate in this in the next five years (so no change to 2030). The difference in the 10-year plan is bringing data from other IT systems from across the trust and healthcare system together into the centralised data warehouse and information team (3 WTE professionals), and potentially having fewer lower-level professionals and more higher levels, equating to the same WTE, but movement within this job level.

Scenario B: Data Desert Future 2030

Projected demand forecast

The demand forecast for a Data Desert Future indicates that the information management staff group will need to:

- (Figure 6C.1) Reduce the number of staff by around 12 per cent between now and 2030, from its estimated current size of 8,125 WTEs to the forecasted required size of 7,150 WTEs.

- (Figure 6C.4) Reduce the number of support staff by around three per cent to 2,475 WTEs by 2030, and the number of professional staff by around 10 per cent to 3,950 WTEs. The number of staff in a management role will need to decrease by around 20 per cent to 750 WTEs. No senior leadership roles were forecasted to be required after 2025 in this staff group.

- (Figure E6.5) Slight adjustments to the composition of the information management staff group will need to be made by 2030 to compensate for the absence of senior leaders. However, the proportion of those in support (34 per cent), professional (55 per cent) and managerial (10 per cent) roles will need to remain broadly the same between now and 2030.

Projected supply

The projected supply for the next 10 years indicates a small increase of one per cent in the overall number of information management staff to around 8,175 WTEs by 2030 (Figure 6C.1). This means that in a Data Desert Future there will be a surplus of around 1,000 WTEs by 2030, in the absence of any policy interventions around redeployment, recruitment and retention.

Viewpoints of participants

The financial constraints of a Data Desert Future will see limited investments made in digital and medical technologies, and a drive towards cost reductions in terms of staffing. Participants in the demand-forecasting exercise still saw the need for information management staff because technology, though perhaps not the most up-to-date, will continue to have an important role in the delivery of health services along with data. Monitoring, adherence and validation of data and information standards, for example, will still need to be undertaken, albeit manually and with limited support from technology. In these circumstances, support staff will be needed but there will be less demand for staff in professional and managerial roles, while staff in leadership positions will not be required. Clinicians will increasingly be expected to take on tasks ensuring the quality of data being entered into information systems, and this may take them away from their patient-facing clinical duties.

Another viewpoint expressed by participants in the demand-forecasting exercise is that investments made in technology and data, and information management staff, will drive efficiency and productivity gains in the NHS. This is particularly important in a financially constrained Data Desert Future. However, NHS information management functions themselves must become more efficient and productive.

Figure 6C.4: Changes in staffing levels required in information management for a Data Desert Future

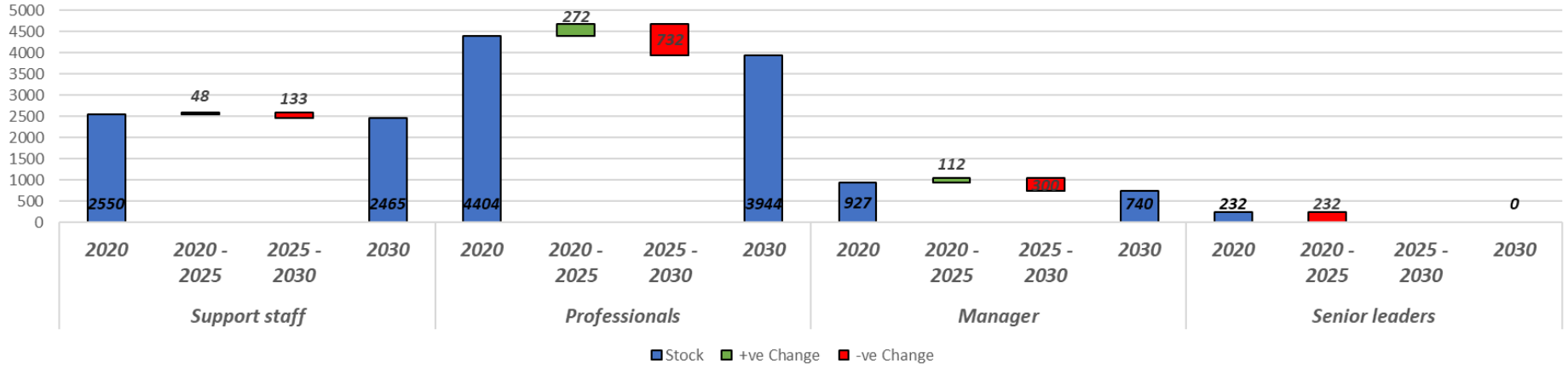
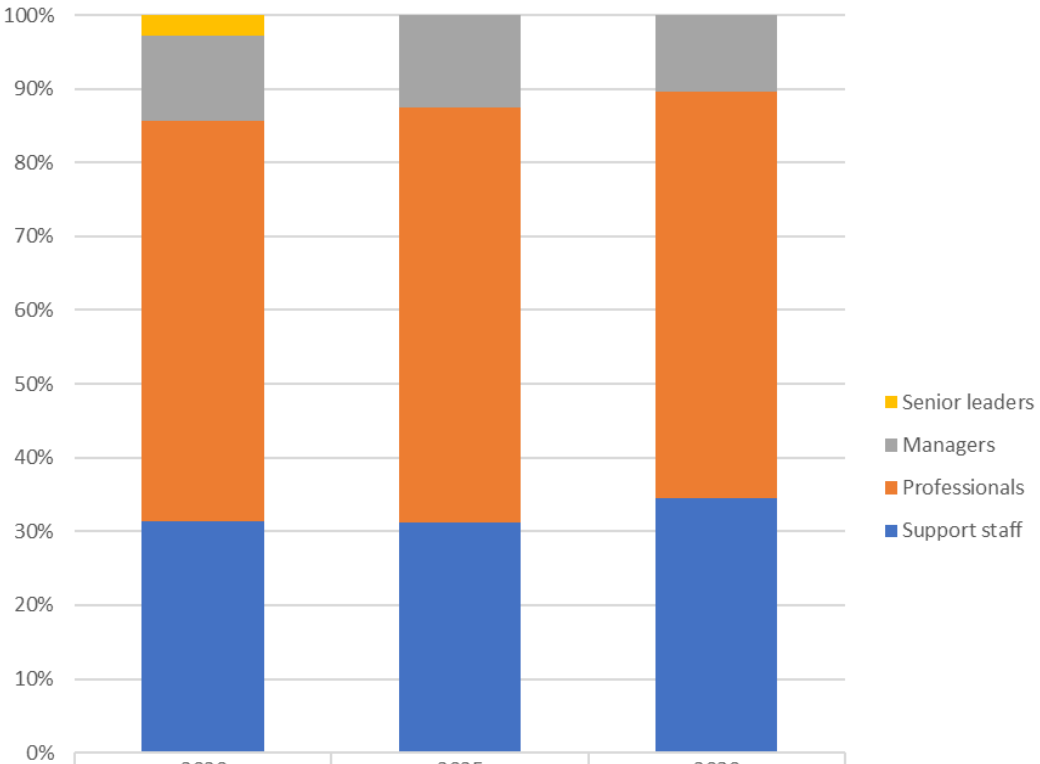


Figure 6C.5: Composition of the information management staff group leading up to and in a Data Desert Future



	2020	2025	2030
Senior leaders	3%	0%	0%
Managers	11%	13%	10%
Professionals	54%	56%	55%
Support staff	31%	31%	34%

Some of these functions undertaken across different NHS trusts, such as standardised reporting, will be merged and provided centrally, and this will reduce the number of staff needed overall. However, the centralisation of these functions depends on resolving issues around information governance and finding the necessary investment to harmonise information systems across different trusts.

Priorities for the information management staff group – 2020 to 2030

Those taking part in the demand-forecasting exercise provided an indication of the priorities that will be placed on the information management staff group over the next 10 years. These priorities are particularly relevant in a Data Driven Future. The suggestions made correspond with those found in reports looking at the future of digital technology and informatics in health services, nationally and internationally.

Protecting and securing data, information, and systems

As the NHS becomes more digitised, information management staff will be expected to have a good understanding of online security issues and work with cybersecurity

staff to ensure measures are in place to protect data, information and systems from unwarranted access or disclosure. Cyber-attacks and malware, if undetected, can seriously corrupt or compromise information held in electronic health and patient records. Organisations accessing or handling NHS patient data must be compliant with statutory and regulatory requirements relating to cyber security and protocols set out in the NHS Data Security and Protection Toolkit[46].

Enabling secondary use of patient data

Information management and governance structures will need to enable and facilitate the secondary use of patient data and information in a Data Driven Future. The ability to use volumes of data, including in real time, is vital to the work of clinicians, data analysts and data scientists, yet access is often restricted due to issues around data protection and patient confidentiality. A recent survey of healthcare organisations, undertaken by the National Data Guardian for Health and Social Care, identified legal and regulatory complexity relating to breach of confidentiality in the onward use of patient data. Concerns over this complexity represent some of the main barriers to the sharing of information to support the direct care of individuals[47]. Patients can elect to opt out from having their data used in this way and this may happen if they perceive that information held on them is not being securely or responsibly handled, or is being shared in unregulated ways. Awareness about collecting patient data online and its secondary usage has been heightened in the media during the Covid-19 pandemic, including concerns about security and whether controls are in place that comply with relevant regulations and protocols. Information management and governance professionals therefore have a crucial role in putting appropriate structures and mechanisms in place to protect patient data and confidentiality, reassure patients, and at the same time enable and facilitate timely access to information needed by clinicians, data analysts and data scientists.

Managing data-sharing arrangements

Access to volumes of patient data and information held in NHS trusts is vital for the work of medical researchers in universities, and the development of pharmaceutical and medical device products by commercial bodies. Data held by the NHS is also important for the development of machine learning and AI applications, and much of this is occurring in the university and commercial sectors. The General Data Protection Regulation (GDPR), as well as protecting data, makes legal provision for organisations to share data but this requires policies and processes to be put into place. Making data available externally could be done through data-sharing agreements. These describe the data flows and how these flows should be managed by parties to the agreement. University and commercial bodies, in seeking access to patient-level data, often find the NHS a complex organisation with which to negotiate such an agreement. Information management and governance professionals could be the main point of contact in NHS trusts when negotiating a data-sharing agreement. These agreements can be complicated to negotiate as they need to identify what information is necessary and for what purpose, and they need to uphold the principles of data protection. Expertise and time are required from information governance professionals to negotiate these agreements and update them should new data requests be made. The successful outcome of any agreement is based on

the willingness of NHS organisations to share data and the establishment of good working relationships between the parties.

Supporting the application of digital and medical technologies

The application of digital and medical technologies will have practical implications for those managing data and information. Information governance structures will need to evolve to facilitate the development of machine learning and AI technologies. New policies and processes will need to be put into place by information management and information governance professionals around the flow and processing of data. These professionals may also have a role overseeing the application of AI through monitoring data that is being processed and the outputs for bias and quality. Biased outputs may result from skewed data being used during the machine learning stage in the development of AI algorithms. Raising questions from a governance point of view about the quality of data and how it is being processed will be an important contribution from those with an information management background. There is also an organisational responsibility to explain how decisions with AI technology are being made. This, again, may be taken on by information management staff. The GDPR, as it applies in the UK, gives certain rights to people whose personal data are being used, including the right to know the logic in decisions that affect them personally and that have been automated. Demonstrating this transparency and explaining AI-driven decisions is challenging, and training in this area will be required, possibly working alongside the developers expected to explain the algorithms used in AI-based applications[48] and make them transparent.

Job roles and skills

Those taking part in the demand-forecasting exercise provided an indication of information management job roles and skills required in NHS organisations in the 10 years leading up to 2030. These requirements are particularly applicable in a Data Driven Future. The suggestions made as to these job roles and skills correspond with those found in reports looking at the future of digital technology and informatics in health services, nationally and internationally.

In-demand, emerging and new job roles

The composition of the information management staff group in terms of job roles and skills required will be quite different in 2030 compared to what is seen today. Some existing job roles and skills may be made redundant by advances in technology, such as AI, or superseded by new roles and skills as the result of digital or organisational transformation of NHS trusts. Based on an analysis of reports in this area, in-demand, emerging and new job roles are identified in Table 6C.1. Some of these job roles will also be found in other areas of the digital technology and informatics workforce in 2030.

Table 6C.1: In-demand, emerging and new job roles in information management in a Data Driven Future – summary of roles and skills required and links to further information

Job role	Summary of role and skills required	Job role – link	Skills – link
Data engineer (practitioner, senior practitioner and advanced practitioner)	Core skills and emphasis on IT and computer coding skills. A data engineer develops and constructs data products and services and integrates them into systems and business processes.	GDS DDaT	DHCI
Performance analyst (practitioner, senior practitioner and advanced practitioner)	Core skills and emphasis on IT and computer coding skills. Develops performance measurement frameworks – key performance indicators, goals, user needs and benefits – and analyses the performance of a service or product against these, adapting the approach and framework appropriately and in line with any changes.	GDS DDaT	DHCI
Business analyst (practitioner, senior practitioner and advanced practitioner)	Core skills and emphasis on IT and computer coding skills. Business analysts understand and analyse user and business needs.	GDS DDaT	DHCI
AI and machine learning engineer (senior practitioner and advanced practitioner) aka knowledge engineer	Emerging, new role. Core skills and emphasis on IT and computer coding skills, and domain knowledge and emotional intelligence. Translate explicit and tacit knowledge into tools and products that support decision-makers in health and care. Following industry trends, these roles are increasingly focusing on creating models and algorithms based on validated knowledge to inform decision-making. Working as a knowledge engineer requires a degree, ideally postgraduate level, and relevant work experience, for example as a data scientist, information and data analyst, digital archivist, or business analyst, to hone analytical skills.		DHCI

Robotics specialists and engineer (senior practitioner and advanced practitioner)	Emerging, new role. Core skills and emphasis on IT and computer coding skills, and domain knowledge and emotional intelligence. Translate explicit and tacit knowledge into tools and products that support decision-makers in health and care. Following industry trends, these roles are increasingly focusing on creating models and algorithms based on validated knowledge to inform decision-making.		DHCI
Chief data officer (leading practitioner)	Core skills and emphasis on IT and computer coding skills, and domain knowledge and emotional intelligence.		DHCI

Investment in information management

The demand-forecasting exercise and a review of reports on digital technology in healthcare have highlighted areas where investment is needed over the next 10 years to develop the capacity and capability of information management staff in the NHS. These areas of investment are particularly required in a Data Driven Future.

Training and continuing professional development

The majority of the information management staff group are in a professional role, and skills and responsibilities will need to expand with the move away from paper-based systems and the increasing application of digital technology, including electronic health and patient records. Many will be required to take on more specialist roles, establishing and maintaining the necessary data architecture and information governance structures in their organisation. This will require investment in the training and CPD of these professionals.

Recruitment and retention

Those in the information management staff group will have extensive knowledge of health and patient data and information, and this could be leveraged to advance their careers into other technology and informatics-related areas within the NHS. Leading and managing the data analytical and clinical informatics function of an organisation is one such example. Data analytics is seen as a growth area in the NHS, and professionals with experience of health information and data management will be well placed to enter the analytical field.

Salary and employment on-costs

The current salary and employment on-costs for the information management staff group of 8,125 WTEs is estimated to be around £335 million. If the number of staff increases to 15,950 WTEs, as projected in the demand forecast for the Data Driven Future scenario, the costs will be in the region of £860 million in 2030 (Figure 6C.6). These calculations are based on a mean salary pay point corresponding to the top of NHS Agenda for Change band 5 and the assumption that salaries will increase by 2.7 per cent per annum, and employment on-cost at 34.9 per cent (21 per cent for the NHS pension and 13.9 per cent National Insurance contribution). The projected salary and employment on-costs for a Data Driven Future does not factor in any changes by job level to the composition of the staff group. Therefore, the figure of £860 million should be regarded as the minimum estimate for 2030. It is worth contrasting the figure of £860 million with the £437 million (baseline costs) that represents the salary and employment on-costs of a workforce remaining at 8,125 WTEs in 2030.

Figure 6C.6: Change in salary and employment on-costs in a Data Driven Future for the information management staff group

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost (Millons)	£335	£413	£453	£495	£539	£584	£635	£688	£743	£800	£860
Baseline Cost (Millons)	£335	£344	£353	£363	£373	£383	£393	£404	£415	£426	£437

6D. Information and communications technology

Requirements in the NHS

Digital transformation in the NHS will have a significant employment effect on the information communications technology (ICT) staff group. This effect will be around meeting the digital technology implementation and operational requirements of NHS trusts. The implementation requirements will involve ICT staff in the design, development and introduction of new technical infrastructure and digital solutions, products, and information systems. This will include ensuring their interoperability, and working with IT strategy staff and IT programme and project managers to plan for and manage the resulting change in clinical and organisational processes. The operational requirements need ICT staff members whose core responsibility is to manage, support, maintain and upgrade the technical infrastructure and digital products that are in place, and ensure the continuing interoperability of systems.

In terms of implementation, requirements over the next 10 years or so will be shaped by the increasing integration within healthcare of cloud computing and mobile, telehealth, and AI technologies. The move to cloud computing, including the NHS Spine, is likely to be a significant technical challenge for ICT staff, but meeting it will enable and facilitate the sharing of data and the development of mobile technologies and associated software, including apps, for remote working and virtual clinician-patient interactions. Digital technology can facilitate virtual consultations between clinicians and patients through, for example, online video conferencing platforms. The need for and rapid adoption of such platforms has been noticeable in the NHS response to the Covid-19 pandemic. This type of technology also allows for clinicians in different locations to connect with each other and share their expertise. Diagnostic images, for example, could be widely shared online among radiologists and oncologists for expert clinical interpretation or discussion in virtual multidisciplinary team meetings. Implementation of digital technology will also require ICT staff to work with commercial suppliers. Commercial IT companies already have a substantial role in the NHS, providing digital products and systems, cybersecurity, quality assurance services, testing of information systems and development of IT infrastructure. Their role is expected to continue and will possibly expand in the next 10 years or so, especially in areas such as healthcare AI.

There are several digital technology operational requirements for ICT staff. Providing service-desk or help-desk support and end-user support to clinicians is one requirement, while others include maintaining technical infrastructure and data warehouses, ensuring ongoing technical interoperability of systems, and so on. For technology to be successful in the NHS, it needs adequate support and modern IT infrastructure. One operational requirement that is becoming increasingly important is around cybersecurity. Digital transformation in the NHS will not diminish the risk of unwarranted access to systems. Protecting IT systems and data contained within them is one of the top security concerns for NHS trusts[16]. Concerns about cyber-attacks and malware have been heightened by the WannaCry cyber-attack in 2017, which led to 19,000 patient appointments being cancelled in the NHS. A review in

2019, led by Lord Darzi, on improving cybersecurity in the NHS recommended that the organisation require the delivery of annual mandatory training in cybersecurity awareness and seek to embed a security culture across all organisations and staff, building upon current training modules that staff in the NHS are required to undertake[49].

Ensuring interoperability of information systems is an implementation requirement as well as an operational one. Technical challenges around interoperability and issues of data standards must both be addressed if a data-driven NHS and the potential of AI in healthcare are to be realised. Different commercial suppliers making a range of IT systems available will require ICT staff in an NHS trust to develop technical solutions, including application programming interfaces (APIs) to make these systems interact. It is also about ensuring that the technology procured can operate with other systems external to an organisation. Radiology information systems (RIS) and picture archiving and communication systems (PACS), for example, are developed by different commercial suppliers and this has limited the seamless sharing of diagnostic images across different NHS trusts[50]. Technical standards developed by the Royal College of Radiologists specify what trusts should demand from suppliers so that all radiology systems can function in the teleradiology environment in a vendor-neutral way[51].

Scenario A: Data Driven Future 2030

Projected demand forecast

The demand forecast for a Data Driven Future indicates that the ICT staff group will need to:

- (Figure 6D.1) Increase the overall number of staff by around 34 per cent between now and 2030, from its estimated current size of 16,400 WTEs to the forecasted required size of 21,975 WTEs.

- (Figure 6D.2) Increase the number of support staff by around 41 per cent to 5,925 WTEs by 2030 and the number of professional staff by around 37 per cent to 13,825 WTEs. There will also need to be a 10 per cent increase in the number of managers, to 1,975 WTEs, and senior leaders, to 250 WTEs, in the ICT staff group.

- (Figure 6D.3) The composition of this staff group in terms of the proportion of individuals in support (27 per cent), professional (63 per cent), managerial (9 per cent) and leadership (1 per cent) roles will need to remain broadly the same between now and 2030.

Figure 6D.1: Supply projection and demand forecasts for ICT staff in a Data Driven Future and Data Desert Future – 2020/21 to 2029/30

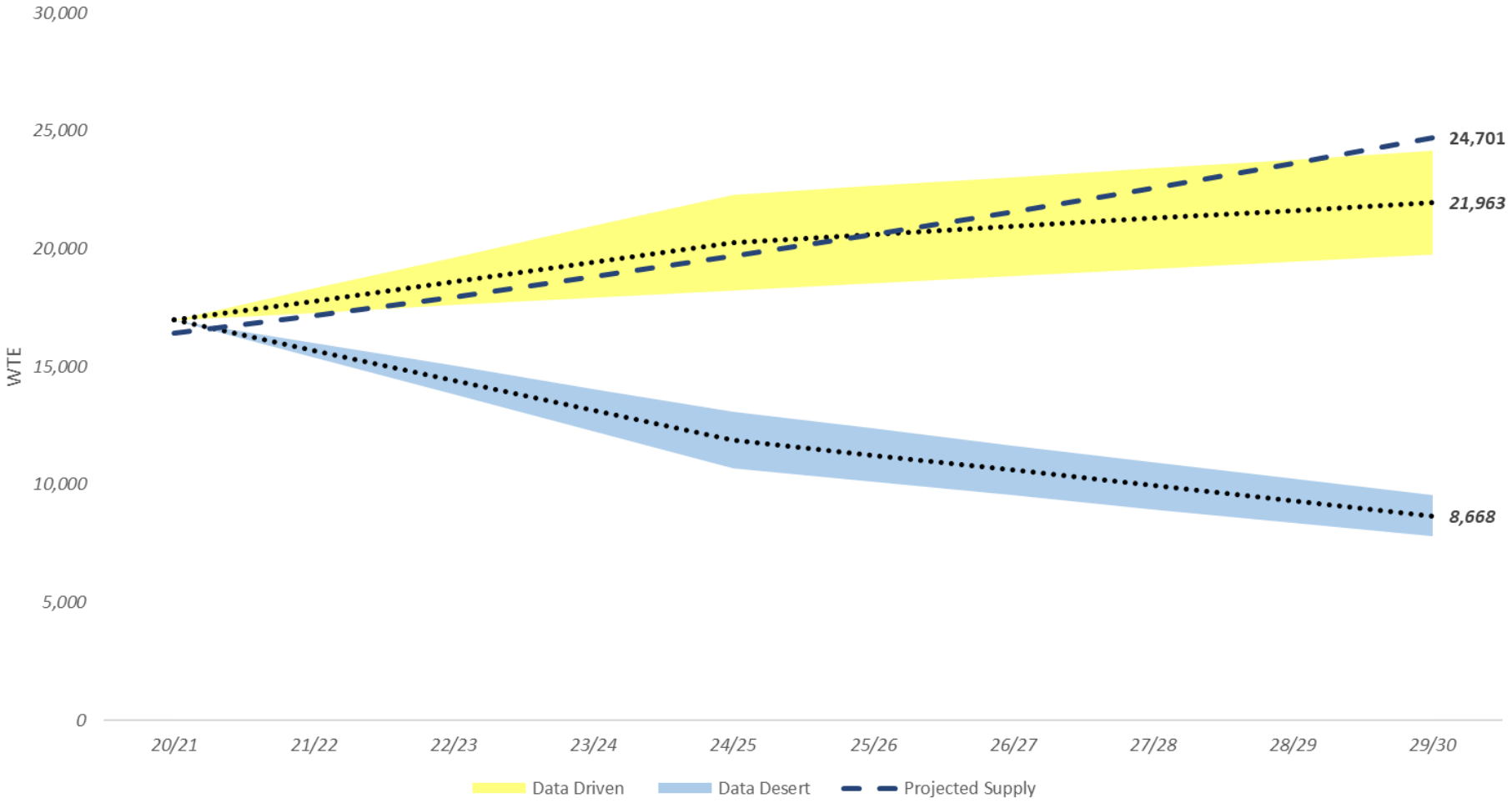


Figure 6D.2: Changes in staffing levels required in ICT for a Data Driven Future

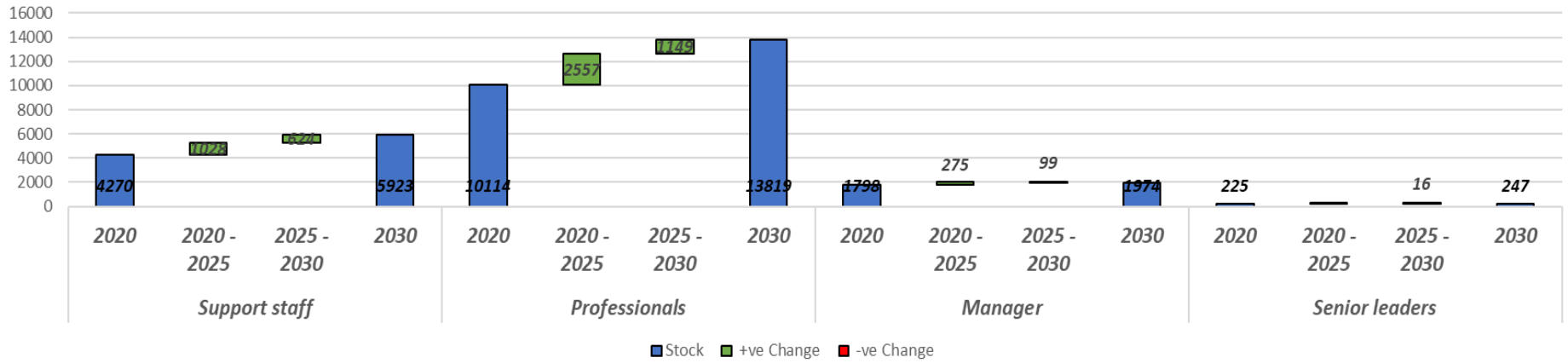
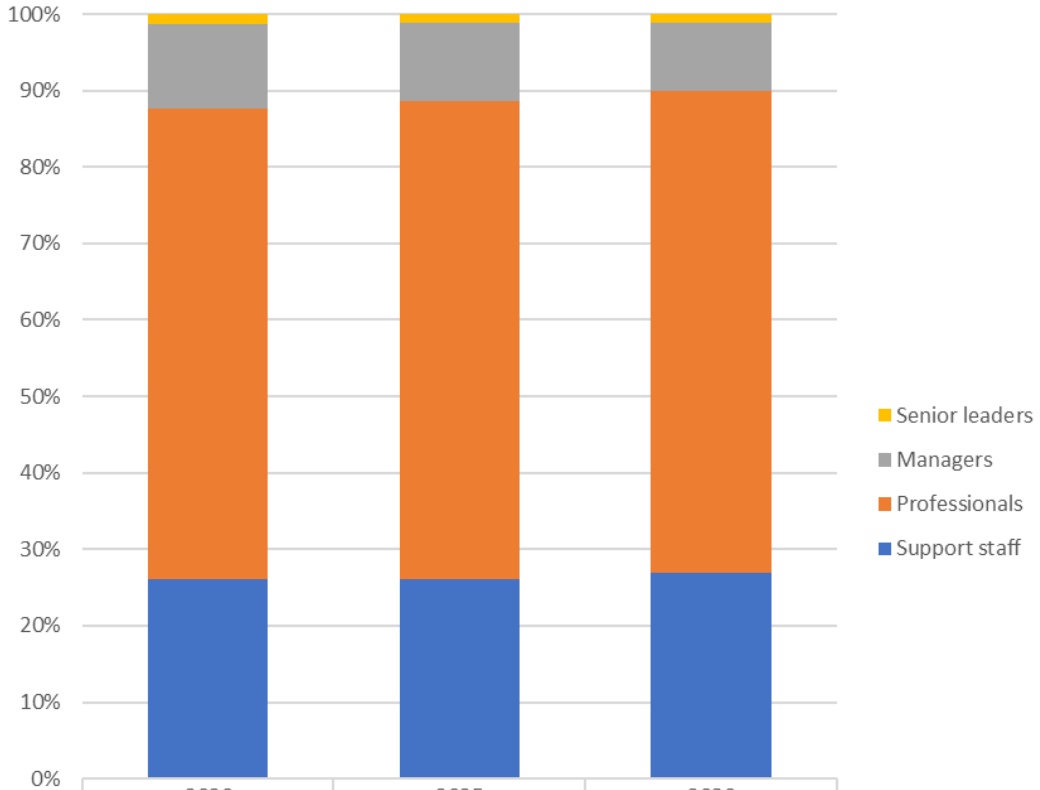


Figure 6D.3: Composition of the ICT staff group leading up to and in a Data Driven Future



	2020	2025	2030
Senior leaders	1%	1%	1%
Managers	11%	10%	9%
Professionals	62%	63%	63%
Support staff	26%	26%	27%

Projected supply

The projected supply for the next 10 years indicates an increase of 51 per cent in the overall number of ICT staff to around 24,700 WTEs by 2030 (Figure 6D.1). This means that in a Data Driven Future there will be a surplus of around 2,750 WTEs by 2030 in the absence of any policy interventions around redeployment, recruitment and retention.

Viewpoints of participants

For participants in the demand-forecasting exercise, the Data Driven Future is one where more cyber and technical infrastructure capability is made available locally within NHS trusts, and also regionally and nationally through cloud-based services. Participants saw those working in ICT as being very much responsible for building this capability by meeting the digital technology implementation and operational requirements of NHS trusts. A future role was also envisaged whereby ICT staff would enable clinical staff to directly develop their own digital solutions and products. ICT staff, having first put into place the technical infrastructure, for example low code

or no code cloud-based services, would provide guidance and advice to allow clinicians to take on this developmental role.

Participants were keen to highlight the role of the commercial IT sector in the NHS. In a Data Driven Future, the expectation is that some IT implementation and operational requirements will be met through outsourcing to commercial suppliers and service-level agreements made with them. Working with commercial suppliers will require strong management and leadership from the ICT department of NHS trusts. The overall number of managers and senior leaders required will increase in a Data Driven Future but not to a great extent (see Figure 6D.2). Increasingly, these individuals will have oversight of several different contracts with commercial suppliers, and take responsibility for monitoring and quality assuring the services being provided. Management and leadership will be particularly important when new technology is implemented by a commercial partner, to ensure any associated organisational and cultural changes to working and clinical practices are embedded.

The NHS will require an increasing number of professional ICT staff. These professionals will be linked to multiple skillsets relating to specialist posts and some will need to have generic skills, for example in change management, to work across different ICT functions of an NHS trust. Qualifications in computer science or IT studies are a pre-requisite for most professional ICT staff, and advanced qualifications will be required by those in more specialist roles. For example, postgraduate degrees in IT security, secure programming and ethical hacking may be required among those seeking to work in the field of cybersecurity. The need for professionals with advanced qualifications reflects the increasing complexity and sophistication of technology as it develops in areas such as cybersecurity, cloud computing, electronic health record systems and AI.

Most participants in the demand-forecasting exercise generally agree that the number of ICT staff will need to increase leading up to 2030 in a Data Driven Future, but the extent of this increase is far from certain due to several possible mitigating factors. Some professional and support staff, and roles or skills, will only be required for the duration of a project in implementing a new digital product or information system. An increase in the size of the ICT staff group might also be mitigated by work being outsourced to commercial suppliers, or undertaken on a shared or centralised basis involving multiple NHS trusts. As explained by these participants:

> Increased reliance on all digital platforms to deliver clinical care, driving centralised computing with tight RPO/RTO expectations from the business. Increased workforce to support this, however [but] may reduce within infrastructure over time (2030) due to centralised computing/cloud, etc.

> The adoption of an EPR and more technology will need an increase in staff to support client devices; there will be more variety of devices at first leading to an increase in staff numbers. A consolidation of hardware types, and an increase in automation regarding support, will then see a drop in the overall numbers of staff needed.

Adding to the uncertainty as to the extent of the increase in the ICT staff group is the deployment of AI technology. Advances in AI can either complement or provide a substitute for ICT staff, or both. For example, it could help defend NHS information systems from cyber attacks and thereby complement and/or substitute for the work of cybersecurity specialists. Participants were also keen to highlight potential enhancements in productivity as the result of introducing new technology, which will have an impact on staffing numbers and skill sets. Some support staff, for example, who provide end-user support to clinicians, could be replaced by chatbots and artificial cognitive processes to guide users to a solution for an IT problem. At the same time, machine learning allowing for predictive analytics and incident-management planning can improve the workflows and productivity of support staff. This will release staff to take on other areas of work deemed important. One participant described how technology has allowed staff to be released to advance their careers in other areas, which in turn has had a positive effect on the delivery of healthcare:

The move to cloud-based services and data centres took extra resource. However, the increase in productivity since the move has more than paid for this. Staff spend significantly less time on maintaining and securing on-site data centres and service. This allows staff to broaden their skill sets and grow into DevOps engineers, following Agile methodology. Local DevOps staff build excellent relationships and teams with architects, business analysts and digital clinical staff, implementing new services that directly improve patient care. Constant development means these services are always able to provide updated and vital functionality, and comply with clinical guidelines.

Scenario B: Data Desert Future 2030

Projected demand forecast

The demand forecast for a Data Desert Future indicates that the ICT staff group will need to:

- (Figure 6D.1) Reduce the number of staff by around 47 per cent between now and 2030, from its estimated current size of 16,400 WTEs to the forecasted required size of 8,675 WTEs.

- (Figure 6D.4) Reduce the number of support staff by around 36 per cent to 2,725 WTEs by 2030, and the number of professional staff by around 51 per cent to 4,975 WTEs. The number of staff in a management role will need to decrease by around 55 per cent to 800 WTEs and those in leadership roles by 28 per cent to 160 WTEs.

- (Figure 6D.5) The next 10 years will see a change in the composition of this staff group. The proportion of support staff will need to increase to 31 per cent and the proportion of professional staff will need to decrease to 57 per cent. The ICT staff group overall will contract in size and this helps to explain why,

Figure 6D.4: Changes in staffing levels required in ICT for a Data Desert Future

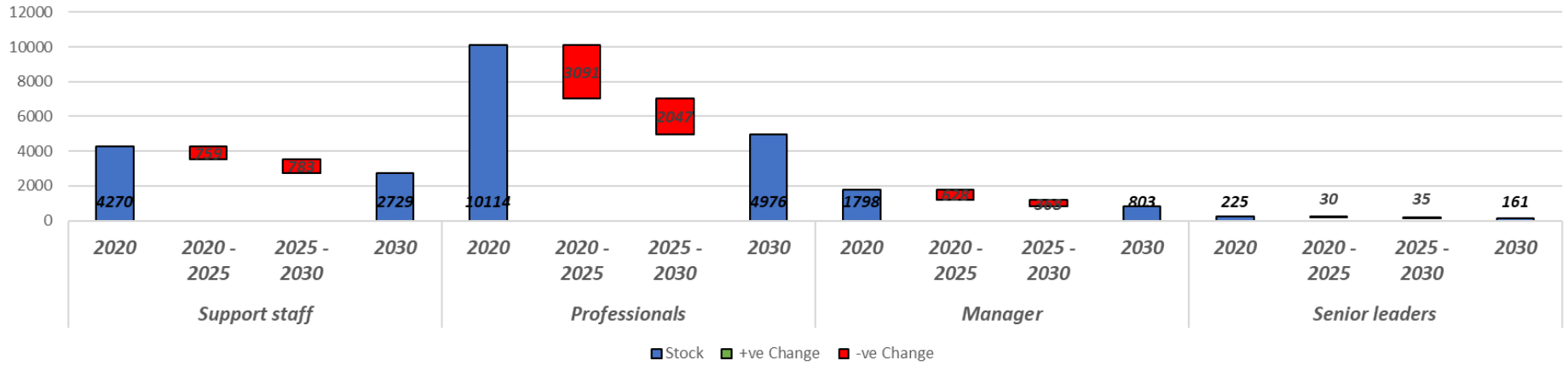
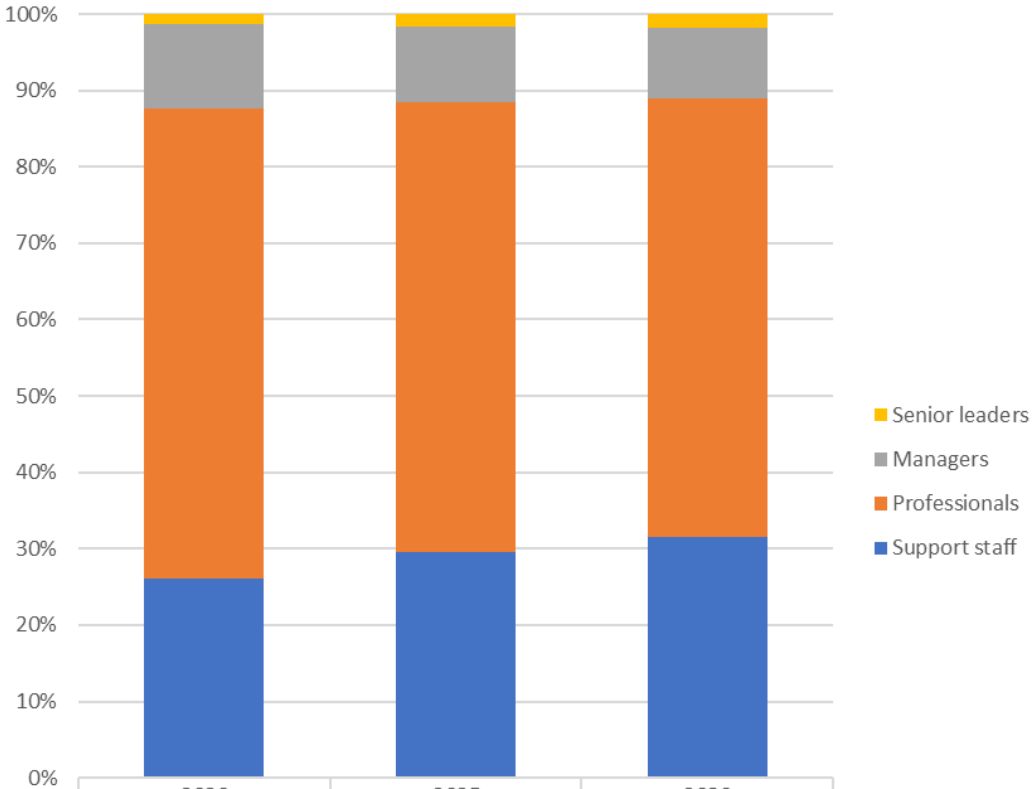


Figure 6D.5: Composition of the ICT staff group leading up to and in a Data Desert Future



	2020	2025	2030
Senior leaders	1%	2%	2%
Managers	11%	10%	9%
Professionals	62%	59%	57%
Support staff	26%	30%	31%

despite a reduction in posts, the proportion of managers (9 to 11 per cent) and senior leaders (1 to 2 per cent) will remain broadly the same in the next 10 years.

Projected supply

The projected supply for the next 10 years indicates an increase of 51 per cent in the overall number of ICT staff to around 24,700 WTEs by 2030 (Figure 6D.1). This will mean that in a Data Desert Future there will be a surplus of around 16,000 WTEs by 2030, in the absence of any policy interventions around redeployment, recruitment and retention.

Viewpoints of participants

The financial constraints of a Data Desert Future could provide impetus for the in-house development of affordable digital solutions and products. It could also force NHS trusts to look at how clinical and organisational processes and operations could be streamlined through the use of technology, such as robotic process automation. However, most participants in the demand-forecasting exercise felt the Data Desert Future will negatively impact on ICT functions and staff in NHS trusts. Financial

constraints will lead to increased outsourcing of IT functions as trusts seek to make cost savings in this area. Mergers of these functions among NHS trusts and centralisation of services will be used in an attempt, again, to reduce costs. A recruitment freeze will be introduced in many trusts and in any case it will be challenging to recruit skilled ICT staff due to the NHS being unable to match market rates for pay. In general, the Data Desert Future will see a dramatic reduction in the size of the ICT staff group over the next 10 years.

Limited investment in digital technologies and ICT staff will result in legacy technologies remaining in use and being updated only periodically, and this will constrain the interoperability of information systems and ability to defend against cyber-attacks. The role of ICT staff will be less about implementation and more about meeting operational requirements, especially in keeping legacy systems running and communicating with each other, and maintaining a patchwork integration of patient data. Staff will struggle to meet their operational requirements because the continued use of older technology will lead to more IT issues and demands from end users. Limited investment in ICT and staffing will have a downward spiral knock-on effect throughout an organisation and on the delivery of healthcare, as explained by one participant:

> It becomes increasingly difficult to attract and retain talented staff within the NHS, leading to a decline in availability of key clinical IT systems impacting patient safety. The extra workload also leads to an increase in sickness-related absence. Implementation of new services grinds to a halt as staff spend all their time firefighting and maintaining current service. More and more money spent on external partners to help shore up a creaking service. Compliance with clinical guidelines cannot always be guaranteed. Network bandwidth and reliability are suboptimal, causing issues trying to share data with neighbouring trusts. Clinicians spend time flitting from one PC to another in the hope of finding a device that works. The failure of IT leads to low morale amongst clinical staff as they are constantly implementing BCP and not spending time on patient care.

Priorities for the ICT staff group – 2020 to 2030

Those taking part in the demand-forecasting exercise provided an indication of the priorities that will be placed on the ICT staff group over the next 10 years. These priorities are particularly relevant in a Data Driven Future. The suggestions made correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

Ensuring technical capability and interoperability of systems

Building and maintaining the technical capability and modern IT infrastructure through meeting the digital technology implementation and operational requirements of NHS trusts remains a core responsibility for ICT staff. Interoperability of

information systems such as RIS and PACS in radiology services, internal and external to an organisation, will provide the foundations for a data-driven NHS. Some staff will need generic skills to work across different ICT functions, yet others will be required to specialise and provide dedicated support relating to some form of technology or activity. This will be reflected in the emergence of new job roles and skills between now and 2030.

Working with commercial sector partners

The commercial IT sector will continue to have a significant role in the NHS over the next 10 years or so. The NHS digital transformation agenda may well increase its role. Managing multiple commercial suppliers is often a challenge for many trusts[23], and ICT staff with managerial and financial responsibilities and skills are needed to work productively with suppliers, negotiate contracts and procure the right technology for their organisation. A good working partnership with suppliers, beginning at the procurement stage, has been advocated as being essential in tailoring digital products so they can be properly integrated into clinical and organisational processes[20]. This way of working is also essential in the procurement of AI products, where suppliers need to be transparent about their algorithms and programmes in processing data and supporting the decision-making of clinicians.

Protecting information systems and data

Cybersecurity specialists in ICT departments will need to work with information governance professionals to ensure NHS trusts are compliant with statutory requirements covering cybersecurity, and protocols set out in the NHS Data Security and Protection Toolkit[46]. It has been highlighted that cybersecurity threats across all sectors of the economy, including healthcare, are increasing but the NHS takes comparatively longer to contain system and data breeches because of inadequate resources, including financial and trained staff, and infrastructure systems[52]. Addressing inadequacy in the availability of trained staff will be challenging for the NHS, as cybersecurity skills are highly sought after by nearly all sectors of the economy.

Job roles and skills

Those taking part in the demand-forecasting exercise provided an indication of ICT job roles and skills required in NHS organisations in the 10 years leading up to 2030. These requirements are particularly applicable in a Data Driven Future. The suggestions made regarding these job roles and skills correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

In-demand, emerging and new job roles

The composition of the ICT staff group in terms of job roles and skills required will be quite different in 2030 compared to what is seen today. Some existing job roles and skills may be made redundant by advances in technology, such as AI, or superseded by new roles and skills as the result of digital or organisational transformation of NHS

Table 6D.1: In-demand, emerging and new job roles in ICT in a Data Driven Future – summary of roles and skills required and links to further information

Job role	Summary of role and skills required	Job role – link	Skills – link
Cybersecurity specialists – administrator, architect and consultant (senior practitioner, advanced practitioner and leading practitioner)	Core skills and emphasis on IT and computer coding skills – architect and administrator. Core skills and emphasis on domain knowledge and emotional intelligence – leading practitioner. Cybersecurity consultant (people) – training their peers on good cybersecurity behaviours and practice. Cybersecurity administrator (processes and technology) – first line of defence in an organisation's systems. Cybersecurity architect (technology and processes) – ensuring cybersecurity is designed into the system by default.	GDS DDaT	DHCI
Software developers and engineers and full stack engineers and developers (senior practitioner, advanced practitioner)	Core skills and emphasis on IT and computer coding skills. A software developer designs, runs and improves software that meets user needs. Responsible for engineering the end-to-end features of a system. From initial user experience to backend code running on distributed servers. They single-handedly design, architect, execute, and operate an entire end-to-end system.	GDS DDaT	DHCI
Data architect (practitioner, advanced practitioner, senior practitioner)	Core skills and emphasis on IT and computer coding skills.	GDS DDaT	DHCI
Network architect (practitioner, advanced practitioner, senior practitioner)	Core skills and emphasis on IT and computer coding skills.	GDS DDaT	DHCI

Technical architect (practitioner, advanced practitioner, senior practitioner)	Core skills and emphasis on IT and computer coding skills.	GDS DDaT	DHCI
Technical specialist architect (practitioner, advanced practitioner, senior practitioner)	Core skills and emphasis on IT and computer coding skills.	GDS DDaT	DHCI
DevOps engineers (advanced practitioner, senior practitioner)	Core skills and emphasis on IT and computer coding skills. Development operations (DevOps) engineers support the development and operation of software through tools, environments and practices.	GDS DDaT	DHCI

trusts. Based on an analysis of reports in this area, in-demand, emerging, and new job roles are identified in Table 6D.1. Some of these job roles will also be found in other areas of the digital technology and informatics workforce in 2030.

Investment in information and communications technology

The demand-forecasting exercise and a review of reports on digital technology in healthcare have highlighted areas where investment is needed over the next 10 years to develop the capacity and capability of ICT staff in the NHS. These areas of investment are particularly required in a Data Driven Future.

Building capacity

Staff working in ICT already form a substantial part of the NHS digital technology and informatics workforce and will need to continue to do so. Based on current staff inflow and outflow rates, the ICT staff group is expected to grow in size to meet and possibly exceed demand up to 2030. However, this growth is not a foregone conclusion. The NHS faces intense competition from other sectors of the economy for the same set of ICT skills and therefore may fail to recruit a sufficient number of ICT staff. A recent report by the Digital Health and Care Institute has identified software developers and engineers and knowledge engineers (who translate knowledge into digital tools to support decision-making) as some of the most urgently needed ICT specialisms in the healthcare sector[35]. Other job roles that are in-demand or emerging in the NHS are listed in Table 6D.1.

Training and continuing professional development

Specialists in areas such as cybersecurity and software development and engineering require an advanced level of computing and mathematical knowledge to design digital solutions and programme end-user products. Developing existing ICT staff with qualifications in computer science to take on these specialist roles is possible if individuals are provided with advanced training and CPD opportunities. Such arrangements are worth exploring in the NHS. This approach may be one of several in a strategy to ensure essential ICT skills are made available.

Recruitment and retention

The NHS will face challenges in recruiting individuals to some areas of ICT. The demand for cybersecurity skills is expected to grow, given that in the UK job market the number of advertised jobs listing cybersecurity as a skill in 2017 was 27,822 and this increased to 41,065 in 2018 and 49,992[5] in 2019. Cybersecurity professionals are listed on the Migration Advisory Council (MAC) Shortage Occupation List (SOC code 2139, Information technology and telecommunication professionals).

Software developer was the fourth most advertised role in the UK job market in 2019 (181,454 jobs advertised, comprising some seven per cent of all job adverts). An analysis of the labour market shows that software developers and engineers have been the most in-demand technical roles in the UK for the last four years, indicating that these skillsets are required in all sectors of the economy. Software developer

was the fourth most advertised digital and informatics role in the NHS in 2019. The median salary calculated for NHS adverts was £29,000, compared to industry median of £45,000. This indicates that these skills and roles are in demand and the NHS faces competition to attract and retain people, given the current market rates[5]. Software developers are also listed in the 2019 Migration Advisory Council (MAC) Shortage Occupation List (SOC code 2136). Challenges in recruiting and retaining ICT staff have also been highlighted by the NHS Pay Review Body in their Thirty-Second Report, published in 2019.

A strategy and portfolio of approaches, including outsourcing work and working collaboratively with other public sector bodies, universities and commercial organisations, will be required by the NHS to secure and retain people who have ICT skills that are most in-demand, not only in healthcare but across the whole economy. Digital technology implementation requirements in NHS trusts are often time limited, and end shortly after a digital product or system has been introduced. Operational requirements meanwhile tend to be permanent. It is worth bearing in the mind the differences between these two requirements when formulating a strategy involving recruitment, collaborative working relationships with public sector bodies, and outsourcing to commercial partners in securing the necessary ICT skills for the NHS. The NHS will also need to be involved in any long-term national strategy or plan that is applicable across the economy in securing the ICT skills that the country requires. The main reason is that the commercial IT sector is interlinked with the NHS, so any skill shortages in the commercial sector will have a direct impact on the NHS.

Salary and employment on-costs

The salary and employment on-costs for the ICT staff group of 16,400 WTEs in 2020 were estimated to be around £839 million. If the number of staff increases to 21,975 WTEs, as projected in the demand forecast for the Data Driven Future scenario, the costs will be in the region of £1.47 billion in 2030 (Figure 6D.6). These calculations are based on a mean salary pay point corresponding to the top of NHS Agenda for Change band 6 and the assumption that salaries will increase by 2.7 per cent per annum, and employment on-costs at 34.9 per cent (21 per cent for the NHS pension and 13.9 per cent National Insurance contribution). The projected salary and employment on-costs for a Data Driven Future does not factor in any changes by job level to the composition of the staff group. Therefore, the figure of £1.47 billion should be regarded as the minimum estimate for 2030. It is worth contrasting the figure of £1.47 billion with the £1.1 billion (baseline costs) that represents the salary and employment on-costs of a workforce remaining at 16,400 WTEs in 2030.

Figure 6D.6: Change in salary and employment on-costs in a Data Driven Future for the ICT staff group

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost (Millons)	£839	£891	£959	£1,031	£1,106	£1,184	£1,236	£1,290	£1,347	£1,405	£1,465
Baseline Cost (Millons)	£839	£861	£885	£908	£933	£958	£984	£1,011	£1,038	£1,066	£1,095

6E. Clinical informatics

Requirements in the NHS

The broader term of informatics is used to cover different job roles, including those in health records and information management, clinical coding, and ICT. For the purposes of the demand-forecasting exercise and this report, the term clinical informatics has been used to focus on those individuals whose role is to work with data and apply computational capability, analytical techniques, and methods drawn from disciplines such as statistics, in order to gain and present insight and intelligence on different aspects of health and healthcare. These individuals work in fields such as health data analytics, data science and bioinformatics, and includes those in the hybrid role of clinician-informatician. This report estimates that there are around 1,800 WTE staff members in the NHS currently working in these fields. Other reports, for example on data analysts in the NHS, have identified a substantially larger workforce because broader inclusion criteria are used to account for those working in the business (finance, operational, etc), clinical coding, information management, and health records function areas found in organisations.

Developments in electronic health and patient record systems have changed the way health data is collected and stored, and advances in technical infrastructure and the interoperability of information systems have allowed for greater sharing of data. As a result, large volumes of data are available for further use and the term 'big data' is frequently employed in the NHS, reflecting the organisation's status as a world leader in data collection[17]. Data from Internet of Things, including wearable sensors used by patients, will add to the volume of data at an increasing rate in the future. Exploiting this data for secondary usage depends on the availability of staff working in the area of clinical informatics, as well as developments in AI and machine learning technologies. Much is also dependent on those in senior leadership roles, including Chief Clinical Information Officers (CCIOs) and Chief Nursing Information Officers (CNIOs), in bringing about a data-driven NHS. These people represent the interest of clinicians around the use of digital technology and data, and how both can be effectively applied in the context of patient care. There have also been calls for NHS trusts to establish the position of Chief Analytical Officer, to work alongside CCIOs and CNIOs, specifically focusing and leading on the area of health data analytics and data science[53].

A wide range of varied skills and expertise are required in the secondary usage of data. These skills are needed in the practical field of health analytics and not just in academic and epidemiological research on disease areas[54]. The practical field supports clinical decision-making processes, the monitoring of safe and effective healthcare, initiatives to improve the quality of professional practice, and efforts in making efficiency and productivity gains in the delivery of services. The focus on practical health analytics will raise awareness of the importance of the clinician-informatician hybrid role in healthcare. The HEE Future Doctor programme recommends that doctors take an active role in the development of digital technology and AI, and also how data should be applied in the delivery of healthcare[31]. This recommendation follows on from the Wachter Review, which acknowledged the

need for a cadre of trained clinician-informaticians with a clinical background in medicine, nursing or pharmacy in NHS trusts to support the CCIO and CNIO[10].

Advances in genomics, AI and machine learning technologies will have an employment effect on the clinical informatics staff group. In the next 10 to 20 years, genomics has the potential to transform healthcare, become integral to all medical specialties, and be embedded into routine practice. However, this is critically dependent on expert computational analysis of genomic and biological datasets, complemented by AI and machine learning technologies. An expansion of the workforce in areas such as data science and bioinformatics is therefore required. Data science is a relatively new concept in healthcare but can be thought of as a domain or specialism that unifies data analysis and statistics and uses techniques drawn from many fields, such as mathematics, computer science and information science. Data science-related roles include health data analysts, AI and machine learning engineers and specialists, performance analysts, statisticians, health economists and more. Bioinformaticians have the skills to undertake complex analysis of genomic data and provide clinical interpretations of genomic findings in the diagnosis of disease. They will work across different clinical services to communicate genomic and (in the future) phenotypic data in the context of patient care. The application of AI to genomic medicine will require data management specialists and knowledge engineers who have the skills to curate datasets, and to construct machine-learning rules and apply them to data. Those with a background in data science are well placed to take on the role of knowledge engineer.

Scenario A: Data Driven Future 2030

Projected demand forecast

The demand forecast for a Data Driven Future indicates that the clinical informatics staff group will need to:

- (Figure 6E.1) Significantly increase the overall number of staff by around 672 per cent between now and 2030, from its estimated current size of 1,775 WTEs to the forecasted required size of 13,725 WTEs.

- (Figure 6E.2) Increase by 632 per cent the number of support staff to 2,175 WTEs, professionals to 8,675 WTEs, and managers to 2,175 WTEs by 2030. Senior leadership roles will need to be introduced into the clinical informatics staff group and by 2030 there will need to be 725 WTEs.

- (Figure 6E.3) The composition of this staff group in terms of the proportion of individuals in support (16 per cent), professional (63 per cent) and managerial (16 per cent) roles will need to remain broadly the same between now and 2030. The introduction of senior leadership roles will mean that individuals in these positions will comprise five per cent of the clinical informatics staff group by 2030.

Figure 6E.1: Supply projection and demand forecasts for clinical informatics staff in a Data Driven Future and Data Desert Future – 2020/21 to 2029/30

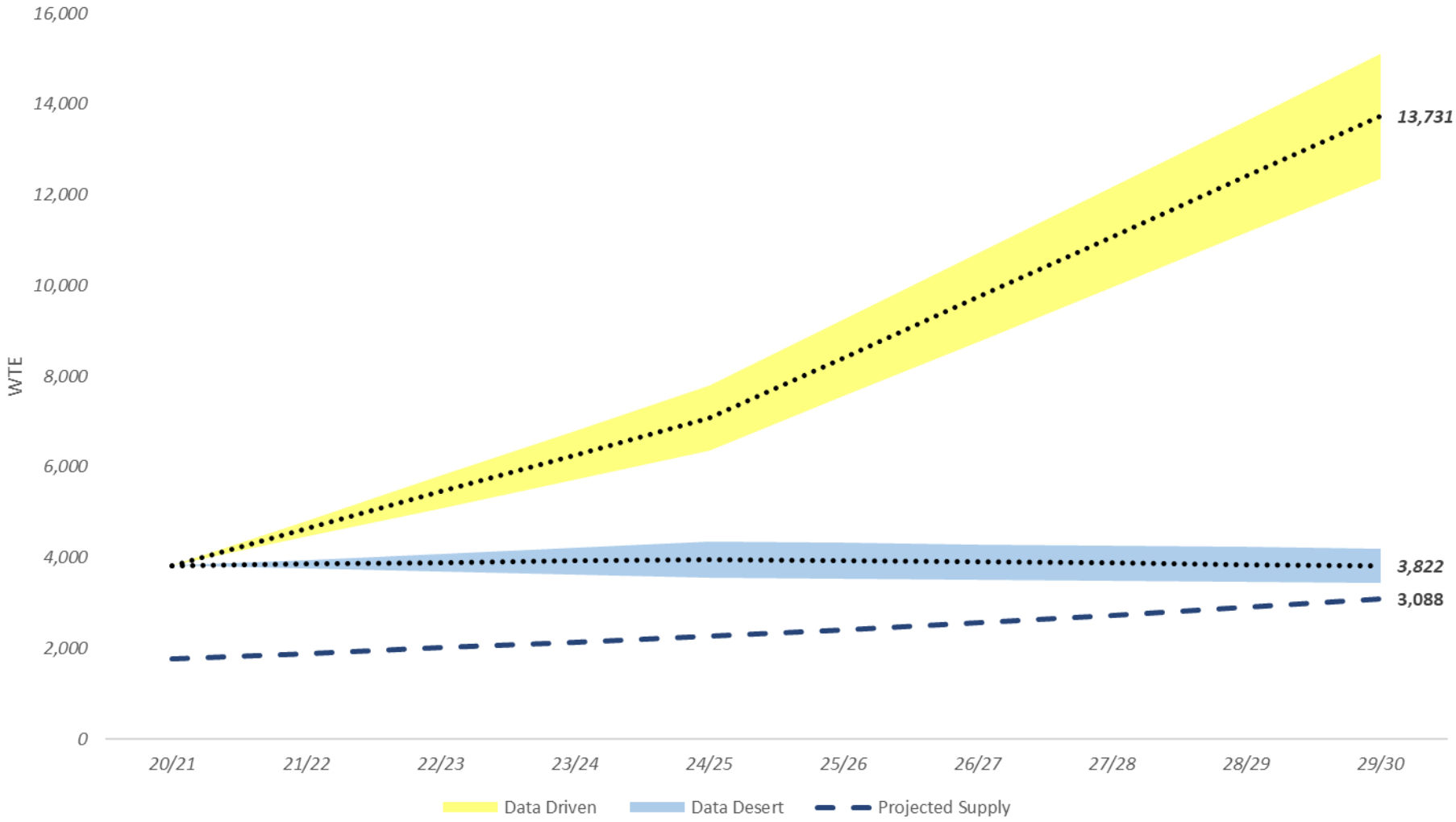


Figure 6E.2: Changes in staffing levels required in clinical informatics for a Data Driven Future

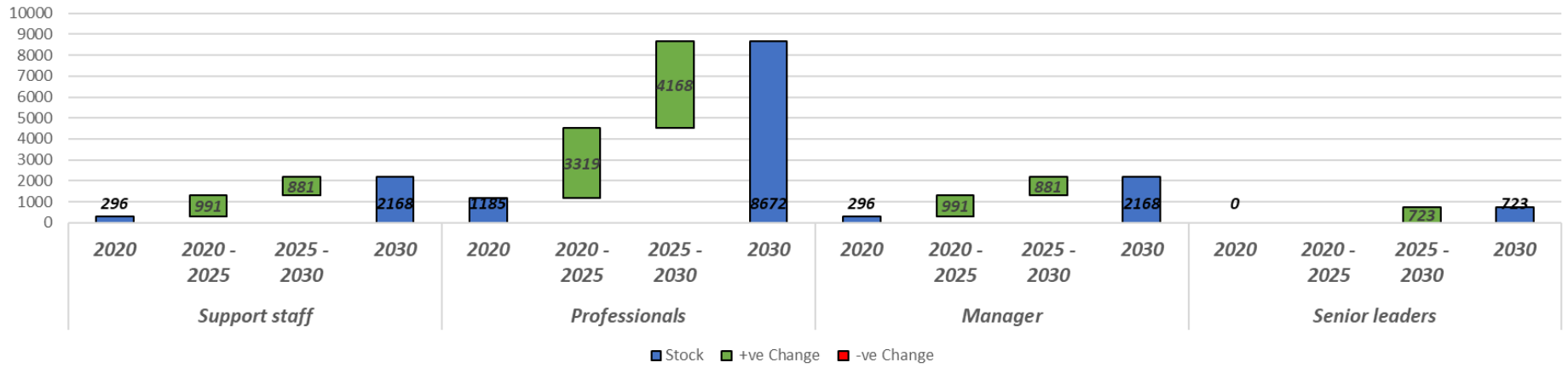
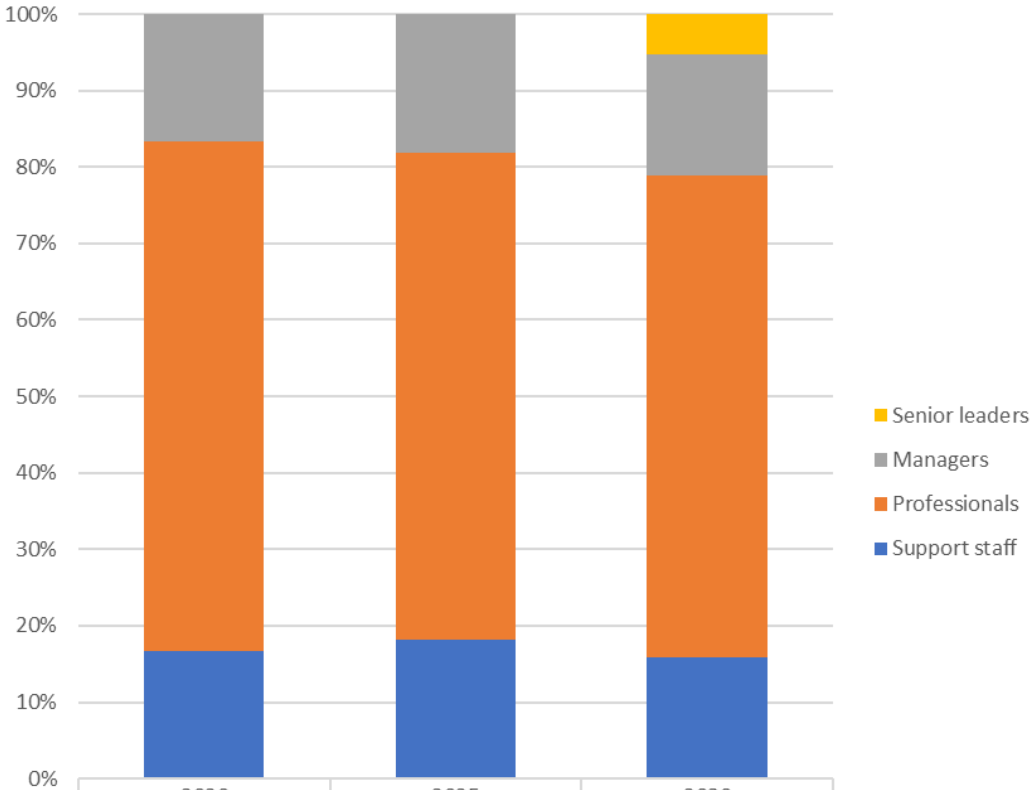


Figure 6E.3: Composition of the clinical informatics staff group leading up to and in a Data Driven Future



	2020	2025	2030
Senior leaders	0%	0%	5%
Managers	17%	18%	16%
Professionals	67%	64%	63%
Support staff	17%	18%	16%

Projected supply

The projected supply for the next 10 years indicates an increase of 74 per cent in the overall number of clinical informatics staff to around 3,100 WTEs by 2030 (Figure 6E.1). This will mean that in a Data Driven Future there will be a significant shortfall of around 10,650 WTEs by 2030, in the absence of any policy interventions and required investments made in the areas of building capacity, training and CPD, or recruitment and retention in the next 10 years.

Viewpoints of participants

Those taking part in the demand-forecasting exercise agreed that data and how it is used will be central to the delivery of healthcare in the next 10 years and beyond. Data analytics will provide insight into how healthcare services are delivered and how patient outcomes can be improved. The need for increased and more sophisticated data modelling was also mentioned in order to anticipate and plan for patient demand across the healthcare system. One participant describes the current set-up in his or her trust:

We have an operational research team, and the future lies in population health management, advanced modelling across the healthcare system, utilising AI and machine learning, forecasting, risk stratification tools, and patient segmentation.

The clinical informatics staff group will need to grow substantially in a Data Driven Future. The overall demand forecast projected by participants will require a sevenfold-to-eightfold increase in the size of this staff group between now and 2030. The numbers of support, professional and managerial staff will need to increase accordingly. Support staff are needed to help build the data analytical infrastructure of the future so their capacity cannot be reduced. The need for data analysts, data scientists and other trained staff to leverage and realise the potential of data justifies the substantial increases in professional and managerial roles. Driving these increases are demands from patients and clinicians for data-integrated and data-driven healthcare services, developments in genomic medicine, and advances in technology and software allowing for more sophisticated use of health data. The importance of clinician-informaticians being active and available in a Data Driven Future was highlighted. As explained by one participant:

Every service in a hospital will need a clinical informatician as a product manager. Typically, a trust has 200 systems. Many of these people will be doing clinical work as well as being clinical informaticians, so 40 WTE might be 200 bodies (at one day a week).

Some participants were keen to highlight the importance of senior leadership in the clinical informatics function of NHS trusts. These roles are important in establishing and taking ownership of the data analytical infrastructure required in a data-driven trust, leading a greatly expanded clinical informatics team and working with external partners (including universities, research bodies and other NHS organisations) on the secondary use of data. The outcome of the demand-forecasting exercise shows that senior leadership roles will need to be introduced into the clinical informatics staff group at the rate of four or five WTEs per NHS trust.

Scenario B: Data Desert Future 2030

Projected demand forecast

The demand forecast for a Data Desert Future indicates that the clinical informatics staff group will need to:

- (Figure 6E.1) Increase the overall number of staff by around 115 per cent between now and 2030, from its estimated current size of 1,775 WTEs to the forecasted required size of 3,825 WTEs.

- (Figure 6E.4) Increase by 158 per cent the number of support staff to 765 WTEs and managers to 765 WTEs, and by 94 per cent the number of professional staff to 2,300 WTEs.

Figure 6E.4: Changes in staffing levels required in clinical informatics for a Data Desert Future

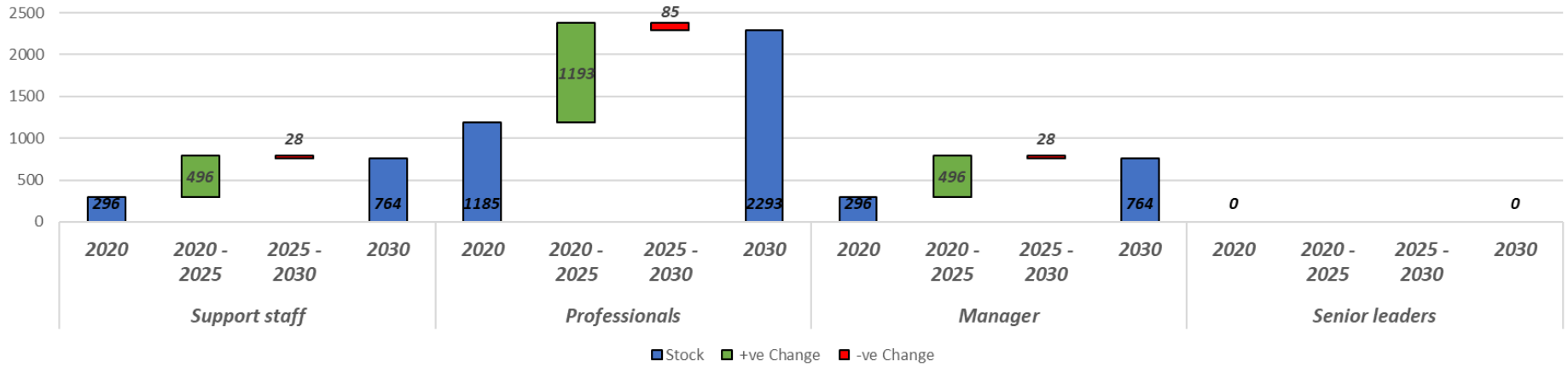
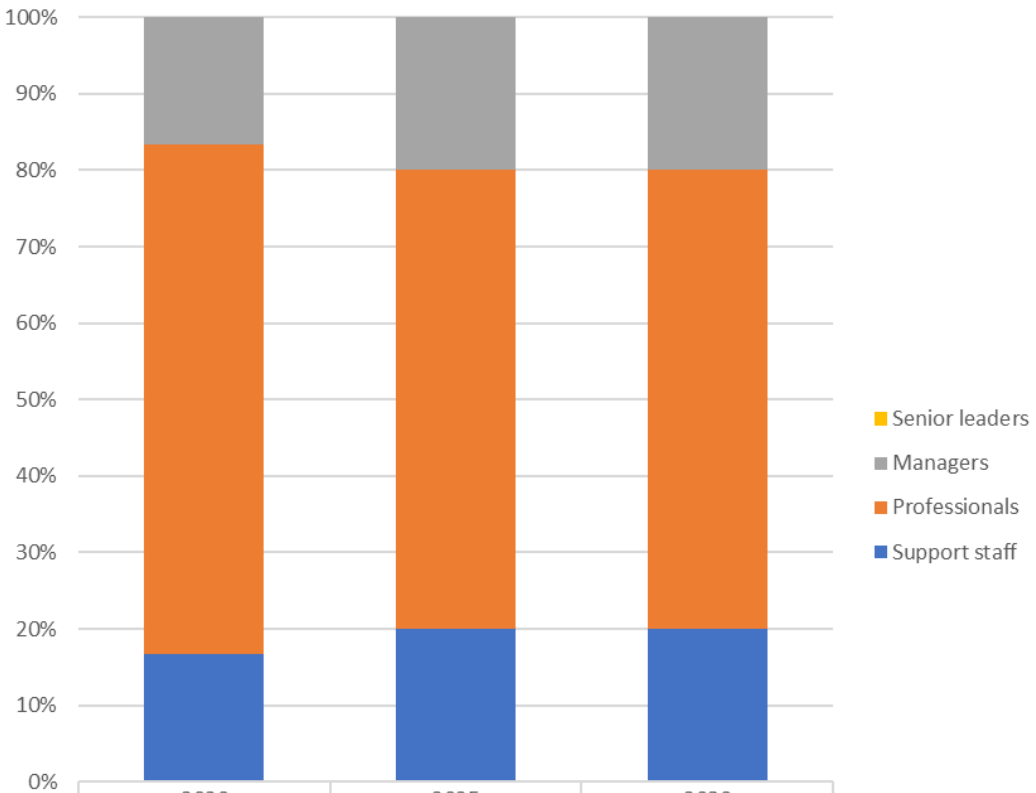


Figure 6E.5: Composition of the clinical informatics staff group leading up to and in a Data Desert Future



	2020	2025	2030
Senior leaders	0%	0%	0%
Managers	17%	20%	20%
Professionals	67%	60%	60%
Support staff	17%	20%	20%

- (Figure 6E.5) Adjust the composition of the clinical informatics staff group by 2030. There will be an increase in the proportion of staff in supporting and managerial roles, each from 17 per cent to 20 per cent. The proportion of staff in professional roles will decline from 67 per cent to 60 per cent.

Projected supply

The projected supply for the next 10 years indicates an increase of 74 per cent in the overall number of clinical informatics staff to around 3,100 WTEs by 2030 (Figure 6E.1). This means that in a Data Desert Future there will be a shortfall of around 725 WTEs by 2030, in the absence of any policy interventions and required investments made in the areas of building capacity, training and CPD, or recruitment and retention in the next 10 years.

Viewpoints of participants

Despite the name of the scenario, Data Desert Future, data will still be used in shaping and delivering healthcare services. This partly explains why the overall demand forecast projects a 115 per cent increase in the size of the clinical informatics staff group between now and 2030. More support, professional, and managerial staff will be required, but not to the same extent as in the Data Driven Future. Specialist professional posts will need to be forgone, including those held by data scientists, bioinformaticians and clinician-informaticians. If they are employed, it is likely to be in shared or central services as NHS trusts, across a local area or region, attempt to reduce costs by merging their clinical informatics functions.

Financial constraints may lead to minimum investment or opportunistic developments around the data analytical infrastructure in NHS trusts. Datasets will be maintained but not necessarily improved, and plans to establish new datasets will be put on hold or cancelled altogether. Data analysis and modelling will be undertaken with pre-built models, using widely available software such as Microsoft Excel. The clinical informatics staff group will not have the capacity, specialist skills or tools to create bespoke or sophisticated data models for clinical teams.

Priorities for the clinical informatics staff group – 2020 to 2030

Those taking part in the demand-forecasting exercise provided an indication of the priorities that will be placed on the clinical informatics staff group over the next 10 years. These priorities are particularly relevant in a Data Driven Future. The suggestions made correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

Developing and embedding the role of clinician-informaticians

The hybrid role of clinician-informatician is one that is expected to grow, in terms of capability and capacity, in the next 10 years or so. Knowing its limits, validity and reliability, clinicians are ideally placed to contextualise the use of data within the patient setting. Their knowledge of health problems is crucial for developing more informed and insightful data models to improve the health of patients and populations. The importance of data analytics and science in healthcare is being recognised by the growing awareness that every clinician should be skilled in and knowledgeable of clinical informatics. The Academy of Medical Royal Colleges has stated that more doctors will be needed who are as well versed in data science as they are in medical practice[19]. The Academy of Medical Sciences has recommended that clinical informatics be incorporated into the training of all healthcare practitioners, and training pathways in clinical informatics be established for clinicians, with the aim of building a critical mass of expertise to fully exploit the availability of health data[55]. An established training pathway and other initiatives, such as developing job plans allowing for time away from direct patient clinical duties, will help to formalise the clinician-informatician role and establish it as a recognised occupation in its own right. Work has already been undertaken by the Faculty of Clinical Informatics in developing a core competency framework (https://facultyofclinicalinformatics.org.uk/core-competency-framework) for clinician-

informaticians. In the framework, particular attention is paid to clinical safety and informatics in the healthcare sector.

Providing advanced data analytics

Advances in digital technology and new types of data, including genomic, will require new and more sophisticated methods of data analysis. Professionals will need to employ data mining, natural language processing, predictive modelling, AI methodologies and other advanced analytical techniques. Use of programming languages such as R and Python will be required to fully exploit the potential of new computer technologies. Some data analysts and data scientists will need to draw on knowledge and theories from areas of healthcare practice including medicine and nursing, and apply methods from disciplines such as statistics, mathematics, economics and behavioural psychology to fully analyse and interpret data. In the case of bioinformaticians, they will require a detailed understanding of genomics, and this will broaden out to phenotypic information, as well as an understanding of concepts drawn from statistics, chemistry, biochemistry and physics.

Working within multidisciplinary clinical teams

As technology and data become more integrated into healthcare, professionals such as data scientists and bioinformaticians will become part of multidisciplinary clinical teams. As well as being competent in analytical techniques, these professionals will need interpersonal team-working skills and abilities in order to communicate the findings of any analytical work on, for example, genomic data. A background knowledge of healthcare practice and the medical sciences is also required in order to contribute productively to the work of a clinical team. Understanding the context of healthcare to frame important questions is the basis for good data analytics in a clinical setting.

Using and applying new technologies

The clinical informatics staff group is going through a transformation, with some routine tasks around data gathering and cleansing being automated by newer technologies and software. At the same time, these technologies will enhance the work of those in clinical informatics. Large volumes of data can be incorporated, and software will assist in data mining, natural language processing, and analysis and visualisation of data. Data analysts and scientists will need to understand the technology and software being used to fully realise their potential. Knowing the technical procedures used to generate and process data, for example, will allow for the assessment of the strengths and weakness in any data analytical work and whether the outputs are valid and reliable.

Developing AI and machine learning capability

The development and application of AI and machine learning technologies in healthcare will also fall into the domain of data scientists, bioinformaticians and other professionals in the clinical informatics staff group. This also includes clinician-informaticians. There are calls, including from the HEE Future Doctor programme,

for a new generation of doctors to integrate the human perception of illness into machine learning processes, and evaluate and work alongside AI knowing its strengths and limitations[17, 31, 56]. Where clinicians are not involved, the development of AI could potentially lead to major harm to patients. Algorithms used in AI which are based on a small number of synthetic non-real cases with very limited input from clinicians can lead to erroneous recommendations being made around how patients should be treated. This was recently highlighted with AI technology used in the field of oncology[42]. Input from clinician-informaticians, as well from data scientists and bioinformaticians, is needed to rigorously evaluate and scrutinise AI before being applied to healthcare.

Job roles and skills

Those taking part in the demand-forecasting exercise provided an indication of clinical informatics job roles and skills required in NHS organisations in the next 10 years leading up to 2030. These requirements are particularly applicable in a Data Driven Future. The suggestions made as to these job roles and skills correspond with those found in reports looking at the future of digital technology and informatics in health services, nationally and internationally.

In-demand, emerging and new job roles

The composition of the clinical informatics staff group in terms of job roles and skills required will be quite different in 2030 compared to what is seen today. Some existing job roles and skills may be made redundant by advances in technology such as AI, or superseded by new roles and skills as the result of digital or organisational transformation of NHS trusts. Based on an analysis of reports in this area, in-demand, emerging and new job roles are identified in Table 6E.1. Some of these job roles will also be found in other areas of the digital technology and informatics workforce in 2030.

Table 6E.1: In-demand, emerging and new job roles in clinical informatics in a Data Driven Future – summary of roles and skills required and links to further information

Job role	Summary of role and skills required	Job role – link	Skills – link
Health data analysts (advanced and leading practitioner)	Core skills and emphasis on IT and computer coding skills. Health data analysts oversee data acquisition, management, analytics and interpretation directly to healthcare data. They are quantitative specialists, who understand the business needs of a hospital or other healthcare organisations and are able to translate data into actionable insights for use by clinicians, clinical researchers, decision makers and others.	GDS DDaT	DHCI
Data scientists (senior practitioner, advanced practitioner and leading practitioner)	Core skills and emphasis on IT and computer coding skills. A data scientist identifies complex business problems while leveraging data value.	GDS DDaT	DHCI
Clinical bioinformatician, (health informatics, genomics, medical physics) HCPC-registered clinical scientist	Clinical bioinformatics is an area of healthcare science responsible for developing and improving methods for acquiring, storing, organising and analysing biological data that supports the delivery of patient care. Core skills and emphasis on IT and computer coding skills, and domain knowledge and emotional intelligence. This is a recognised occupation with a standard career pathway in three specialist areas. Entry routes into the programme and career pathways are described on the HEE National School of Healthcare Science (NSHCS) website. Entry is at postgraduate pre-registration (Level 7), and Level 8 doctoral-level programme training is available for professionals to further develop towards applying for consultant scientist posts.		DHCI
Biostatistician and bioinformatics scientist	There is a more general, non-registered route for specialists who use computational, data analytical and data mining techniques applied to a range of problems in the life sciences. Core skills and emphasis on IT and computer coding skills, and domain		DHCI

	knowledge and emotional intelligence.		
Statistician (practitioner, senior practitioner, advanced practitioner)	Core skills and emphasis on IT and computer coding skills.		DHCI
Health economist (practitioner, senior practitioner, advanced practitioner)	Core skills and emphasis on IT and computer coding skills.		DHCI
Chief analytical officer (leading practitioner)	Core skills and emphasis on IT and computer coding skills, and domain knowledge and emotional intelligence.		DHCI
Chief data officer (leading practitioner)	Core skills and emphasis on IT and computer coding skills, and domain knowledge and emotional intelligence.		DHCI
Chief clinical information officer (leading practitioner)	A chief clinical informatics officer leads and manages the ICT services and information development activities within them to support the safe and efficient design, implementation and use of informatics to deliver improvements in the quality and outcomes of clinical health and care. Core skills and emphasis on IT and computer coding skills, and domain knowledge and emotional intelligence.		DHCI
Chief nursing information officer (leading practitioner)	The chief nursing information officer provides the clinical management of informatics delivery and development activity to support the safe and efficient design implementation and use of informatics solutions to deliver improvements in the quality and outcomes of care. Core skills and emphasis on IT and computer coding skills, and domain knowledge and emotional intelligence.		DHCI
Emerging and new CCXIO roles e.g. Chief clinical technology officer, chief clinical analytical officer (leading practitioner)	Core skills and emphasis on IT and computer coding skills, and domain knowledge and emotional intelligence.		DHCI

Investment in clinical informatics

The demand-forecasting exercise and a review of reports on digital technology in healthcare have highlighted areas where investment is needed over the next 10 years in developing the capacity and capability of clinical informatics staff in the NHS. These areas of investment are particularly required in a Data Driven Future.

Building capacity

It is anticipated that healthcare in the future will be driven by digital transformation, molecular biology, genomics and advanced data analytics. Concurrent development in each of these areas is important and will have implications for the clinical informatics staff group. The demand-forecasting exercise indicates that staff numbers must be significantly increased in a Data Driven Future. Realising the extent of this increase will be challenging for the NHS because of the demand from across the economy for people with data analytical and data science skills. Various reports, including those from the Nuffield Trust and Digital Health and Care Institute, recognise the intense competition between different sectors of the economy for qualified data analysts and that the NHS is not always able to compete in regard to paying market-rate salaries[23, 35, 57, 62]. Investments made in paying market-rate or professional-level salaries should be considered as part of an overall strategy to build capacity in the clinical informatics staff group.

Particular attention will need to be given to developing senior leadership capacity in the clinical informatics staff group. The demand-forecasting exercise has projected that 725 WTE senior leaders will be required by 2030 in a Data Driven Future. Some of these will be CCIOs and CNIOs who have completed the Postgraduate Diploma in Digital Health Leadership commissioned by the NHS Digital Academy[59]. It is important that this programme, and other similar initiatives, continue if demand for senior leaders in clinical informatics is to be met in the next 10 years.

NHS organisations do not always recognise the value of and need for data analytics and, in turn, data analysts and data scientists. A possible reason for this is a lack of analytical leadership at the highest levels to influence and shape the demand for data analytics[22]. Investment in developing data analytical leadership roles has been called for, together with each NHS organisation establishing the post of chief analytical officer to work alongside the chief information officer, CCIOs and CNIOs[53]. Addressing this leadership deficit in health data analytics will help organisations in finding and implementing data solutions in the delivery of healthcare services[58]. The appointment of a chief analytical officer may also lead to greater importance being placed on the training of healthcare staff to manage and use data in their clinical work.

Recruitment and retention

NHS trusts will find it challenging recruiting skilled individuals into some job roles in clinical informatics. Demand for these individuals will come from all sectors in the economy. Labour market occupational dynamics indicate that there will be a growth in data science roles. The number of advertised data science roles has been growing

by 46 per cent year-on-year in the UK. Between January to April 2020, around 3,500 roles for data scientists were advertised[5]. The Royal Society, in 2017-18, indicated that the top 10 specific skills in data science and advanced analytic roles advertised in the UK in are data science, Python, SQL, machine learning, big data, research, Apache Hadoop, communication skills, Java, and Scala[58]. In a labour market analysis report commissioned by HEE[5], only 'coding' and 'data' appeared as specific digital skills mapped to the skills advertised in the top 10 data, digital and technology roles in the NHS. This could indicate that the NHS is not advertising for these analytical skills, limiting the potential for data and digital transformation. Forecasting data for future digital- and data science-specific skills indicates that an explosive level of growth and demand (>100 per cent) from employers is expected in the next five years for advanced analytics in understanding big data, machine learning and data science, along with a very fast growth for tableau, Apache Hadoop and data management. Stable growth (decline by 10 per cent) is expected for SAS (statistical analysis system) and business intelligence. Crucially, there is no expected decline by more than 20 per cent for any of the analytical and data science skills projected[6].

Monetary reward is important in the recruitment and retention of staff. Consideration should also be given to non-monetary motivations in attracting and retaining staff. It has been highlighted that health data analytical roles are perceived as being low in status and categorised as administrative and clerical, and not professional scientific and clinical occupations in the NHS[23, 54]. This poses a problem for staff recruitment and retention as well as career development. Data analytical staff in administrative occupations are paid at a lower level and may be attracted to higher paying jobs outside of the NHS. They will also have fewer opportunities to access specialist and advanced training and CPD programmes.

Opportunities to develop skills and further careers in a stimulating work environment are some of the factors that may attract data analytical talent into the NHS. A study of the NHS recommended that people with data analytical skills should be coordinated to allow them to work across different organisations. An organised system of rotations would enable this, along with the establishment of professional networks and talent banks allowing NHS trusts to post requests for data analytical skills to meet upcoming projects and pieces of work[63]. Such initiatives will no doubt create a stimulating working environment for those in the clinical informatics staff group.

Training and continuing professional development

A strategic approach in building capacity should take into account the investments needed to ensure an adequate training pipeline into the clinical informatics staff group, and the possibilities of developing talent in-house. The importance of training the next generation is recognised by Health Data Research UK, who are leading an ambitious training and talent programme to create a cohort and network of thousands of health data analysts and scientists[60]. Central to this programme is supporting the development and growth of new postgraduate-level programmes in health data science. Five masters programmes in England (and three in the rest of the UK) have started or will start in 2021 and have been fully funded to deliver a three-year student intake. Health Data Research UK, together with the Alan Turing Institute and in partnership with seven UK partner universities, is delivering PhD

programmes in health data science[60]. Postgraduate programmes in this area are also being offered by universities such as Oxford, Exeter and Imperial College London. The National School of Healthcare Science has developed a higher specialist scientist training programme in clinical bioinformatics. So far, 114 places on this programme have been commissioned since 2013. This offers a pathway into this discipline and those qualifying will be clinical scientists and have a key role in NHS genomic services. These training programmes are required because, as genomic information become routinely captured, the importance of bioinformatic analysis becomes ever greater. The attention placed on preventive medicine in the NHS rests on developments made in genomics, and this again highlights a further need for bioinformaticians.

Developing talent in-house is another approach to building capacity. It has been observed that the NHS already has a large workforce of well-qualified and data-savvy people, many of whom routinely use data to meet organisational performance measurement, and financial and governance compliance requirements[63]. These people could be upskilled, through training, CPD, secondments and other forms of structured support, to develop predictive modelling skills, for example, and help meet the clinical data analytical demands of the NHS. Another study has, however, identified a lack of clear career pathways hindering the movement of a vast NHS workforce, many in administrative roles requiring data management skills, into the field of health data analytics[54].

For those already working in the field of clinical informatics, investment in further training and CPD is required if organisations are to take data analytics and data science seriously. This has not necessarily been the case in recent years. It has been reported that data analysts in NHS trusts have very few opportunities to develop their skills professionally[22, 53, 54]. A survey carried out on the healthcare data, information and knowledge workforce in Scotland found that only six per cent of respondents were engaged in defined learning opportunities, while 64 per cent said they would welcome learning and development opportunities, particularly in advanced technical skill areas including AI methodologies, R and Python[61]. Further training and CPD opportunities could be made available to staff in clinical informatics through organised programmes of shared learning. Design and development of effective programmes will require investments to be made in order to, for example, secure expert input from educationalists. Investment in developing regional or national learning infrastructure to enable the sharing of learning and best practice in data science is a recommendation that has been put forward by the Health Foundation[22].

Addressing the further training and CPD needs of the existing clinical informatics staff group is about recognising that there are different forms and types of competencies required in this area. These competencies are based on qualifications setting out domain knowledge gained, skills developed through on-the-job training and practice in the use of data analytical techniques, and experience of using data in a healthcare setting. Recognising these different forms and types of competencies will mean that different levels of training and CPD will need to be made available. Some individuals may not necessarily have an MSc in health data science but instead an under- or postgraduate degree in, for example, the social or life sciences, acquiring skills in data analytics in a non-healthcare setting. Their training and CPD

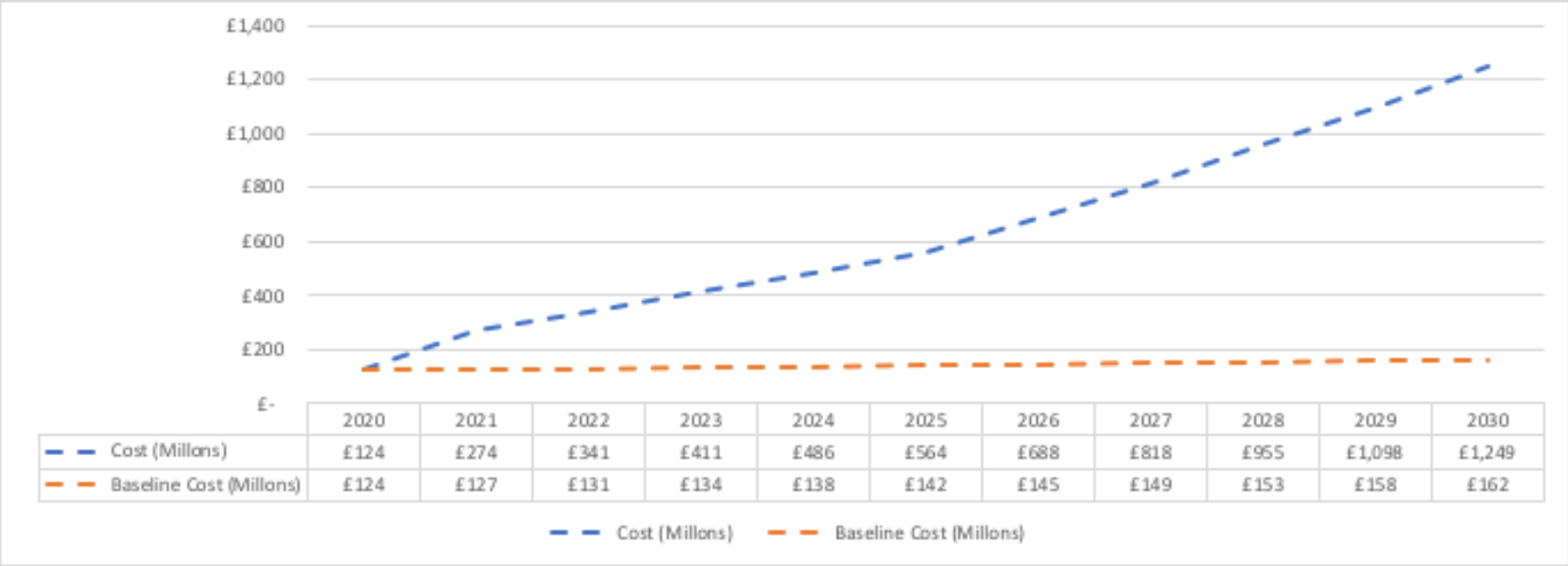
will therefore need to focus on applying their existing skill set to the context of healthcare and acquiring a working knowledge of the medical sciences. Data scientists in the NHS looking to work in the field of knowledge engineering will need to apply their existing skills in statistical analysis and data modelling, undertake training to develop technical competence around computer programming and computational thinking, and understand data-based reasoning when applying AI in healthcare.

Development opportunities exist for clinicians to develop burgeoning careers in data, digital and technology-enhanced roles. These include the Topol Digital Health Fellowship, commissioned by HEE, which provides protected time for multi-professional clinicians to be supported to deliver a digital change project in their service. However, given that digital health career roles have not been formally recognised and professionalised means that the landscape for clinicians to emerge and develop a digital career is restricted. Accrediting digital education, and training and mapping digital competencies into training pathways for clinicians, can ensure that these skill sets are visible and integrated into teams and career pathways. Developing hybrid clinical job roles, agreed by professional bodies, the medical royal colleges, and health and care services, can further this integration and ensure professionals can safely practice as digital health care professionals.

Salary and employment on-costs

The salary and employment on-costs for the clinical informatics staff group of 1,775 WTEs in 2020 was estimated to be around £124 million. If the number of staff increases to 13,731 WTEs, as projected in the demand forecast for the Data Driven Future scenario, the costs will be in the region of £1.25 billion in 2030 (Figure 6E.6). These calculations are based on a mean salary pay point corresponding to the top of NHS Agenda for Change band 8a and the assumption that salaries will increase by 2.7 per cent per annum, and employment on-cost at 34.9 per cent (21 per cent for the NHS pension and 13.9 per cent National Insurance contribution). The projected salary and employment on-costs for a Data Driven Future does not factor in any changes by job level to the composition of the staff group. Therefore, the figure of £1.25 billion should be regarded as the minimum estimate for 2030. It is worth contrasting the figure of £1.25 billion with the £162 million (baseline costs) that represents the salary and employment on-costs of a workforce remaining at 1,775 WTEs in 2030.

Figure 6E.6: Change in salary and employment on-costs in a Data Driven Future for the clinical informatics staff group



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost (Millons)	£124	£274	£341	£411	£486	£564	£688	£818	£955	£1,098	£1,249
Baseline Cost (Millons)	£124	£127	£131	£134	£138	£142	£145	£149	£153	£158	£162

6F. Knowledge management

Requirements in the NHS

NHS knowledge and library services incorporate knowledge-management functions in NHS trusts. The delivery of knowledge services within trusts encompasses the management of physical and online library services, and resources for NHS staff and learners. It includes mobilising knowledge, including staff know-how, delivering evidence to the point of care, and ensuring the right knowledge and all types of evidence – not just clinical – are available to clinicians and non-clinicians, learners (including apprentices and students on work placement in the NHS), patients, and the public. This is achieved through a broad service offer that includes mediated evidence searches, training in information skills, and the adoption of knowledge, mobilisation techniques, horizon scanning, and the management of corporate knowledge and assets. The HEE Knowledge and Library Services team has reported that demand for knowledge services has grown, with a 30 per cent increase in service users since 2014.

Scenario A: Data Driven Future 2030

Projected demand forecast

The demand forecast for a Data Driven Future indicates that the knowledge management staff group will need to:

- (Figure 6F.1) Increase the overall number of staff by around 179 per cent between now and 2030, from its estimated current size of 788 WTEs to the forecasted required size of 2,200 WTEs.

- (Figure 6F.2) Increase the number of support staff by around 140 per cent to 880 WTEs by 2030, and the number of professional staff by around 301 per cent to 960 WTEs. There will also need to be a 61 per cent increase in the number of managers, to 290 WTEs. Senior leadership positions will need to be introduced into the knowledge management staff group, including knowledge and library services, to the extent of 65 WTEs by 2030.

- (Figure 6F.3) The next 10 years will see an increased professionalisation of this staff group. There will be an increase in the proportion of staff in a professional role, from 30 per cent to 44 per cent, while the proportion of support staff will decline from 47 per cent to 40 per cent. The introduction of senior leaders will see them make up three per cent of the knowledge management staff group by 2030 but the proportion of managers will fall to 13 per cent.

Figure 6F.1: Supply projection and demand forecasts for knowledge management staff in a Data Driven Future and Data Desert Future – 2020/21 to 2029/30

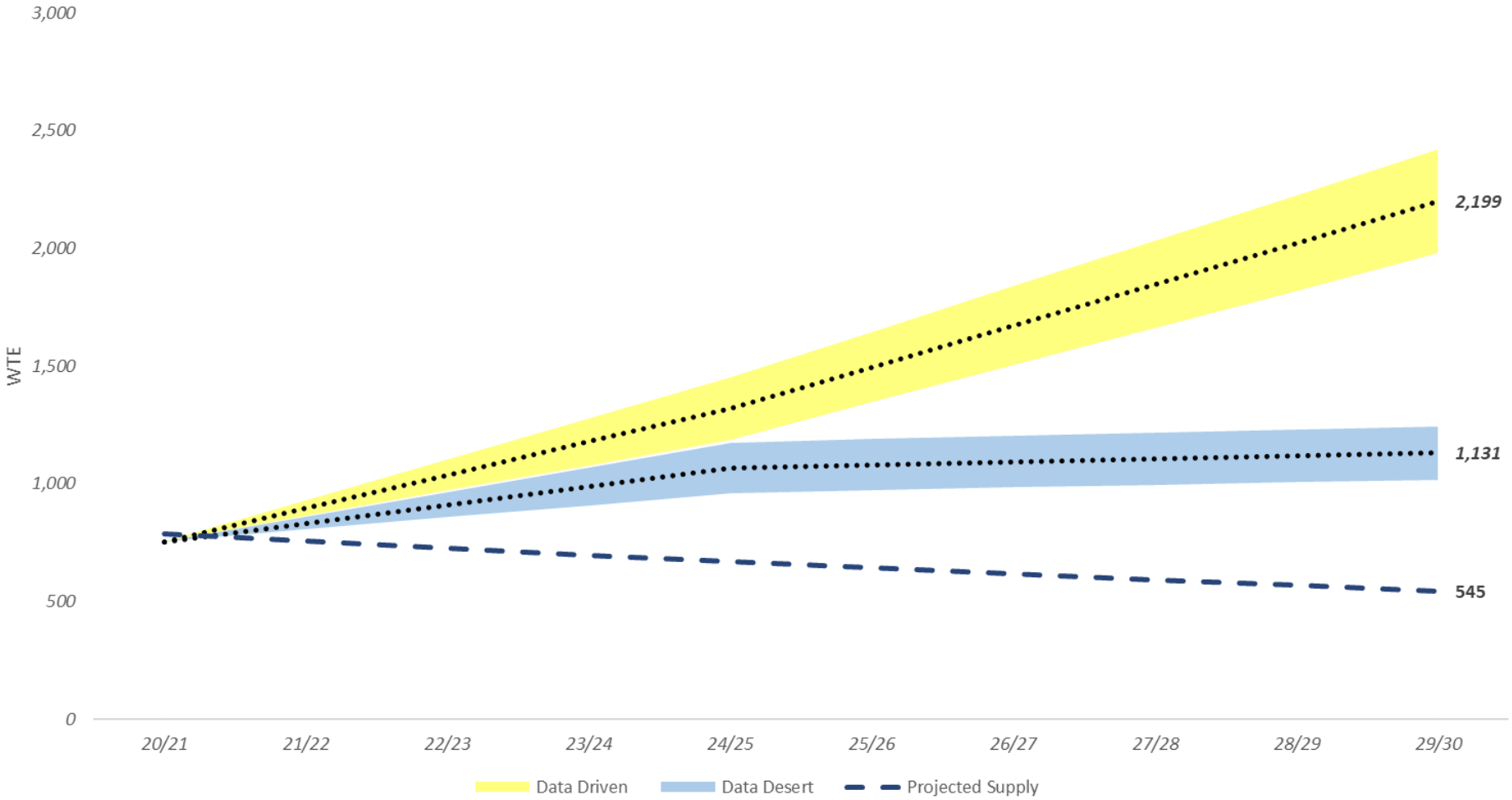


Figure 6F.2: Changes in staffing levels required in knowledge management for a Data Driven Future

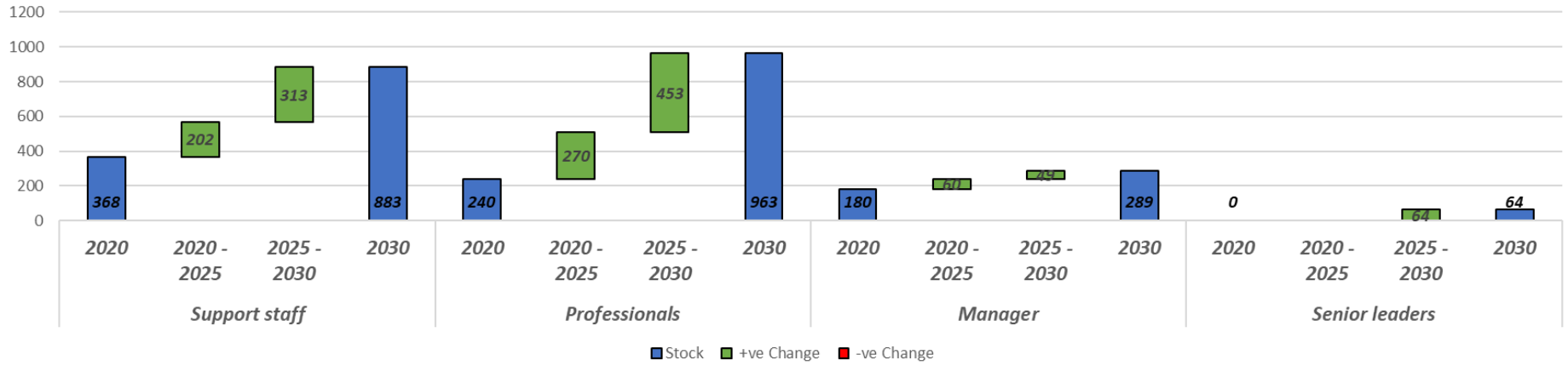
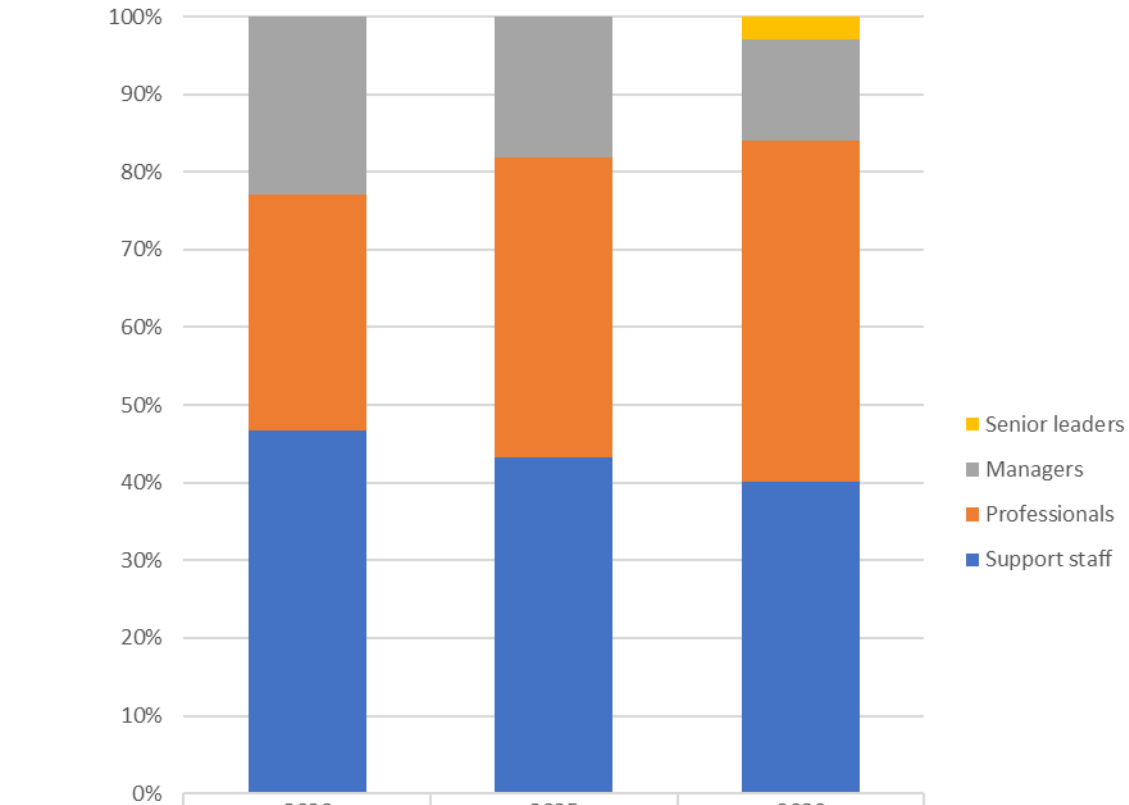


Figure 6F.3: Composition of the knowledge management staff group leading up to and in a Data Driven Future



	2020	2025	2030
Senior leaders	0%	0%	3%
Managers	23%	18%	13%
Professionals	30%	39%	44%
Support staff	47%	43%	40%

Projected supply

The projected supply for the next 10 years indicates a decrease of 31 per cent in the overall number of knowledge management staff, including those in knowledge and library services, from 788 WTEs in 2020 to 545 WTEs by 2030 (Figure 6F.1). This will mean that in a Data Driven Future there will be a shortfall of around 1,650 WTEs by 2030 in the absence of any policy interventions and required investments made in the areas of building capacity, training and CPD, or recruitment and retention in the next 10 years. The supply projection is based on data held in the NHS Electronic Staff Record (ESR) system for those staff members categorised as working in the area of knowledge management. The baseline figure of 788 WTEs derived from the ESR database does not correspond with the figure of 1,004 WTEs identified in a 2019-20 survey of this staff group by the HEE Knowledge and Library Services team.

Viewpoints of participants

Those taking part in the demand-forecasting exercise perceived knowledge management staff very much as a gateway for others, including clinicians and

patients, to access data and information and the evidence base around health and healthcare. Face-to-face provision of services will likely diminish but contact with professional staff is important for clinicians and patients when negotiating a growing and ever more complex healthcare knowledge base. This contact with services and professional staff will, in the next 10 years, increasingly be made remotely through online channels.

The Data Driven Future is one where the knowledge and information base underpinning healthcare will continue to grow and expand, and this will have an employment effect on the knowledge management staff group. This is reflected in the projected demand figures for this scenario, where a noticeable increase in support, professional and managerial staff is required in the next 10 years. One participant highlighted the current HEE policy recommendation that there should be one qualified library and knowledge management professional for every 1,250 staff members in healthcare. The recommendation from HEE is that those NHS organisations with a staffing ratio in the region of the current average, or less, strive to achieve a ratio of at least one qualified librarian or knowledge specialist per 1,250 WTE NHS staff (https://kfh.libraryservices.nhs.uk/staff-development/achieving-an-improved-staffing-ratio/). Clinicians accessing the healthcare knowledge base will be particularly dependent on professional and highly skilled knowledge management staff, as explained by one participant:

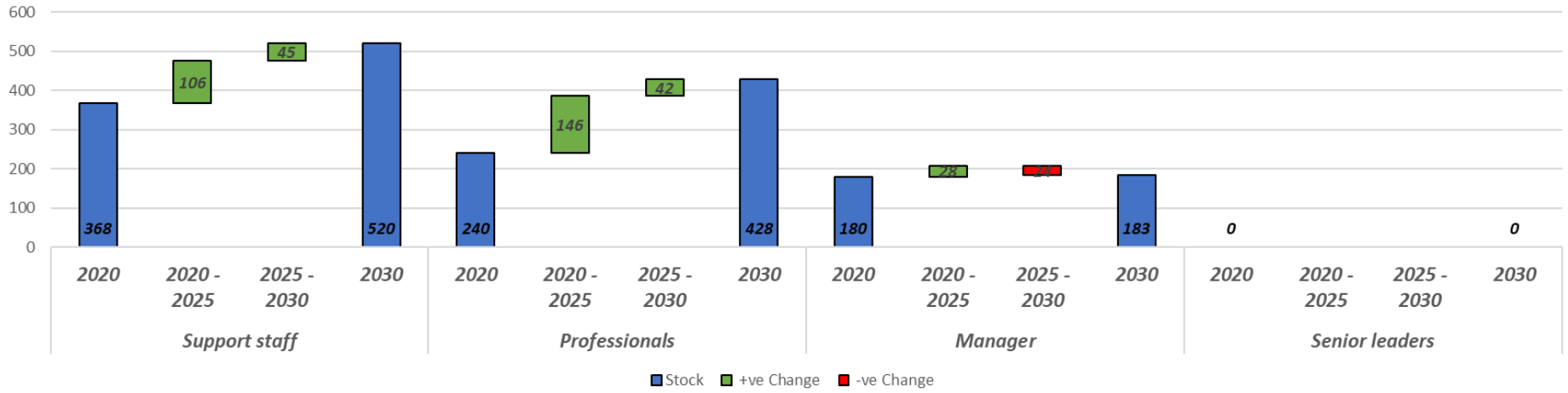
> The increasing requirements of a data-driven organisation and learning from data will require support from library services, and a 'clinical knowledge expert post' could be established within the professional section, possibly. This will allow direct contact with library services.

Those working in library and knowledge services were not seen as passive facilitators but instead would need to be actively involved in creating and developing products and services enabling access to a growing body of knowledge that is relevant to a clinician or patient. As explained by one participant, around supporting the information needs of patients:

> Increasingly important that knowledge is available for citizens regarding their personal information. Requires good content design, ability for individual to self-serve, clinical relevancy, inclusion and accessibility.

The educational role of knowledge management staff is seen to be very important in a Data Driven Future. This role is important if clinicians and patients alike are able to search for and critically appraise peer-reviewed published studies and link their findings to concerns about health and the delivery of healthcare. Critical appraisal requires an understanding of the analysis used in studies, and variations and implications of any findings. One participant made the point that clinicians need to distinguish between lesser- and higher-quality evidence, and therefore need to acquire skills in evidence analysis, deconstruction and synthesis to extract the relevant aspects from research to inform patient care and contribute to service transformation. It could also be argued that clinicians need to acquire or develop their research and publication skills to contribute to the knowledge base that underpins healthcare.

Figure 6F.4: Changes in staffing levels required in knowledge management for a Data Desert Future



Scenario B: Data Desert Future 2030

Projected demand forecast

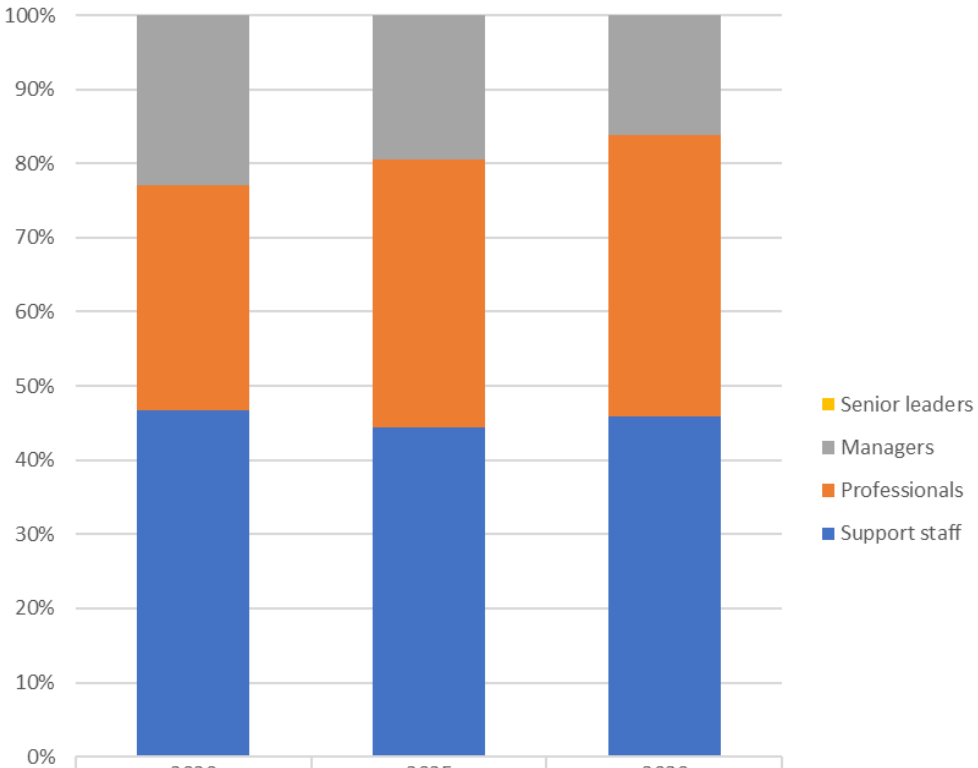
The demand forecast for a Data Desert Future indicates that the knowledge management staff group will need to:

- (Figure 6F.1) Increase the number of staff by around 44 per cent between now and 2030, from its estimated current size of 800 WTEs to the forecasted required size of 1,125 WTEs.

- (Figure 6.F4) Increase the number of support staff by 41 per cent to 525 WTEs and professional staff by 78 per cent to 425 WTEs. The number of managerial staff needs to remain the same at around 180 WTEs.

- (Figure 6.F5) Adjust to the composition of the knowledge management staff group by 2030. The proportion of professional staff will increase to 38 per cent but managers will decline to 16 per cent. The proportion of staff in supporting roles will need to remain the same at around 46 per cent.

Figure 6F.5: Composition of the knowledge management staff group leading up to and in a Data Desert Future



	2020	2025	2030
Senior leaders	0%	0%	0%
Managers	23%	19%	16%
Professionals	30%	36%	38%
Support staff	47%	44%	46%

Projected supply

The projected supply for the next 10 years indicates a decrease of 31 per cent in the overall number of knowledge management staff, including those in knowledge and library services, from 788 WTEs in 2020 to 545 WTEs by 2030 (Figure 6F.1). This will mean that in a Data Desert Future there will be a shortfall of around 575 WTEs by 2030, in the absence of any policy interventions and required investments made in the areas of building capacity, training and CPD, or recruitment and retention in the next 10 years. The supply projection is based on data held in the NHS Electronic Staff Record (ESR) system for those staff members categorised as working in the area of knowledge management. The baseline figure of 788 WTEs derived from ESR does not correspond with the figure of 1,004 WTEs identified in the 2019-20 survey of this staff group by the HEE Knowledge and Library Services team.

Viewpoints of participants

Those taking part in the demand-forecasting exercise acknowledged that the financial constraints of the Data Desert Future would lead to budgetary pressures being placed on knowledge management and library services in the NHS. However, these services are still needed by clinicians and patients alike. Clinicians will still need to access the healthcare knowledge and evidence base to support their work, while for patients the focus will be on helping them make informed decisions around self-care, preventive healthcare, and lifestyle choices.

The continued need for knowledge management and library services is reflected in an increase in demand for support and professional staff, although definitely not to the same extent as in a Data Driven Future. Some cost savings may be found by increasing the delivery of services remotely and online, and/or through the centralisation of staff in providing services to multiple NHS trusts.

Priorities for the knowledge management staff group – 2020 to 2030

Those taking part in the demand-forecasting exercise provided an indication of the priorities that will be placed on the knowledge management staff group over the next 10 years. These priorities are particularly relevant in a Data Driven Future. The suggestions made correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

Making increasing use of machine learning technologies and AI

The Chartered Institute of Library and Information Professionals (CILIP), the professional body for knowledge managers, is currently undertaking a technology review to identify new and emerging roles for knowledge and library specialists in a Data Driven Future. These roles include working in organisations that make increasing use of machine learning and AI. While the role of the knowledge specialist is often overlooked in relation to these technologies, they are particularly relevant to both search and customer-facing functions. Applications in machine learning and AI are particularly relevant in this sector.

Working within multidisciplinary clinical, management and research teams

Demand has been growing for embedded knowledge-broker roles responsible for searching and presenting evidence that is synthesised and summarised. The NHS will require proactive knowledge services with a blend of expertise, encompassing posts embedded in clinical and management teams delivering decision-ready information, and knowledge managers who mobilise organisational knowledge and staff know-how to underpin strategy and operations. It is anticipated that knowledge and library specialists will need to be embedded within multidisciplinary clinical and research functions of NHS trusts, or aligned with clinical specialty or departmental teams and other functions such as quality improvement teams and clinical practice guideline committees. Demand for knowledge management roles will also grow in the NHS outside of trusts, for example within HEE, academic health science networks (AHSNs), and arm's-length bodies including the Behaviour Change Unit at NHS England and Improvement.

Knowledge management specialists in embedded posts will need to work physically or virtually, outside the traditional library space, with their clinical, management and research colleagues throughout the organisation. Examples of these specialists are clinical librarians, quality improvement librarians, evidence and evaluation managers within clinical commissioning groups, and evidence specialists working alongside allied health professionals.

Managing corporate functions

The corporate functions of NHS trusts are becoming increasingly complex to manage. Knowledge managers are required with specialist skills and responsibilities for managing corporate functions through which knowledge is gathered, shared and used effectively to develop the organisation, support day-to-day practice, and improve performance and avoid errors.

Supporting the health, algorithmic and digital literacy agendas of the NHS

Knowledge specialists will be needed to highlight patient health literacy concerns through training sessions delivered to health professionals and NHS partners in other sectors. These specialists will also have a vital role in helping clinicians gain insight into and understanding of the operations of information search engines, to enable a critical appraisal and evaluation of search results. A good understanding of search engine ranking and bias, commercial influence, keyword appropriation, and other factors will be required by knowledge specialists in order to train clinicians. Supporting the NHS staff digital literacy agenda is becoming implicit throughout many of the functions of knowledge specialists. As knowledge services and resources are increasingly provided digitally, end users often require assistance in adapting to this model of delivery.

Table 6F.1: In-demand, emerging and new job roles in knowledge management in a Data Driven Future – summary of roles and skills required and links to further information

Job role	Summary of role and skills required	Job role – link	Skills – link
Clinical librarian	Member of a multi-professional clinical team and provides evaluated clinical evidence for patient care at the time and point of need.	HEE LKS	CILIP
Commissioning knowledge officer	Works closely with commissioners and provides evidence relating to commissioning and service redesign, and supports understanding of the wider health economy.	HEE LKS	CILIP
Knowledge manager	Develops and leads on implementation of knowledge management strategy, policy, protocols, systems and processes to ensure robust evidence underpins all decision-making in organisations.	HEE LKS	CILIP
Patient information specialist librarian	Provides information to patients, families, staff and visitors by managing walk-in patient information points and handling enquiries.	HEE LKS	CILIP
Public health evidence and knowledge officer	Synthesises evidence and knowledge to inform commissioning, policy and service design decisions. Works alongside researchers and analysts, summarising reports and disseminating complex public health information and issues to the wider public health workforce.	HEE LKS	CILIP
Systems manager	Manages shared regional library management systems, leads and coordinates resource-sharing, and provides oversight of electronic resource procurement and provision.	HEE LKS	CILIP
Embedded knowledge specialist	Working outside of the library space, the embedded knowledge specialist works with teams within the organisation to proactively identify knowledge and evidence needs, and deliver in a timely fashion. Key skills include evidence searching, critical appraisal, team-working, facilitation, and communication.		

Research specialist	Main responsibilities include systematic searching, automation of processes through the use of AI for text or data mining, and creation and maintenance of repositories for research and data sets.		

Job roles and skills

Those taking part in the demand-forecasting exercise provided an indication of knowledge management job roles and skills required in NHS organisations in the 10 years leading up to 2030. These requirements are particularly applicable in a Data Driven Future. The suggestions made as to these job roles and skills correspond with those found in reports looking at the future of digital technology and informatics in health services, nationally and internationally.

In-demand, emerging and new job roles

The composition of the knowledge management staff group in terms of job roles and skills required will be quite different in 2030 compared to what is seen today. Some existing job roles and skills may be made redundant by advances in technology such as AI, or superseded by new roles and skills as the result of digital or organisational transformation of NHS trusts. Based on an analysis of reports in this area, in-demand, emerging and new job roles are identified in Table 6F.1. Some of these job roles will also be found in other areas of the digital technology and informatics workforce in 2030.

Investment in knowledge management

The demand-forecasting exercise and a review of reports on digital technology in healthcare have highlighted areas where investment is needed over the next 10 years to develop the capacity and capability of knowledge management staff in the NHS. These areas of investment are particularly required in a Data Driven Future.

Building capacity

The approach of the HEE Knowledge and Library Services team to planning and developing the knowledge and library specialist workforce is outlined in their Knowledge for Healthcare Strategy document (due for publication in January 2021). The team is also working with several higher education institutions that deliver masters-level programmes in knowledge, library, and information specialisms to ensure health is included within the curriculum. The team is working through the National School of Healthcare Science with Manchester University to develop a Certificate in Digital Technologies, tailored for knowledge specialists, looking particularly at AI and machine learning in this function. Health Education England has worked with partners in the development of a Level 3 apprenticeship, which is currently in place for library, information and archive assistants. Level 6/7 apprenticeships offering an alternative route into the profession for knowledge and library specialists is currently under development. The Chartered Institute of Library and Information Professionals (CILIP) offers professional registration at certified, chartered and fellowship level, providing professional recognition for knowledge managers, library and information specialists, and data managers. A Professional Knowledge and Skills Base (PKSB) developed by CILIP provides a professional competency framework to assist in the development of staff in this sector[64].

Training and continuing professional development

The Knowledge and Library Leads team at HEE has a well-established national CPD programme for NHS knowledge and library specialists. Well-attended study workshops have included, for example, the application of AI in knowledge and library services. Provision of training and CPD is through a hybrid of face-to-face and online courses, with content determined by strategic development priorities, supplemented by a biennial development-needs survey and analysis. These mechanisms will be utilised to ensure that equitable, consistent, and appropriate opportunities for skills development are available to health knowledge and library specialists across England.

A proposal is underway to develop a HEE specialist Learning Academy for the Health Library and Knowledge Services Workforce in order to co-ordinate a tailored and accredited training offer for specialists. Health Education England should also continue to prioritise the provision of leadership development opportunities, along with training and CPD initiatives aimed at building a digitally confident health knowledge and library services workforce, and supporting self-directed personal and professional development via an online learning zone. Investment is required in education and training for the new roles and responsibilities presented by AI, machine learning and robotics, which are already reshaping the ways that knowledge and library service teams can create, discover, use and share information, working alongside clinical teams and clinical informaticians.

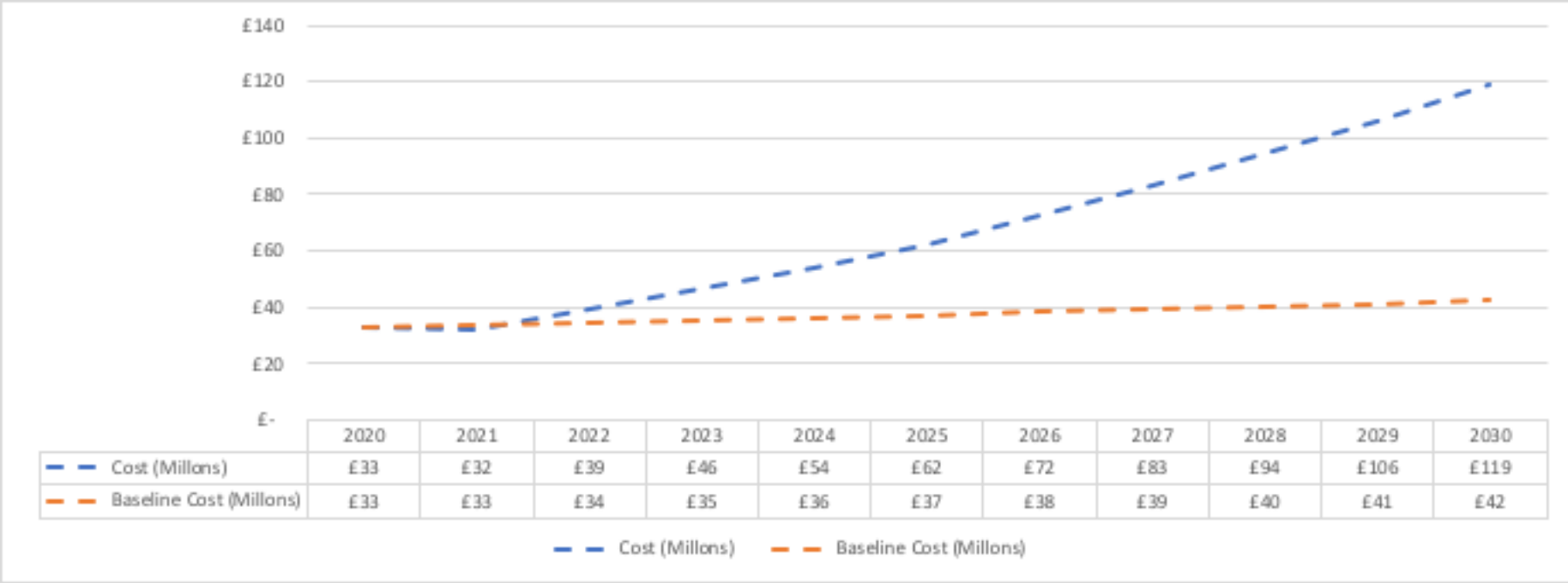
Recruitment and retention

The Knowledge and Library Leads team at HEE maintains a collection of recent job descriptions and person specifications for use, alongside the appropriate NHS Agenda for Change Job Profiles, in advising NHS organisations when recruiting for knowledge-specialist staff. This will help ensure that the changing requirements of the digital future are reflected in the criteria against which knowledge specialists are recruited. Efforts will need to be made to change current recruiting practices, which tend to focus job advertisements on existing NHS staff and those signed up to the NHS Jobs website, to ensure staff are recruited from more diverse backgrounds and sectors. The use of social media platforms such as LinkedIn may offer one solution to this. The HEE team has developed a range of resources for the redesign of knowledge and library service roles, to meet the changing needs of organisations. The resources for role redesign include a suite of job role descriptions, together with an outline of the skills required for each. Efforts to ensure a range of career pathways is available to knowledge specialists, combined with appropriate CPD to address any skills gaps, will help with retention issues. Work currently underway in this regard includes plans to develop training offers for those interested in pursuing knowledge and library service manager roles.

Salary and employment on-costs

The salary and employment on-costs for the knowledge management staff group of 800 WTEs in 2020 was estimated to be around £33 million. If the number of staff increases to 2,200 WTEs, as projected in the demand forecast for the Data Driven Future scenario, the costs will be in the region of £119 million in 2030 (Figure 6F.6).

Figure 6F.6: Change in salary and employment on-costs in a Data Driven Future for the knowledge management staff group



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost (Millons)	£33	£32	£39	£46	£54	£62	£72	£83	£94	£106	£119
Baseline Cost (Millons)	£33	£33	£34	£35	£36	£37	£38	£39	£40	£41	£42

These calculations are based on a mean salary pay point corresponding to the top of NHS Agenda for Change band 5 and the assumption that salaries will increase by 2.7 per cent per annum, and employment on-cost at 34.9 per cent (21 per cent for the NHS pension and 13.9 per cent National Insurance contribution). The projected salary and employment on-costs for a Data Driven Future does not factor in any changes by job level to the composition of the staff group. Therefore, the figure of £119 million should be regarded as the minimum estimate for 2030. It is worth contrasting the figure of £119 million with the £42 million (baseline costs) that represents the salary and employment on-costs of a workforce remaining at 800 WTEs in 2030

6G. IT programmes and project management

Requirements in the NHS

Digital transformation and change in the NHS require IT programmes and project management staff who understand the principles underpinning the technology and implications for an organisation and its work processes. Individuals in specialist roles such as business analysts, change managers, data integration specialists, implementation facilitators, knowledge engineers, product owners, service managers, solution architects, system designers or user experience designers may all be working on a project management basis. These roles often involve examining the flow of information within organisations and then engaging with clinical teams to translate their requirements and develop the right digital tools for improving the delivery of healthcare. Professionals in these roles form the digital and product delivery teams that all NHS trusts must plan for. Health Education England and NHS Providers have published guidance, entitled Building and Enabling Digital Teams[65], on the roles required in digital teams and, while they are not traditional generic project and programme managers, they are responsible for safe and effective digital change and change management.

Many NHS trusts have already made significant changes to their digital technology workforce, including the recruitment of programme and project managers and role specialists working in this capacity. This is particularly the case in trusts recognised as Global Digital Exemplars or seeking this status[23]. Figures from the NHS Electronic Staff Record system shows the number of staff categorised as working in IT programmes and project management increased by 196 per cent over five years, from 456 WTEs in 2014 to 1,350 WTEs in 2019.

Scenario A: Data Driven Future 2030

Projected demand forecast

The demand forecast for a Data Driven Future indicates that the IT programmes and project management staff group will need to:

- (Figure 6G.1) Significantly increase the overall number of staff by around 179 per cent between now and 2030, from its estimated current size of 1,750 WTEs to the forecasted required size of 4,850 WTEs.

- (Figure 6G.2) Increase the number of support staff by around 230 per cent to 1,325 WTEs by 2030, and the number of professional staff by around 230 per cent to 2,575 WTEs. The number of staff in a managerial role will need to increase by around 59 per cent to nearly 900 WTEs. Senior leadership roles will need to be introduced into this staff group so that 70 or so WTEs will be employed by 2030.

Figure 6G.1: Supply projection and demand forecasts for IT programmes and project management staff in a Data Driven Future and Data Desert Future – 2020/21 to 2029/30

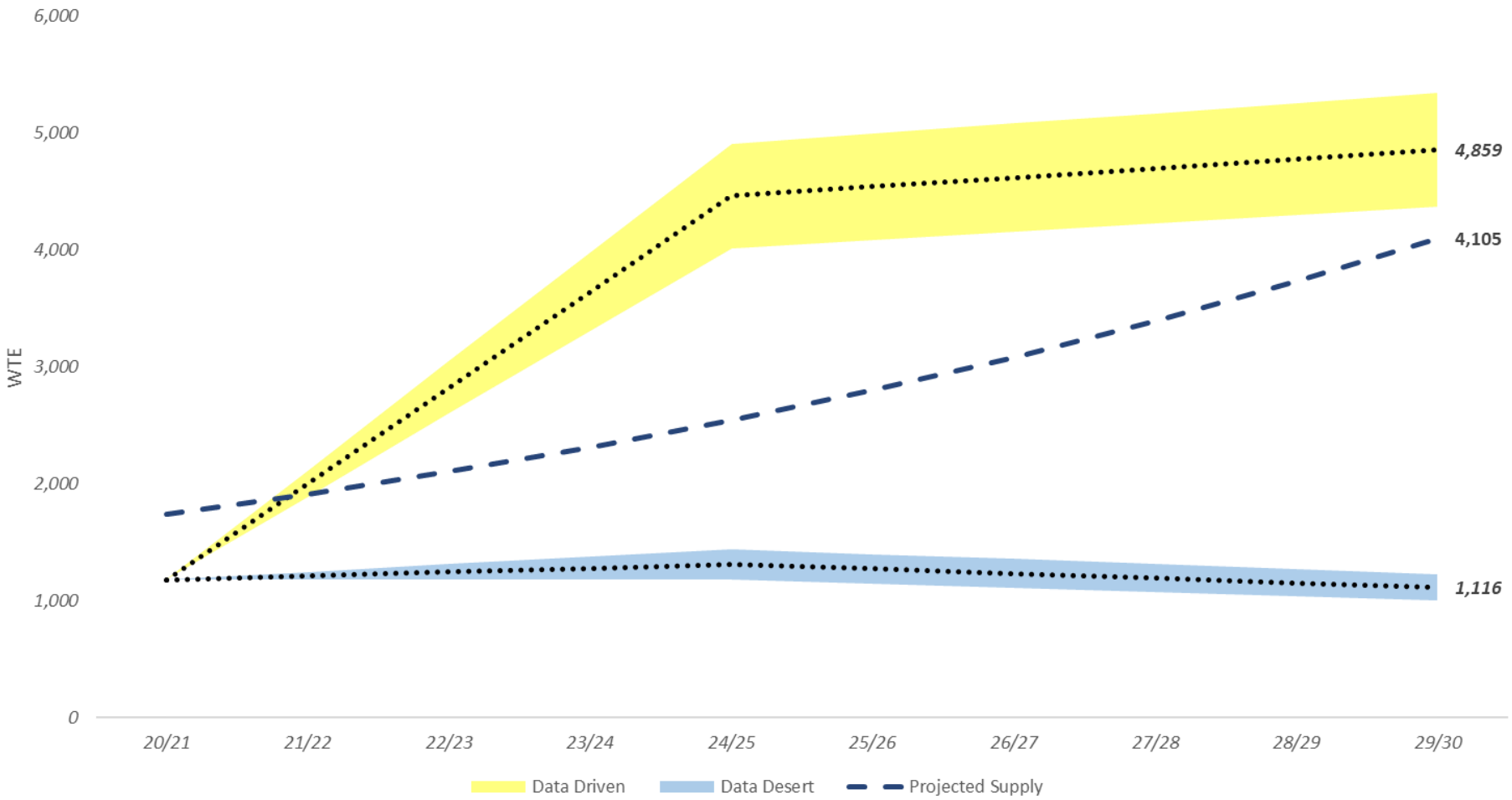


Figure 6G.2: Changes in staffing levels required in IT programmes and project management for a Data Driven Future

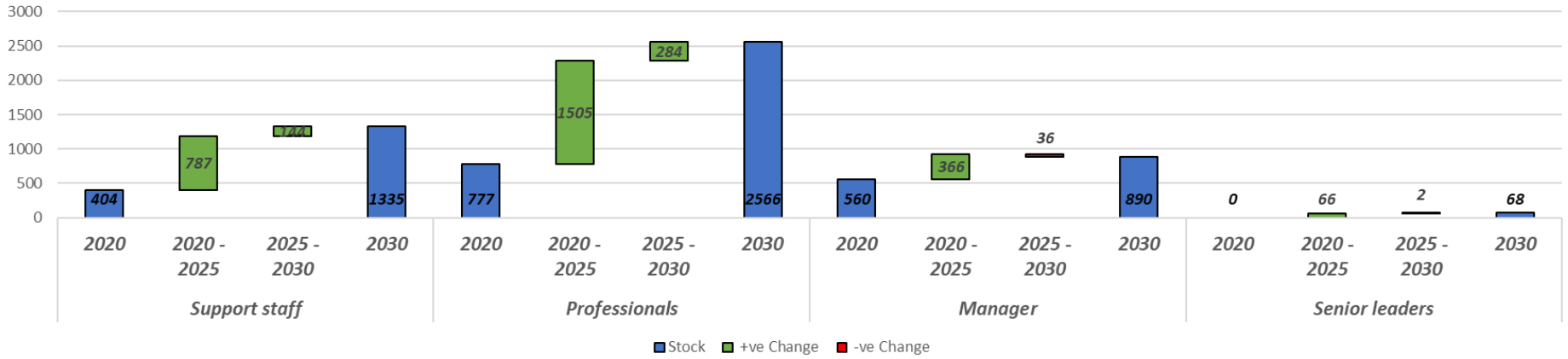
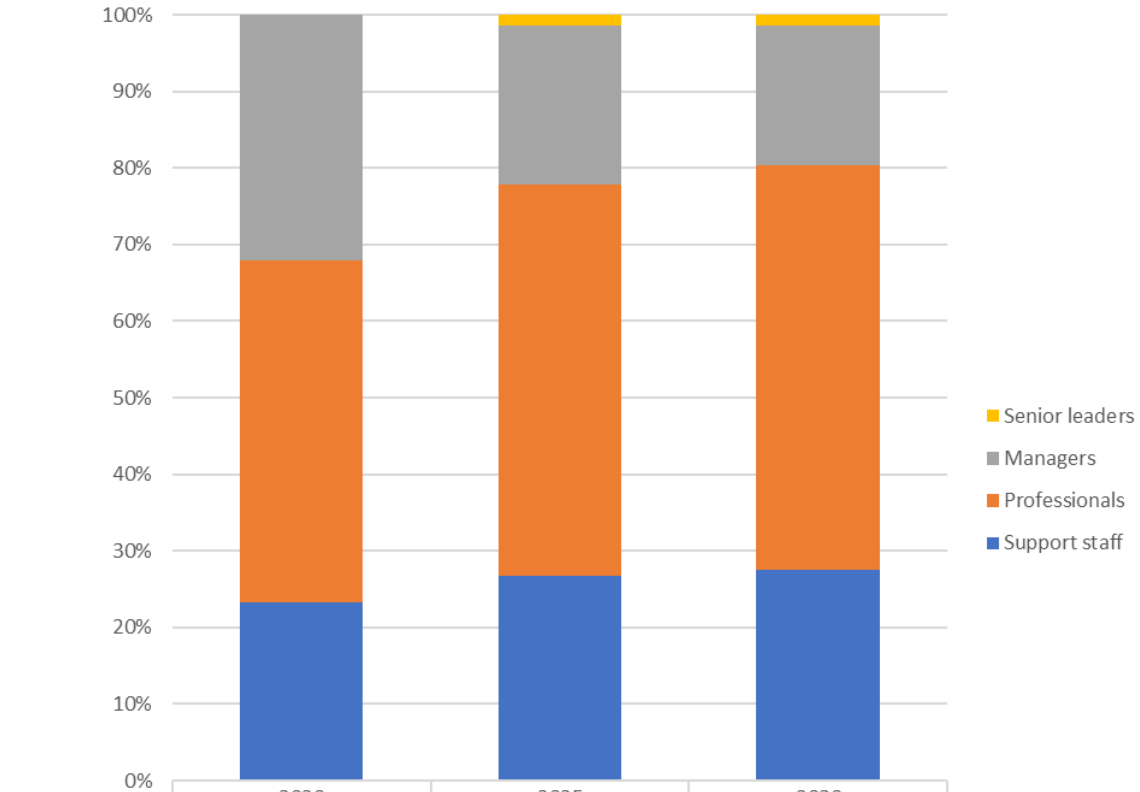


Figure 6G.3: Composition of the IT programmes and project management staff group leading up to and in a Data Driven Future



	2020	2025	2030
Senior leaders	0%	1%	1%
Managers	32%	21%	18%
Professionals	45%	51%	53%
Support staff	23%	27%	27%

- (Figure 6G.3) The next 10 years will see a change in the composition of this staff group. The proportion of support staff will need to slightly increase to 27 per cent and the proportion of professional staff to 53 per cent. Although there will be an increase in the number of staff in a managerial role, as a proportion of the IT programmes and project management staff group there will be a reduction from 32 per cent to 18 per cent. The introduction of senior leadership positions will mean that by 2030 this role will make up one per cent of this staff group.

Projected supply

The projected supply for the next 10 years indicates an increase of 136 per cent in the overall number of IT programmes and project management staff to around 4,100 WTEs by 2030 (Figure 6G.1). This will mean that in a Data Driven Future there will be a shortfall of around 750 WTEs by 2030, in the absence of any policy interventions and required investments made in the areas of building capacity, training and CPD or recruitment and retention in the next 10 years.

Viewpoints of participants

Digital transformation and change go hand-in-hand with IT programmes and project management. Those participating in the demand-forecasting exercise saw the criticality of change management where technology is used to transform services in an NHS trust. To do this effectively requires a centralised project management office (PMO) in the organisation. The PMO would be staffed by specialist programme and project management staff and support staff in areas such as business analytics, solution architecture, and system and user-experience design. As explained by one participant:

> Significant increase in PMO resource to drive and embed the progression of the digital environment, manage the change and realise the benefits in order to progress further. Existing acute trusts with digital ambition in 2020 need good and full range of PMO skills [and] resources.

The need for a dedicated PMO is supported by the reasoning that digital technologies will proliferate within an NHS trust and change would be a common and constant feature in the Data Driven Future. Successful digital and technological change would be increasingly complex to implement. The legacy technical position that many NHS trusts operate from requires careful management to transition to newer technologies. Adding to this complexity is the need to link new technologies to existing ones within the organisation and external to it. This linkage requires the use of standards around clinical risk management, clinical vocabulary such as SNOMED-CT, and interoperability, which should all be in the technical skill or knowledge domains of specialist programme and project managers. Those working as solution architects, for example, would have in their remit keeping abreast of national NHS Digital and NHSX initiatives and engaging with regional and national networks to share learning and best practice. It is also envisaged that programme and project managers work within specialist clinical teams to implement advanced technology such as robotic process automation in enhancing the delivery of healthcare.

Scenario B: Data Desert Future 2030

Projected demand forecast

The demand forecast for a Data Desert Future indicates that the IT programmes and project management staff group will need to:

- (Figure 6G.1) Reduce the number of staff by around 36 per cent between now and 2030, from its estimated current size of 1,750 WTEs to the forecasted required size of 1,125 WTEs.

- (Figure 6G.4) Significantly reduce the number of support staff by around 50 per cent to 200 WTEs by 2030, and the number of professional staff by around 14 per cent to 675 WTEs. The number of staff in a management role will need to decrease by around 57 per cent to 250 WTEs.

Figure 6G.4: Changes in staffing levels required in IT programmes and project management for a Data Desert Future

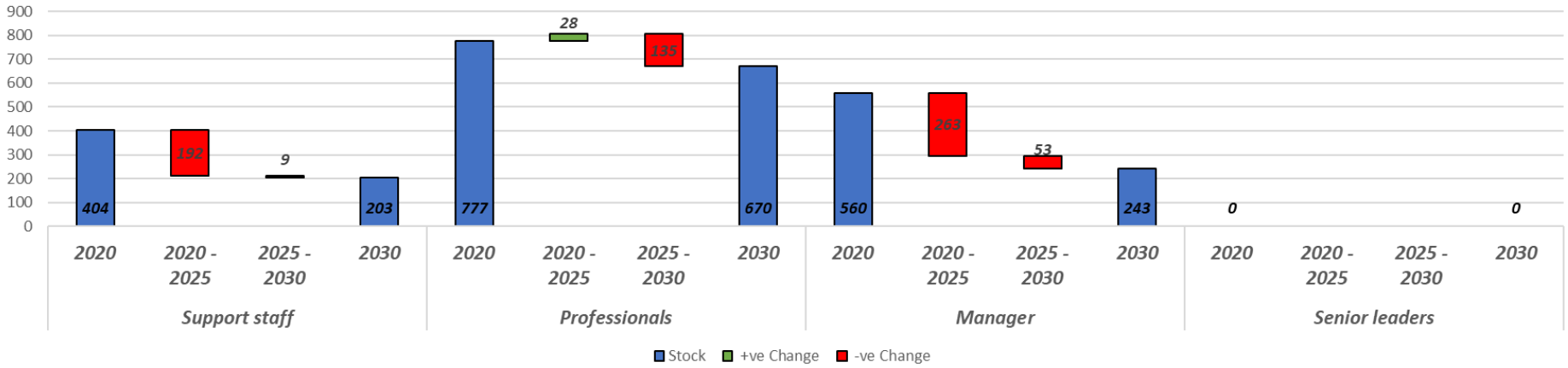
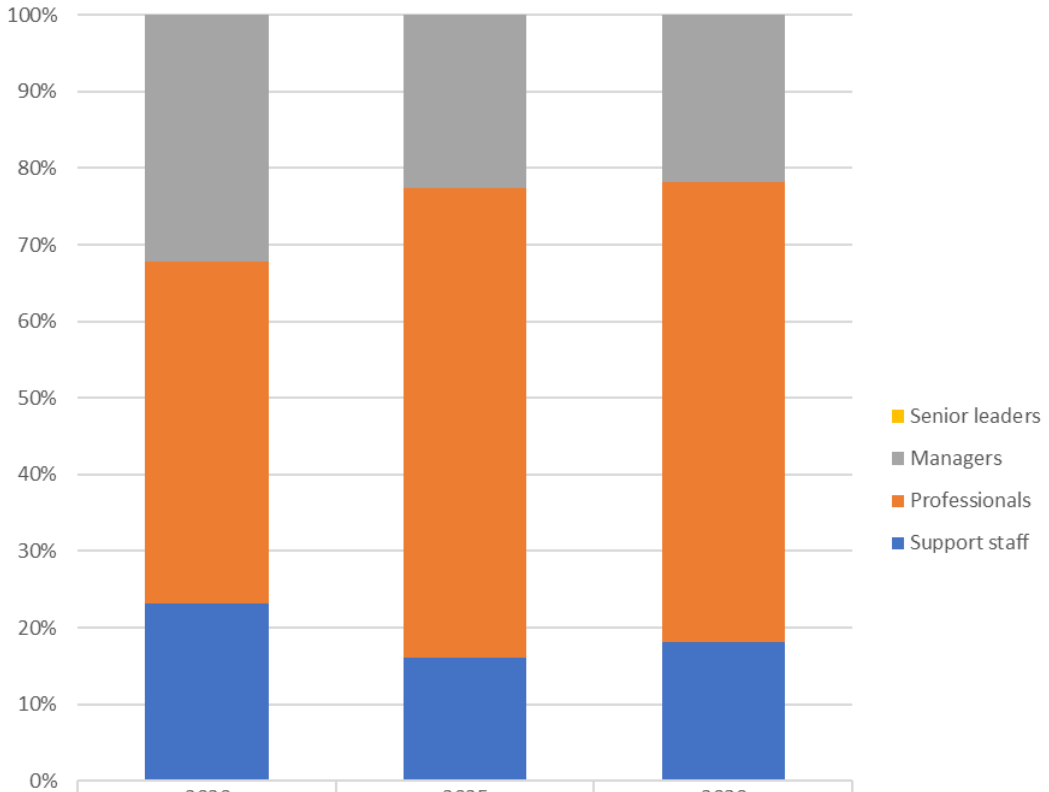


Figure 6G.5: Composition of the IT programmes and project management staff group leading up to and in a Data Desert Future



	2020	2025	2030
Senior leaders	0%	0%	0%
Managers	32%	23%	22%
Professionals	45%	61%	60%
Support staff	23%	16%	18%

- (Figure 6G.5) The next 10 years will see a change in the composition of this staff group. The proportion of support staff will need to fall to 18 per cent and managers to 22 per cent of the IT programmes and project management staff group. There will be an increase in the proportion of staff in a professional role from 45 per cent to 60 per cent.

Projected supply

The projected supply for the next 10 years indicates an increase of 136 per cent in the overall number of IT programmes and project management staff, to around 4,100 WTEs by 2030 (Figure 6G.1). This will mean that in a Data Desert Future there will be a surplus of around 3,000 WTEs by 2030, in the absence of any policy interventions around redeployment, recruitment and retention.

Viewpoints of participants

Those taking part in the demand-forecasting exercise felt the financially constrained environment of the Data Desert Future will mean that digital and technological change is downgraded as a priority in NHS trusts. This runs the risk of existing IT

systems and dependent healthcare services failing, healthcare records (and therefore clinical care) becoming fragmented or only partly integrated, and the maintenance of remaining legacy IT systems placing a heavy burden on IT staff.

Any changes made will be undertaken as small-scale projects focussed on making critical replacements in IT, or optimising ongoing operations based on existing IT systems and infrastructure. Changes will be isolated events not involving integration with other systems, and therefore will require a lower technical skill set. The management of these changes is likely to be absorbed by clinicians, technicians and general managers rather than through the appointment of specialist programme and project management staff.

Limited investment in new technologies and digital change will result in less demand for IT programmes and project managers and role specialists working in this capacity. Financial constraints placed on the NHS will mean difficulties recruiting and retaining talented staff, including programme and project managers. Without a sufficient number of these professionals, less in-house IT bespoke development work will be carried out and NHS trusts will see less integration of new technology at the scale required for full digital transformation and functionality. Those programme and project managers continuing to work in the NHS will need to take on other responsibilities, including the provision of IT training, helpdesk support and end-user support. Any dedicated project management teams remaining will be under-resourced and only be able to deal with short-term urgent requests rather than be involved in long-term digital transformation activities.

Priorities for the IT programmes and project management staff group – 2020 to 2030

Those taking part in the demand-forecasting exercise provided an indication of the priorities that will be placed on the IT programmes and project management staff group over the next 10 years. These priorities are particularly relevant in a Data Driven Future. The suggestions made correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

Adopting Agile project management skills

The next 10 years will see large-scale digital projects to embed cross-organisational systems, such as electronic health and patient records, come to fruition in the NHS, while supplier markets providing standards-based interfacing technology will reach maturity. This will mean large-scale development and integration projects declining in number as we approach 2030. The emphasis instead will be on continuously improving existing technology through small-scale but focused projects, and working collaboratively with clinicians in different specialties to create digital products that enhance their work and the delivery of healthcare. In managing these types of projects, there is a need to move away from prescribed methodologies, such as PRINCE2, to more Agile tools and techniques. Agile project management is an umbrella term for an approach in delivering requirements and improvements iteratively and incrementally, by working collaboratively with stakeholders.

Collaborative working with clinicians and patients

The ability to coordinate digital health projects with input from key stakeholders is important, especially given that a key feature of effective digital innovation in health services is collaborative design[21]. This approach involves bringing together and managing the contributions of technical innovators, clinicians and patients throughout the digital innovation process. Bringing together and establishing a working partnership between these stakeholders, and understanding their complex needs, requires good business analytical skills and project management skills.

Take on digital and technical translator roles

Good programme and project management in the realisation of digital transformation and change is about understanding and translating the clinical needs of health services and healthcare staff into requirements for technological and data products. Case studies on successful digital change management in the NHS have highlighted the importance of 'bridge' professionals, who hold boundary-spanning roles and act as translators between the clinical and technical professions[20]. A report by the Digital Health and Care Institute based at University of Strathclyde Glasgow envisages professionals working in the space between technology and people[35]. These professionals, sometimes called product owners, implementation facilitators, knowledge engineers or user-service designers, work on projects that require understanding and translation of the technological, data and knowledge needs of end users in the development and implementation of digital products. Product owners, for example, have a critical role in Agile software development projects, translating the needs of clinicians into actionable work for IT development teams.

Managing external IT suppliers

NHS organisations implementing changes to their digital and technological set-up are often supported by external bodies, including commercial IT suppliers working on a defined project basis. Establishing a good working partnership with a supplier and ensuring that their products are tailored to the needs of the organisation is important. A programme or project manager in the NHS will need to get clinicians on board and at the same time utilise the expertise of the supplier, who will often have considerable experience of supporting digital change in other organisations[20].

In the pharmaceutical industry, the trend when making changes to digital technology has been to outsource development work to external IT suppliers for cost savings and better technical support[66]. This trend has prompted a sharper focus on – and increased need for – project management account executives in pharmaceutical companies, to manage relationships with these suppliers. The same need may arise in the NHS. One of the participants in the demand-forecasting exercise questioned whether NHS trusts should be developing their own digital applications, given the lack of technical capacity and the difficulty in managing risks associated with such projects. It was felt that commercial suppliers were in a better position to deliver these applications, subject to them meeting interoperability standards. Outsourcing of IT development activities is expected to become more prominent in all sectors of the economy, including healthcare. This is the view of the UK Commission for Employment and Skills on the future of work, and organisations will need to have the

skills to enable collaborative and project-based ways of working with external suppliers[57].

Job roles and skills

Those taking part in the demand-forecasting exercise provided an indication of IT programmes and project management job roles and skills required in NHS organisations in the 10 years leading up to 2030. These requirements are particularly applicable in a Data Driven Future. The suggestions made regarding these job roles and skills correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

In-demand, emerging and new job roles

In terms of job roles and skills required, the composition of the IT programmes and project management staff group will be quite different in 2030 compared to what is seen today. Some existing job roles and skills may be made redundant by advances in technology such as AI, or superseded by new roles and skills as the result of digital or organisational transformation of NHS trusts. Based on an analysis of reports in this area, in-demand, emerging and new job roles are identified in Table 6G.1. Some of these job roles will also be found in other areas of the digital technology and informatics workforce in 2030.

Investment in IT programmes and project management

The demand-forecasting exercise and a review of reports on digital technology in healthcare have highlighted areas where investment is needed over the next 10 years to develop the capacity and capability of IT programmes and project management staff in the NHS. These areas of investment are particularly required in a Data Driven Future.

Building capacity

Programme and project management staff with experience of digital transformation and change is one category of professionals identified as being in short supply in reports focussing on the NHS in England[20, 23]. Similar shortages have been highlighted in Scotland, where project management specialists such as product owners, implementation facilitators and knowledge engineers are seen as the most in-demand professionals in healthcare[35]. The current reported shortages in England do not seem to have been addressed by the significant increase (196 per cent) of programme and project management staff leading up to 2020. The demand forecast for the Data Driven Future shows an increase of 179 per cent is required over the 10 years up to 2030.

Meeting the current shortage and future increase in demand will require more than one approach from NHS organisations. They will need to consider in-house development of existing staff to work as programme and project managers, recruiting new staff who already have these management skills and training them to work

Table 6G.1: In-demand, emerging and new job roles in IT programmes and project management in a Data Driven Future – summary of roles and skills required and links to further information

Job role	Summary of role and skills required	Job role – link	Skills – link
Product owner and manager (advanced practitioner, senior practitioner)	Core skills and emphasis on domain knowledge and emotional intelligence. Product management as a specialism is one of the most important digital era roles. Product managers are leaders who care deeply about solving problems for users and achieving outcomes for the business. This vision is combined with the right technical and design understanding to be able to determine at a high level 'how' this can be done. Product managers are the first among equals in a digital multidisciplinary team and the face of a project. Product managers are different from project managers. Project managers tend to be focussed on an output ("deliver this thing"), whereas a product manager is focussed on outcomes ("solve this problem for users").	GDS DDaT	DHCI
Clinical product owner and manager	Emerging, new role. Can map to GDS DDaT capability framework: Product manager. Core skills and emphasis on domain knowledge and emotional intelligence. A product manager is responsible for the quality of their products and will use knowledge of user needs and business goals to frame problems and set priorities for delivery teams.	GDS DDaT	DHCI
Clinical digital service owner and manager	Emerging, new role. Core skills and emphasis on domain knowledge and emotional intelligence. A service owner is accountable for the quality of their service and will be expected to adopt a portfolio view and manage end-to-end services that include multiple products and channels.	GDS DDaT	DHCI

Delivery manager	Core skills and emphasis on domain knowledge and emotional intelligence. If the product manager is the pilot of a plane, the delivery manager is the engine. A delivery manager's role is to ensure that the team has the right environment to successfully deliver. They remove blockers to delivery and use a variety of Agile techniques and tools to ensure the team is happy and delivering value. In a public sector environment, they can often pick up some traditional project management tasks by default, such as budget management or commercial activity, but they are at their best when performing a servant leadership role for a team and focusing their efforts on making it tick.	GDS DDaT	DHCI
User experience researcher	Emphasis on domain knowledge and emotional intelligence. Responsible for helping the team understand users and their needs. They regularly test products with users and ensure that the team understands how the feedback translates into changes to the product or service they are working on. It is argued that the NHS is already good at this because, for instance, patient stories might be taken to boards, or patient representatives might be on project boards. This is useful but it is not the same as actually observing users try – and often fail – to use a product or service that has been delivered, because what users do is different to what they say.	GDS DDaT	DHCI
User-centred interaction designer	Core skills and emphasis on domain knowledge and emotional intelligence. An interaction designer ensures that the service provides a clear and consistent user experience. They specialise in how users interact with digital products and services, and tend to have the skills to prototype or code screens and flows that can be quickly tested with users, iterated, and delivered.	GDS DDaT	DHCI
User-centred service designer	Core skills and emphasis on domain knowledge and emotional intelligence. A service designer is responsible for the end-to-end journey of a service. Their focus is on ensuring that a user can	GDS DDaT	DHCI

	complete their goal and the service helps the organisation deliver its policy or clinical intent. The notion of service design does exist in health but is still rarely considered as a formal profession with the appropriate skill set.		
User-centred content designer	Core skills and emphasis on domain knowledge and emotional intelligence. A content designer is responsible for creating, reviewing and iterating the words used in products or services so they are clear, easily understood, and meet the needs of users. Content design is particularly important in health, where language and concepts can be difficult for people to understand.	GDS DDaT	DHCI
Implementation facilitators, aka organisational development specialists, new technology specialists and digital transformation specialists	Core skills and emphasis on domain knowledge and emotional intelligence. This newly described role in digital health supports the uptake and embedding of clinical, technological or service innovation as part of day-to-day practice. Implementation facilitators raise awareness of the innovation in question, identifying and overcoming barriers and leveraging strengths to foster the implementation of said innovation. The focus of the implementation facilitators should be on how to prepare the workplace to embed a new technology or a service as part of their day-to-day practice with as little disruption as possible.		DHCI
IT project managers	Core skills and emphasis on domain knowledge and emotional intelligence. IT project managers oversee the development and installation of computer systems for organisations. They are responsible for making sure projects are completed to time, cost and quality.		DHCI

within a healthcare setting, and seeking project management capability from commercial sources.

Many NHS trusts already augment their project management capability by outsourcing to commercial consultants and suppliers. This may be the right approach where digital technological implementation and change is cyclical, and demand for management expertise is time limited and can be met by enlisting project-specific staff from the commercial sector for a specified period of time. The challenge of balancing several digital technology projects, and meeting day-to-day IT operational requirements, is an impetus for NHS trusts to seek external help if projects are to be completed on time. The outsourcing of project management to commercial consultants and suppliers can be expensive. Another downside is that skills and expertise secured externally are temporary and available just for the duration of a project, and often are not transferred to teams in the NHS, where they can be built on. Employment of in-house programme and project management staff will help the NHS address issues of retaining skills and expertise resulting from working on digital technology implementation and change projects.

Training and continuing professional development

The translation and collaborative design roles of IT programmes and project managers require them to speak the clinical language of healthcare staff and the technical language of IT application developers. Securing such talent is a major challenge faced by NHS trusts. Some trusts see the development of programme and project management staff who can take on the clinical-to-technical translation role as a worthwhile investment[67]. This will have implications in terms of investment in providing specialised training and CPD programmes. The procurement and implementation of digital products from external suppliers is often done on a project basis. Managing the relationship with suppliers requires certain skills that IT programmes and project managers will need to develop with support from their employers.

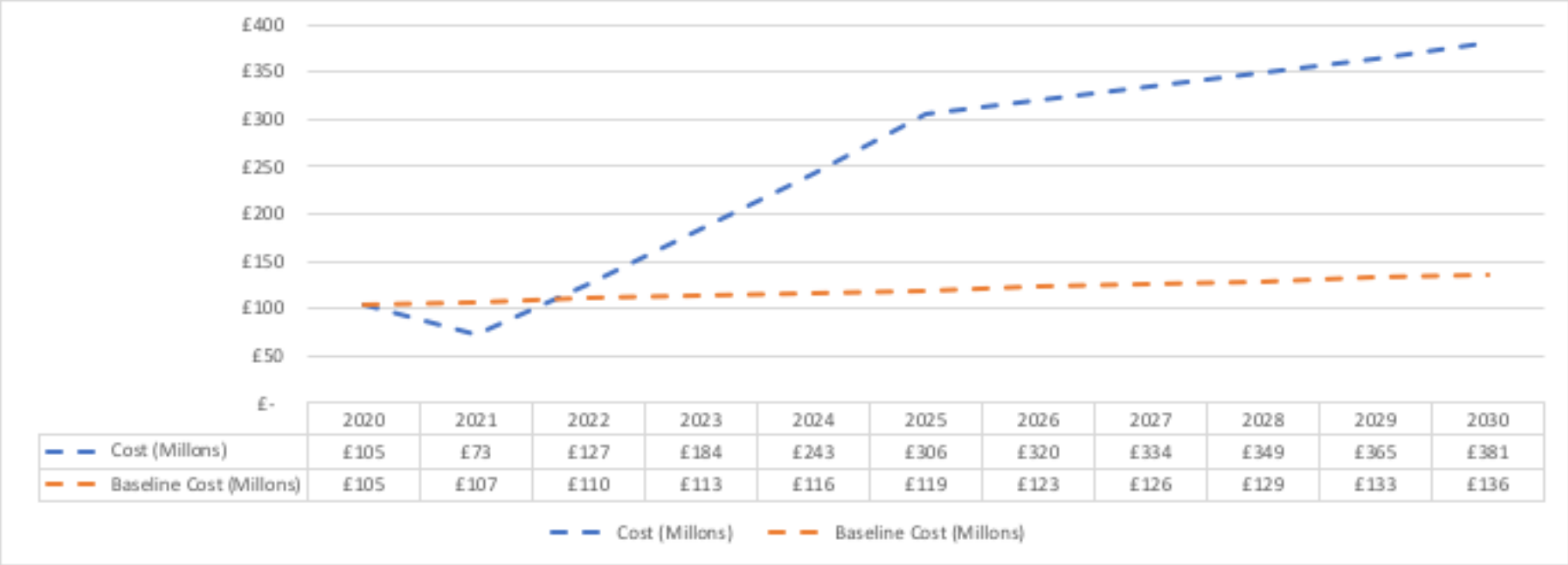
Recruitment and retention

Figures from ESR show that 25 per cent of the current IT programmes and project management staff group in the NHS are on fixed-term contracts. Across the whole NHS digital technology and informatics workforce, eight per cent are on fixed-term contracts. The retention rate (percentage still in post over a 12-month period) for this staff group in 2018-19 was 54 per cent, compared to 77 per cent across the digital technology and informatics workforce. Projects are nearly always defined by a fixed endpoint, and this probably explains the extent of fixed-term contracts in this area and comparatively high-turnover rate. Retaining staff who have acquired valuable experience of working in a healthcare setting once a project has finished should be a matter of priority for the NHS. Ways and means of doing so will need to be identified but no doubt involve mechanisms facilitating the movement of individuals to work in different NHS organisations.

Salary and employment on-costs

The current salary and employment on-costs for the IT programmes and project management staff group of 1,750 WTEs in 2020 are estimated to be around £105 million. If the number of staff increases to 4,850 WTEs, as projected in the demand forecast for the Data Driven Future scenario, the costs will be in the region of £381 million in 2030 (Figure 6G.6). These calculations are based on a mean salary pay point corresponding to the top of NHS Agenda for Change band 7, and the assumption that salaries will increase by 2.7 per cent per annum, and employment on-cost at 34.9 per cent (21 per cent for the NHS pension and 13.9 per cent National Insurance contribution). The projected salary and employment on-costs for a Data Driven Future do not factor in any changes by job level to the composition of the staff group. Therefore, the figure of £381 million should be regarded as the minimum estimate for 2030. It is worth contrasting the figure of £381 million with the £136 million (baseline costs) that represents the salary and employment on-costs of a workforce remaining at 1,750 WTEs in 2030.

Figure 6G.6: Change in salary and employment on-costs in a Data Driven Future for the IT programmes and project management staff group



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost (Millons)	£105	£73	£127	£184	£243	£306	£320	£334	£349	£365	£381
Baseline Cost (Millons)	£105	£107	£110	£113	£116	£119	£123	£126	£129	£133	£136

6H. IT strategy and development

Requirements in the NHS

Realising the ambitions of the Topol Review[1] and NHS Long Term Plan[2] around the use of digital technologies in healthcare will require planning at a strategic level, nationally, regionally and also locally within NHS trusts. The development or commissioning of digital products should be done with a strategic intent. The implementation or upgrade of an electronic patient record system, for example, requires linkages to other clinical information and business support systems in a trust, and consideration about how data generated by these systems can improve the quality of healthcare services.

Digital change in the NHS on a small or large scale can be complex, affecting multiple layers and parts of an organisation. Some NHS organisations struggle to implement change involving digital technologies, resulting in less than optimum outcomes. Barriers to and enablers of digital change in the NHS are topics well covered in reports and journal articles. These barriers and enablers can be broadly categorised as being technical, financial, organisational and cultural, and are in many cases interlinked when implementing or making changes to technology. Dealing with this complexity requires a large degree of strategic planning that involves anticipating and addressing the barriers to and enablers of digital change. This will require engagement and communication with stakeholders, including clinicians in an NHS trust. The development of technology in organisations should be approached formatively, whereby end-user feedback is sought from the beginning and improvements are made incrementally after a process of thorough testing.

Scenario A: Data Driven Future 2030

Projected demand forecast

The demand forecast for a Data Driven Future indicates that the IT strategy and development staff group will need to:

- (Figure 6H.1) Significantly increase the overall number of staff by around 325 per cent between now and 2030, from its estimated current size of 800 WTEs to the forecasted required size of 3,400 WTEs.

- (Figure 6H.2) Significantly increase the number of support staff by around 207 per cent to 700 WTEs by 2030, and the number of professional staff by around 473 per cent to 1,525 WTEs. Those in a managerial role will need to increase by around 205 per cent to 800 WTEs. Senior leadership roles will need to increase from the current number of around 40 WTEs to 380 WTEs, an increase of 824 per cent.

- (Figure 6H.3) Significantly change the composition of this staff group over the next 10 years. The proportion of professional staff will need to increase to 44 per cent of the IT strategy and development staff group and senior leaders to

Figure 6H.1: Supply projection and demand forecasts for IT strategy and development staff in a Data Driven Future and Data Desert Future – 2020/21 to 2029/30

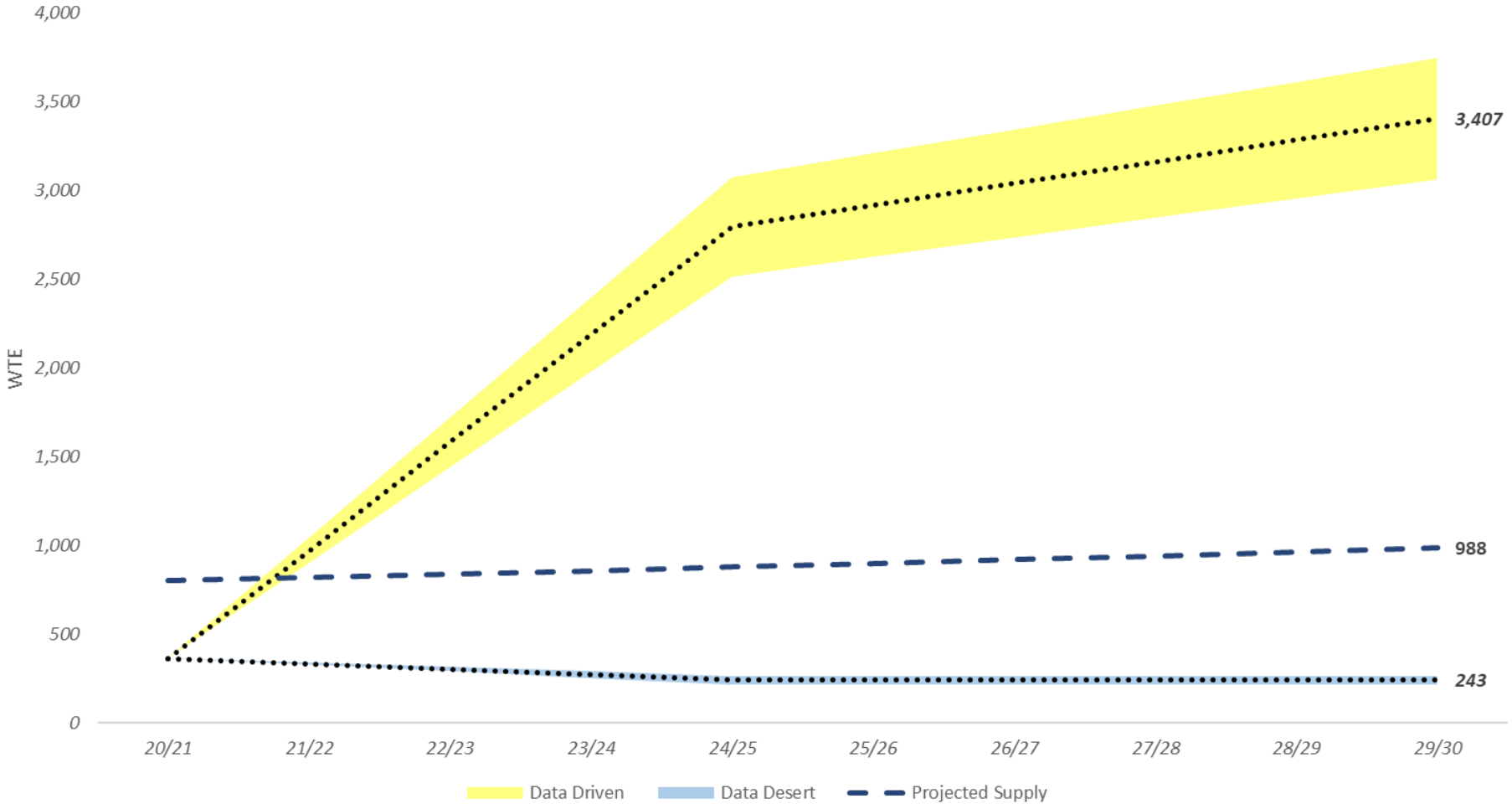


Figure 6H.2: Changes in staffing levels required in IT strategy and development for a Data Driven Future

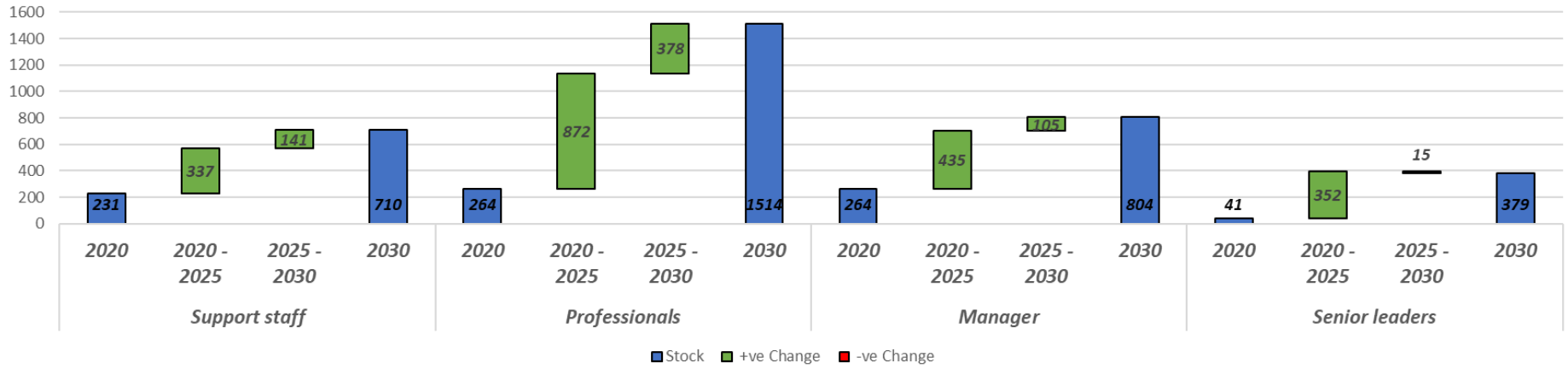
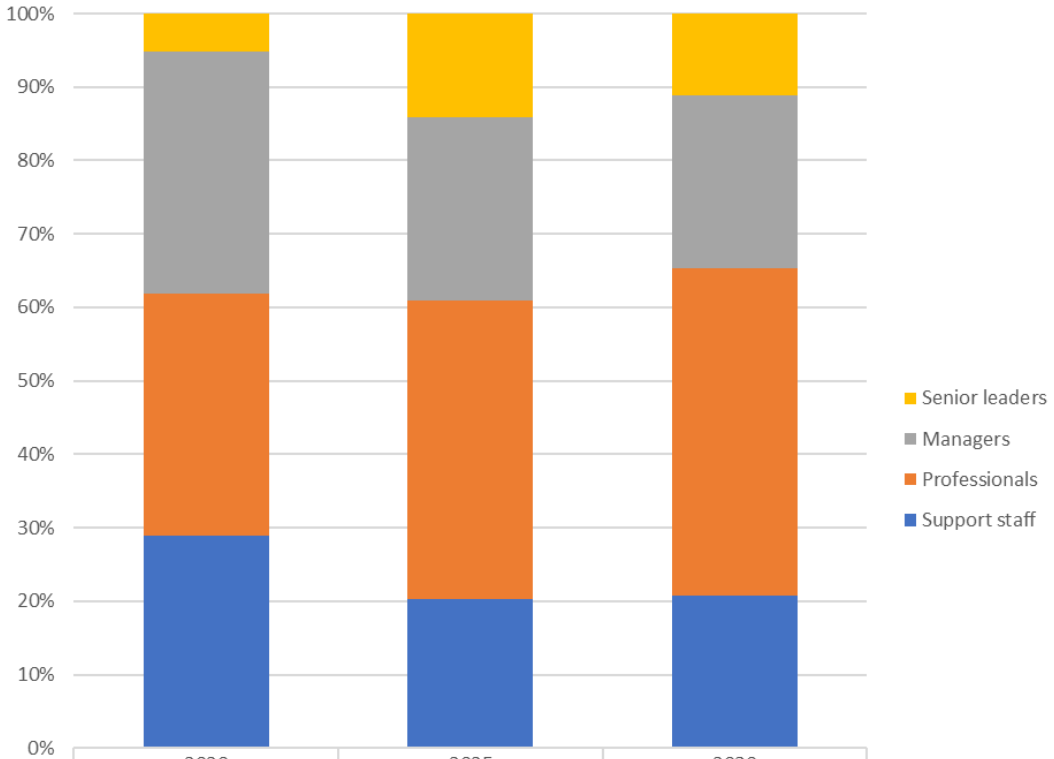


Figure 6H.3: Composition of the IT strategy and development staff group leading up to and in a Data Driven Future



	2020	2025	2030
Senior leaders	5%	14%	11%
Managers	33%	25%	24%
Professionals	33%	41%	44%
Support staff	29%	20%	21%

11 per cent. The proportion of those in an administrative or supporting role will decline to 21 per cent, and managerial roles to 24 per cent.

Projected supply

The projected supply for the next 10 years indicates an increase of 23 per cent in the overall number of IT strategy and development staff to around 1,000 WTEs by 2030 (Figure 6H.1). This will mean that in a Data Driven Future there will be a shortfall of around 2,425 WTEs by 2030, in the absence of any policy interventions and required investments made in the areas of building capacity, training and CPD, or recruitment and retention in that period.

Viewpoints of participants

The proliferation of digital technologies in a Data Driven Future and complexities in their implementation are reasons explaining the forecasted increase in demand for IT strategy and development staff. As mentioned by these participants in the demand-forecasting exercise:

I have increased the workforce in this section, as this part of the organisation will be central to ensuring implementation of data strategies. Managing change in the organisation will require significant input to ensure this progresses and continues.

Increase [in the IT strategy and development workforce] due to a shift to a fully aligning organisational, clinical, and business strategy, and understanding the IT and data elements of it. Ongoing need to re-iterate strategy requires resource.

The roles envisaged in IT strategy and development include those undertaken by business analysts, chief technical officers, change managers, and others who will be required to horizon-scan and evaluate new innovations and best practice, and to plan for and manage an influx of new technologies and resulting adaptions to clinical and working practices in NHS trusts. One participant saw these as vital operational roles in IT strategy and development. Those in a professional or managerial role will need to understand technology, clinical practice, functioning of health systems and change management. Some of their work will be undertaken on a programme or project management basis, or in liaison with dedicated IT programme and project managers, or working with external suppliers and negotiating licenses to use their digital products. The ability to manage change was particularly emphasised in a Data Driven Future. New technologies such as AI and the proliferation of Internet of Things could potentially revolutionise the business support (including booking and appointment systems) and clinical operations of NHS trusts.

Digital transformation and change require a clear strategy and direction-setting from those in a leadership role. Those taking part in the demand-forecasting exercise highlighted the importance of CIOs, CCIOs and CNIOs setting direction in a Data Driven Future. The following set up was envisaged by one participant in this future scenario:

CIO and CNIO are now part of – or closely associated with – the trust board. Digital is part of every strategy within the organisation and it enables senior leaders to facilitate change and have collaborative relationships.

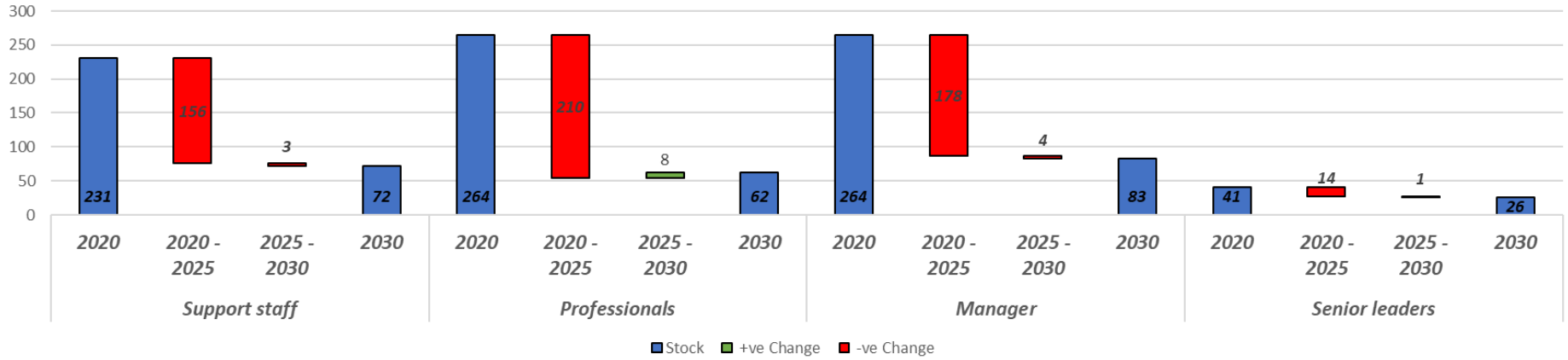
Scenario B: Data Desert Future 2030

Projected demand forecast

The demand forecast for a Data Desert Future indicates that the IT strategy and development staff group will need to:

- (Figure 6H.1) Significantly reduce the number of staff by around 70 per cent between now and 2030, from its estimated current size of 800 WTEs to the forecasted required size of 250 WTEs.

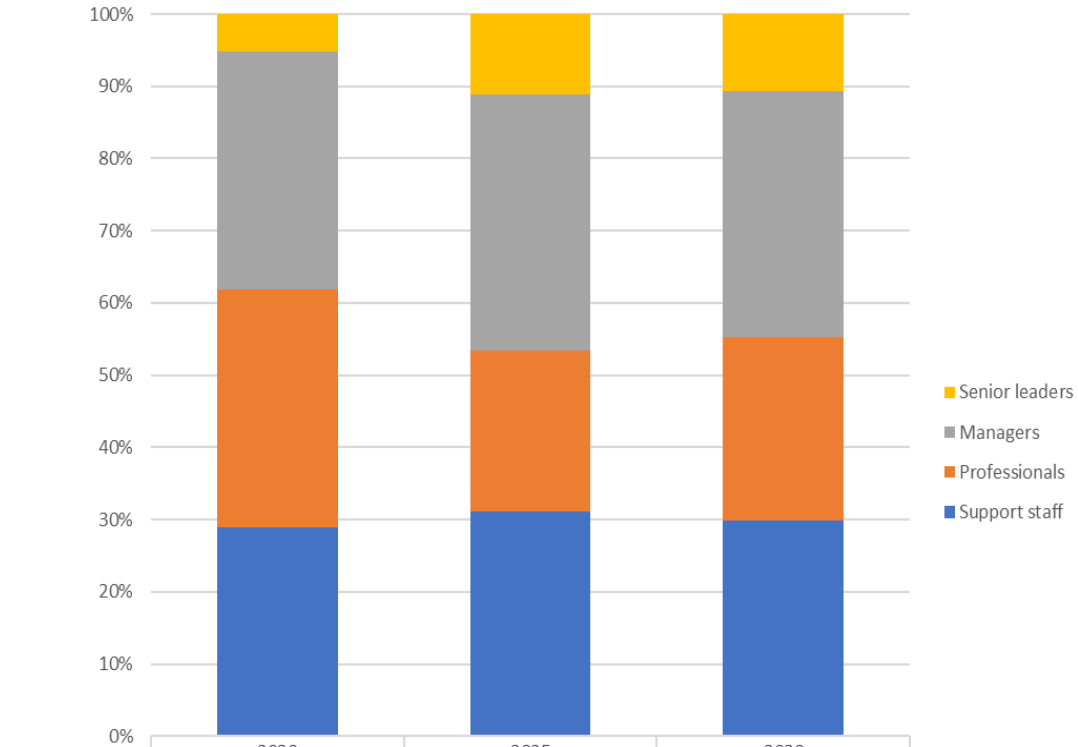
Figure 6H.4: Changes in staffing levels required in IT strategy and development for a Data Desert Future



- (Figure 6H.4) Significantly reduce the number of support staff by around 69 per cent to 70 WTEs by 2030, and the number of professional staff by around 76 per cent to 60 WTEs. The number of staff in a management role will need to decrease by around 69 per cent to 85 WTEs and those in senior leadership roles to 25 WTEs.

- (Figure 6H.5) The next 10 years will see a slight change in the composition of this staff group. The proportion of support staff (30 per cent) and managers (34 per cent) will need to remain broadly the same between now and 2030. The proportion of staff in a professional role will fall from 33 per cent to 26 per cent. The proportion of those in a leadership role will increase to 11 per cent as the IT strategy and development staff group contracts in size.

Figure 6H.5: Composition of the IT strategy and development staff group leading up to and in a Data Desert Future



	2020	2025	2030
Senior leaders	5%	11%	11%
Managers	33%	36%	34%
Professionals	33%	22%	26%
Support staff	29%	31%	30%

Projected supply

The projected supply for the next 10 years indicates an increase of 23 per cent in the overall number of IT strategy and development staff to around 1,000 WTEs by 2030 (Figure 6H.1). This will mean that in a Data Desert Future there will be a surplus of

around 750 WTEs by 2030, in the absence of any policy interventions around redeployment, recruitment and retention.

Viewpoints of participants

Some participants in the demand-forecasting exercise reasoned that the financial constraints of a Data Desert Future will mean that digital technology and change will not be a priority and therefore neither will IT strategy and development work in NHS trusts. Other participants had a slightly different view and felt there would be a cautious or less than ambitious approach to IT strategy and development. The emphasis would be on planning for day-to-day maintenance and upkeep of existing systems. Responsibilities for implementing these plans would largely be absorbed by CIOs, CCIOs and CNIOs as part of their digital leadership role but they would have limited access to business analysts, change managers and so on.

An alternative and very different view was also expressed. It was felt that the financial constraints of a Data Desert Future would actually be a justification for digital transformation and change, and work on IT strategy and development would very much be required. It was reasoned that the NHS as a whole will be impacted by these financial constraints and would be required to reduce wastage and improve efficiency. Digital technology and effective use of data offers the opportunity to realise significant efficiency and productivity gains in the NHS. The drive towards efficiency in a trust could be the impetus for greater involvement from clinicians in developing digital and data solutions to improve the productivity of their work. The NHS would save on costs if demand for healthcare was controlled, and this may be the impetus for developing digital self-care and preventive care applications aimed at patients.

Priorities for the IT strategy and development staff group – 2020 to 2030

Those taking part in the demand-forecasting exercise provided an indication of the priorities that will be placed on the IT strategy and development staff group over the next 10 years. These priorities are particularly relevant in a Data Driven Future. The suggestions made correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

Managing the complexities of clinical and organisational transformation

Those working in the area of IT strategy and development will need take into account how digital technology can support clinical and organisational transformation, and not just focus on digital transformation by itself. Becoming a digitally enabled NHS trust is not just about replacing paper processes with digital ones or layering technology on top of existing clinical practices; it also requires the re-engineering of work processes and structures[16]. The process of transformation is ongoing and is one that requires formative evaluation to identify areas for improvement. A digital transformation strategy therefore needs to complement or be part of a broader clinical or organisational transformation strategy.

Clinical and organisational processes, team structures, and even individual jobs may need to be redesigned. This requires thinking at a strategic level. In regard to AI and machine learning, it is about considering which possibilities work best in the organisation, the skills needed to deliver automation, and how existing roles should be redesigned to attract new talent with advanced skills[68]. The clinical and organisational complexities of digital change will need to be managed by those working in the area of IT strategy and development. These complexities go beyond technical concerns like the interoperability of systems and data, and will include issues relating to finance, human resources, governance and organisational culture. Developing strategy and implementation plans will involve addressing the barriers and enablers of digital transformation and change in NHS organisations.

Planning for the adaptive elements in digital change

The type of strategic planning required for digital transformation not only covers the technical aspects but also its adaptive elements. The Wachter Review highlighted the importance of both the technical and adaptive change elements of successful digital transformation in the NHS[10]. The adaptive elements are concerned with human behaviour and working towards acceptance by clinicians and managers of new workflows and ways of working that will need to be introduced as a result of digital change. It has been argued that rather than focussing on the technical aspects of digital change first and then its subsequent impact on work processes, the primary focus should be on clinical and organisational transformation and how it can be supported by technology[20].

Those working in the area of IT strategy and development will need to bring on board and facilitate the active involvement of clinicians and managers in any digital change process. Case studies on digital change in the NHS have highlighted the importance of involving clinicians from the outset[20]. This is especially true, as this type of change often affects ways of working and workflows in clinical practice, and this has to be acceptable to clinicians. Poor communication with clinicians and failure to listen to their concerns may lead to resistance to the implementation of new technology. The professional values held by clinicians are important, and any concerns about the security and reliability of systems affecting patient safety must be addressed from the beginning of the digital change process.

Job roles and skills

Those taking part in the demand-forecasting exercise provided an indication of IT strategy and development job roles and skills required in NHS organisations in the 10 years leading up to 2030. These requirements are particularly applicable in a Data Driven Future. The suggestions made regarding these job roles and skills correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

In-demand, emerging and new job roles

The composition of the IT strategy and development staff group in terms of job roles and skills required will be quite different in 2030 compared to what is seen today.

Some existing job roles and skills may be made redundant by advances in technology such as AI, or superseded by new roles and skills as a result of digital or organisational transformation of NHS trusts. Based on an analysis of reports in this area, in-demand, emerging and new job roles are identified in Table 6H.1. Some of these job roles will also be found in other areas of the digital technology and informatics workforce in 2030.

Table 6H.1: In-demand, emerging and new job roles in IT strategy and development in a Data Driven Future – summary of roles and skills required and links to further information

Job role	Summary of role and skills required	Job role – link	Skills – link
The C Suite (CXIO) including chief information officer, chief technology officer, chief data officer, chief analytical officer and director of transformation (leading practitioner)	Core skills and emphasis on IT and computer coding skills, and domain knowledge and emotional intelligence.		DHCI
IT business analyst (senior practitioner and leading practitioner)	Core skills and emphasis on IT and computer coding skills. Business analysts understand and analyse user and business needs.	GDS DDaT	DHCI
Content strategist (practitioner, advanced practitioner, senior practitioner and leading practitioner)	Core skills and emphasis on IT and computer coding skills. A content strategist takes an overview of content and how it is produced.	GDS DDaT	DHCI

Investment in IT strategy and development

The demand-forecasting exercise and a review of reports on digital technology in healthcare have highlighted areas where investment is needed over the next 10 years in developing the capacity and capability of IT strategy and development staff in the NHS. These areas of investment are particularly required in a Data Driven Future.

Building capacity

Digital change and the implementation of technology is unique to each NHS organisation, and its departments and clinical teams, and strategies and development plans must reflect and account for the uniqueness of situations and how working processes will be disrupted and eventually enhanced. The development

and implementation of these strategies will require leadership and professional support staff, including business analysts, chief technology officers, change managers and behavioural scientists, who understand technology, clinical practice, the functioning of health systems and change management.

Training and continuing professional development

The IT strategy and development staff group will need a wide range of skills beyond those relating to technology. A skill set is required to manage the complexities of technology-enabled clinical and organisational transformation. Knowledge about human behaviours and factors in change management will be required when creating and implementing IT strategy and development plans. Access to training and CPD programmes will help staff acquire this knowledge and these skills. Specialist roles are needed to support CIOs, CCIOs and CNIOs in developing and operationalising IT strategy and development plans, including business analysts, chief technology officers, change managers and behavioural scientists. Existing staff could be developed through training and education programmes to take on some of these roles.

Recruitment and retention

The NHS may face challenges recruiting IT business analysts. These professionals are listed on the Migration Advisory Council (MAC) Shortage Occupation List (SOC code 2135: IT business analysts, architects and systems).

Salary and employment on-costs

The salary and employment on-costs for the IT strategy and development staff group of 800 WTEs in 2020 was estimated to be around £80 million. If the number of staff increases to 3,400 WTEs, as projected in the demand forecast for the Data Driven Future scenario, the costs will be in the region of £442 million in 2030 (Figure 6H.6). These calculations are based on a mean salary pay point corresponding to the top of NHS Agenda for Change band 8c and the assumption that salaries will increase by 2.7 per cent per annum, and employment on-cost at 34.9 per cent (21 per cent for the NHS pension and 13.9 per cent National Insurance contribution). The projected salary and employment on-costs for a Data Driven Future does not factor in any changes by job level to the composition of the staff group. Therefore, the figure of £442 million should be regarded as the minimum estimate for 2030. It is worth contrasting the figure of £442 million with the £104 million (baseline costs) that represents the salary and employment on-costs of a workforce remaining at 800 WTEs in 2030.

Figure 6H.6: Change in salary and employment on-costs in a Data Driven Future for the IT strategy and development staff group

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost (Millons)	£80	£37	£102	£170	£242	£318	£340	£364	£389	£415	£442
Baseline Cost (Millons)	£80	£82	£84	£86	£89	£91	£93	£96	£98	£101	£104

6I. IT education and training

Requirements in the NHS

The process of digital transformation and change is also about focussing on NHS staff and their education needs, training needs and requirements. A digitally literate workforce is required to realise the benefits of technology. This has been highlighted in the Topol Review, NHS Long Term Plan and reports on healthcare digital technology[1, 2, 23, 69]. Case studies of NHS organisations have identified multiple factors in successful digital change management, including investing in training so that people can make the most of any new technology being introduced[20]. Without an adequate and sufficient level of digital literacy in the NHS workforce, deployed technologies will be underused or used incorrectly. Education and training are therefore key enablers of successful digital transformation and change.

A basic or foundational level of digital literacy is required from NHS staff working in organisations that are becoming increasingly reliant on technology. Technology will add another intellectual challenge to working in healthcare and will heighten the importance of learning new digital skills[68]. This is seen in the introduction of electronic patient record systems, mobile devices issued to staff so they can access real-time information and, during the Covid-19 pandemic, a significant roll-out of online video consultation software.

Beyond the basic or foundational level, there exist different levels of digital skill and knowledge that enable different staff members to do their jobs in healthcare. The same digital product will require different levels of technical competence and capability from staff[70]. An advanced level of digital literacy is required from clinicians seeking to engage in the development of new technology and realise its potential in their area of medical practice. The Academy of Medical Royal Colleges and HEE Future Doctor programme have both highlighted the risks to patient safety if AI was to be carelessly introduced into healthcare, and doctors must be actively involved in the development, evaluation and use of this technology[19, 31]. A vital digital skill, in the broadest sense, is knowing the limits of AI and its role in supporting clinical decision making.

Realising the benefits of digital technology also depends on clinicians acquiring skills and knowledge in data management, governance and analytics. As well as being digitally literate, staff will need to be data literate. Clinicians often do not have the knowledge and skills to interrogate health data or even ask good questions of data analysts when seeking to improve the quality of healthcare[54]. Those in a clinical role should have a sufficient degree of data literacy in order to conduct informed discussions about data, and be able to critically evaluate the outputs from any data-analytical work undertaken.

Health Education England aims to raise the level of training and education for NHS staff, allowing them to use the technology and data appropriate to their roles now and throughout their careers[7]. However, much also depends on the availability in NHS organisations of dedicated staff with a background in working with IT and data, and qualifications and skills in adult education and training. These professionals will

be responsible for delivering training as well as developing, organising, commissioning or signposting face-to-face or online programmes on behalf of their organisations. The need for IT education and training professionals will become more prominent as the sophistication of technology and complexity of data used in NHS organisations increases. Some IT training and education may be organised or delivered through the new regional informatics skills development networks (ISDNs). These networks are being rolled out in 2021, with support and funding from the HEE Digital Readiness programme, based on the model for the already established ISDN in North West England.

Scenario A: Data Driven Future 2030

Projected demand forecast

The demand forecast for a Data Driven Future indicates that the IT education and training staff group will need to:

- (Figure 6I.1) Increase the overall number of staff by around 83 per cent between now and 2030, from its estimated current size of 210 WTEs to the forecasted required size of 390 WTEs.

- (Figure 6I.2) Increase the number of support staff by around a third to 150 WTEs by 2030, and the number of professional staff by around 163 per cent to 190 WTEs. The number of staff in a managerial role will need to increase by around 25 WTEs to 40 WTEs – a 64 per cent increase. A very small number of senior leadership roles will need to be introduced into this staff group, up to four WTEs across the country.

- (Figure 6I.3) The next 10 years will see a change in the composition of this staff group. The proportion of professional staff will need to increase to 49 per cent. The proportion of managers will remain stable at 11 per cent but those in an administrative and supporting role will decline to 39 per cent.

Figure 6I.1: Supply projection and demand forecasts for IT education and training staff in a Data Driven Future and Data Desert Future – 2020/21 to 2029/30

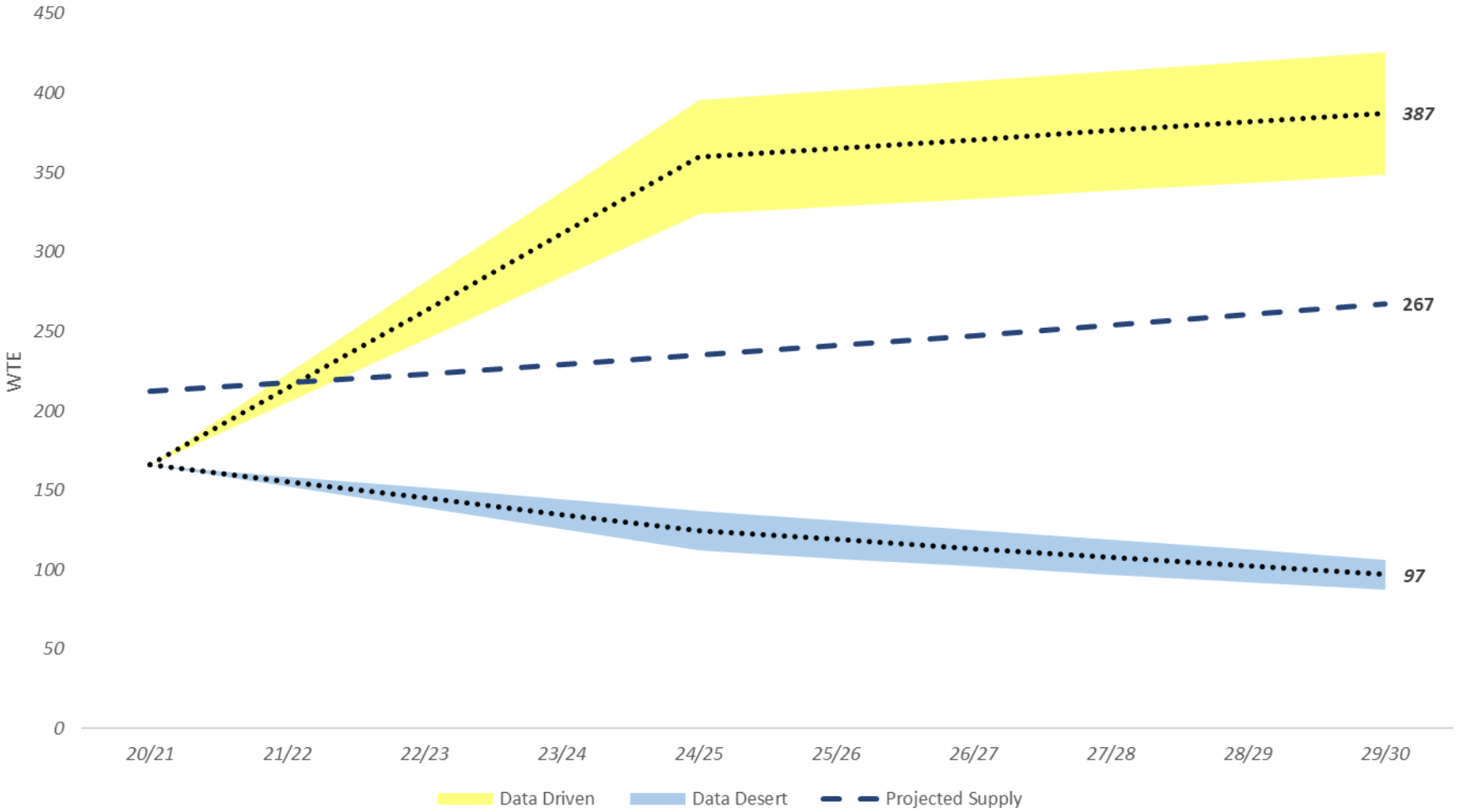


Figure 6I.2: Changes in staffing levels required in IT education and training for a Data Driven Future

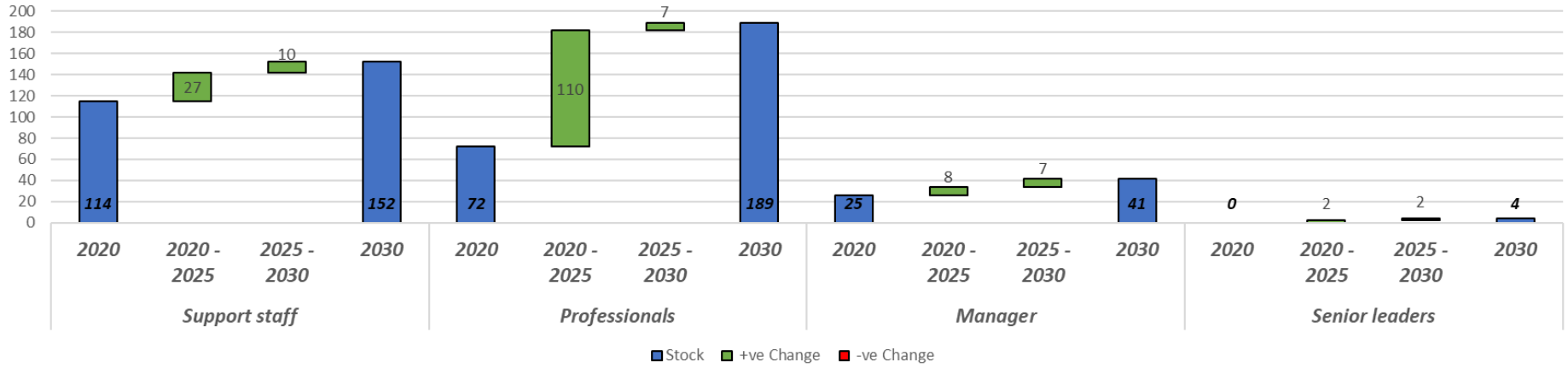
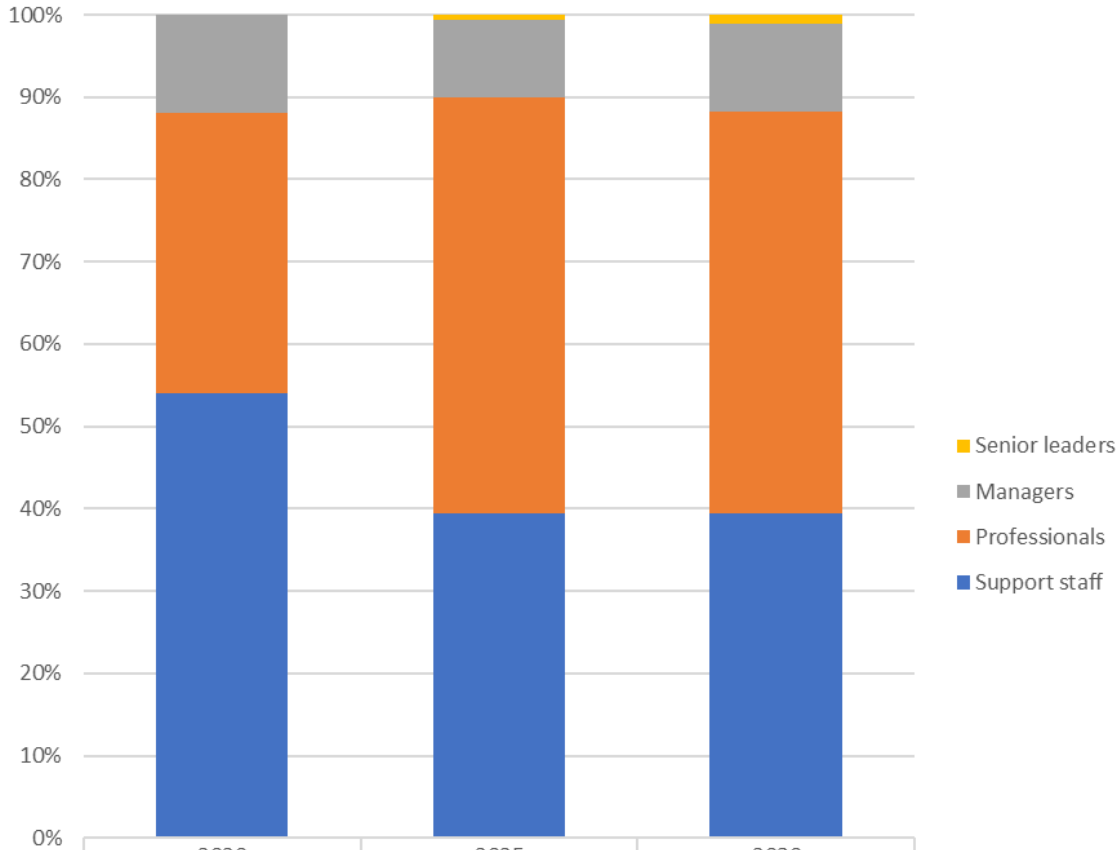


Figure 6I.3: Composition of the IT education and training staff group leading up to and in a Data Driven Future



	2020	2025	2030
Senior leaders	0%	1%	1%
Managers	12%	9%	11%
Professionals	34%	51%	49%
Support staff	54%	39%	39%

Projected supply

The projected supply for the next 10 years indicates an increase of 26 per cent in the overall number of IT education and training staff to around 270 WTEs by 2030 (Figure 6I.1). This will mean that in a Data Driven Future there will be a shortfall of around 120 WTEs by 2030, in the absence of any policy interventions and required investments made in the areas of building capacity, training and CPD, or recruitment and retention in the next 10 years.

Viewpoint of participants

Those taking part in the demand-forecasting exercise saw education and training of NHS staff as integral to the process of successfully implementing or making changes to digital technology. With the expected proliferation of technology in the Data Driven Future, there is a need to provide more training of a higher quality to staff, and equip them with the skills to use new digital and data products. This reasoning helps

explains the projected increase in demand for IT education and training professionals leading up to 2030. As explained by one participant:

> [IT education and training professionals] Required to embed the progression of the digital environment, manage the change and, especially, to realise the benefits in order to progress further. Required to ensure maximum benefits for staff and patients.

An appropriate level of digital literacy will allow clinical staff acquiring new bespoke digital tools to insightfully discuss solutions with IT developers and external suppliers. Participants also highlighted that several different forms of training will need to be provided. These included traditional face-to-face training sessions, together with learning via online, virtual and other such methods. The success of online tools in training NHS staff has been perceived as mixed but, as they become more user-centric and easy to use, they are seen as the way forward in forming a portfolio of learning opportunities in digital technology. Online tools are seen to be ideal in delivering 'bite-sized' training and support, and are viewed as being useful for staff in developing their data literacy and analytical skills. Participants expect the NHS Digital Academy to expand its work from developing digital leaders to commissioning, developing and accrediting online educational tools to support the NHS digital literacy agenda.

The scale of digital transformation and change will influence the resources required for education and training. A 'big bang' approach in implementing a large, integrated electronic patient record system in an NHS trust will require more training staff to support its implementation than a smaller-scale project. Some of those providing training would be product experts. These people have detailed knowledge of the digital product being implemented, and this enables them to provide effective training in its usage. The NHS reliance on external suppliers of digital technology will require some of these product experts to be secured from the supplier to act as trainers.

In the next 10 years, digital transformation will be about making iterative and incremental improvements to technology. Continuous improvement of technology will also require continuous training of staff, allowing them to make use of new features and functions. Rather than running a one-off training event when a digital product is introduced, an ongoing programme of training is required as the product evolves. Development, organisation and co-ordination of these programmes (including face-to-face sessions and online learning) will require support staff and specialist input from educationalists.

Information governance will be an increasing area of concern for NHS trusts in a Data Driven Future. Information governance covers a range of policies and processes that organisations use to manage and safeguard the collection, usage and sharing of information, in order to remain compliant with legal regulations and requirements. A good information governance framework is needed in healthcare particularly, given the nature of work being carried out with patients. Implementation of the framework will require co-operation from, and training of, all staff in an NHS trust. Some of this training will be mandatory, generic and done online. For staff

working extensively with patient data, more detailed and face-to-face training will be required.

Training and education in using digital technology and data in NHS trusts will need to be resourced and organised. This is the consensus of participants in the demand-forecasting exercise when thinking about the Data Driven Future. Resources include a sufficient number of professionals with skills in adult education and training, and insight and knowledge of digital technology. One participant in the demand-forecasting exercise envisaged a set-up consisting of small teams of specialist trainers focussing on particular areas of digital technology, or working with particular clinical departments. This would allow these teams to develop in-depth knowledge of the training needs and requirements in their domain areas and, if working with a clinical department, form close relationships to better support training needs.

Scenario B: Data Desert Future 2030

Projected demand forecast

The demand forecast for a Data Desert Future indicates that the IT education and training staff group will need to:

- (Figure 6I.1) Reduce the number of staff by around 54 per cent between now and 2030, from its estimated current size of 210 WTEs to the forecasted required size of 100 WTEs.

- (Figure 6I.4) Reduce the number of support staff by around 63 per cent to 40 WTEs by 2030, and the number of professional staff by around 38 per cent to 45 WTEs. Those in a managerial role will need to decrease from around 25 WTEs to 10 WTEs – a 60 per cent decrease.

- (Figure 6I.5) Adjustments to the composition of the IT education and training staff group will need to be made by 2030. There will be an increase in the proportion of staff in a professional role, from 34 per cent to 47 per cent. The proportion of support and administrative staff will reduce from 54 per cent to 43 per cent. The proportion of managers in this staff group will remain the same at around 10 per cent.

Figure 6I.4: Changes in staffing levels required in IT education and training for a Data Desert Future

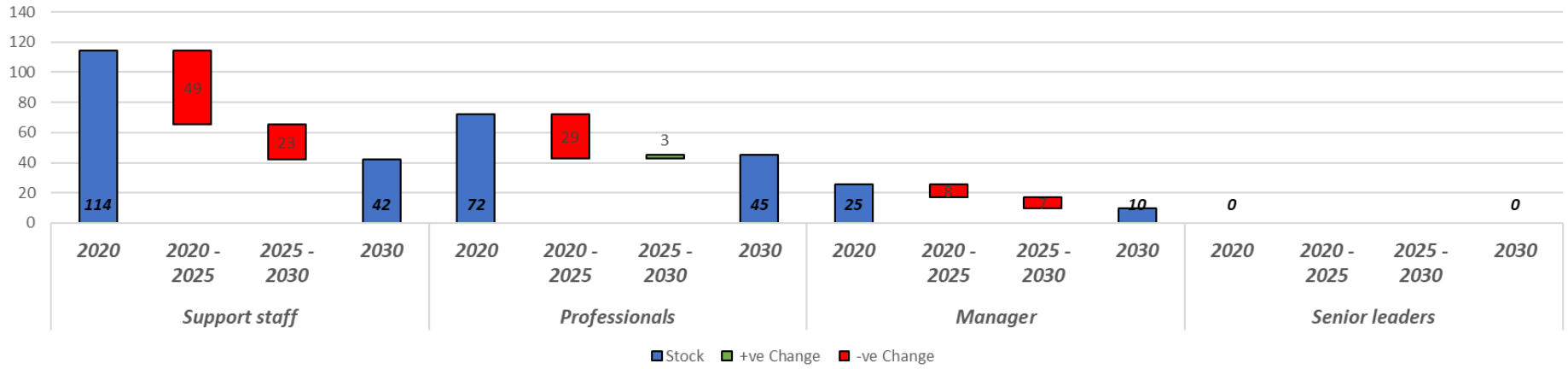
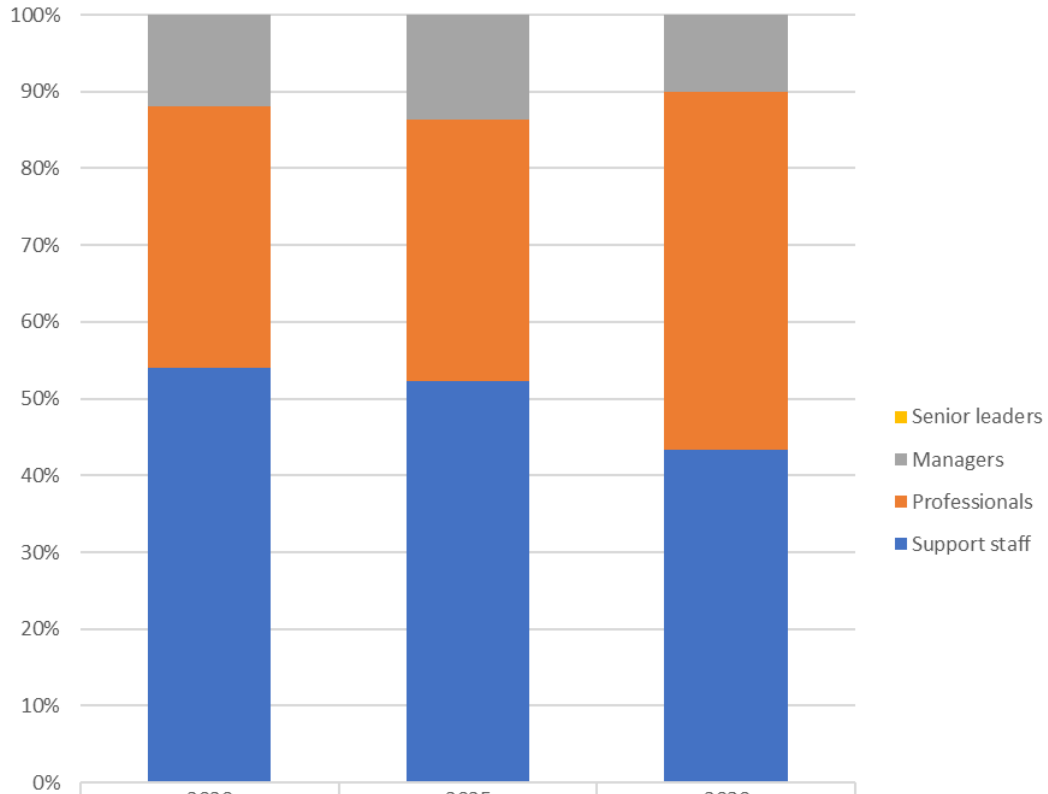


Figure 6I.5: Composition of the IT education and training staff group leading up to and in a Data Desert Future



	2020	2025	2030
Senior leaders	0%	0%	0%
Managers	12%	14%	10%
Professionals	34%	34%	47%
Support staff	54%	52%	43%

Projected supply

The projected supply for the next 10 years indicates an increase of 26 per cent in the overall number of IT education and training staff to around 270 WTEs by 2030 (Figure 6I.1). This will mean that in a Data Desert Future there will be a surplus of around 170 WTEs by 2030, in the absence of any policy interventions around redeployment, recruitment and retention.

Viewpoints of participants

The financial constraints of the Data Desert Future will impact on the IT education and training functions of NHS trusts. These constraints will result in the downgrading of digital and technological change as a priority, and therefore less need for change-management support from IT education and training staff.

Training and education in digital technology and data analytics will not be totally discontinued in a Data Desert Future. NHS staff will still need to use digital technologies in their clinical and non-clinical work, even if the products and applications are not the most up-to-date. Legacy and outdated IT systems will

increase clinical risks in healthcare but could be mitigated to some extent by training staff to use the full functionality of the technologies available to them. However, staff will find it difficult to gain immediate access to face-to-face support and training due to limited IT education and training capacity in their NHS trust.

More emphasis will be placed on national bodies, rather than individual NHS trusts, to develop online training platforms and deliver education virtually. This approach is seen to be cost-efficient and cost-effective. One participant in the demand-forecasting exercise saw the financial constraints of the Data Desert Future as a positive factor in driving investment in online technology to deliver IT training and support to NHS staff. As explained:

> Investment in technology to aid delivery of both training and support will be essential in our current climate, where we may have to consider service delivery adjustments to fit any crisis state, as proved by the current status. The technology most beneficial would be a more effective training portal, with ability for staff to be logged on from any location (including home) that links to ESR for competency reasons. An investment in software for training preparation would be needed, which includes software that can provide good levels of user interaction during the training session.

Priorities for the IT education and training staff group – 2020 to 2030

Those taking part in the demand-forecasting exercise provided an indication of the priorities that will be placed on the IT education and training staff group over the next 10 years. These priorities are particularly relevant in a Data Driven Future. The suggestions made correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

Supporting a wide range of abilities and training needs

The digital literacy agenda has highlighted that NHS staff at all levels and in different parts of the organisation will need a degree of competency in technological and data usage appropriate to their role. This requires people who can provide or organise training for a range of staff members, from school leavers entering the NHS on apprenticeships to those working at senior levels including consultant healthcare staff and executive managers, and each with different levels of ability in using technology and data. This viewpoint corresponds with that highlighted during the Topol Review, where it regarded successful implementation of technology as requiring an engaged and appropriately trained workforce[14].

Meeting the advanced training needs of clinicians

The volume and complexity of data used in clinical practice and decision-making is expected to increase in the next 10 years. Advanced training in this area will be required for clinicians. Some doctors, due to the data intensity of their work, will need

to be as skilled in data science as they are in clinical medicine and need to work alongside statisticians and epidemiologists. This will certainly be the case as genomics becomes mainstream in many areas of clinical practice. The Royal College of Surgeons of England has highlighted that, in the next 20 years, developments in data analytics and science and genomics will improve understanding of diseases, and the training of surgeons must take this into account[17]. Some IT education and training staff will need to become product experts or specialists, focusing on one or a few digital products or supporting the training needs of individual clinical departments or teams. The data-richness of NHS organisations also means that they are excellent places for students to undertake placements and projects. Supporting these students while they are in the NHS will be another role for IT education and training staff.

Focus on the human factor elements of training

The provision of IT education and training must take into account those attitudes and behaviours of staff that act as barriers to technological and digital change. Some of these attitudes are understandable. Clinicians place great importance on patient safety and are sceptical of new technology, especially when an evidence base showing that it does more good than harm is lacking. Significant barriers to embracing technological change also include fear of change in required ways of working, poor previous experience with digital products, and being unprepared to engage with new systems. The Wachter Review considered successful technological change as involving technical and adaptive processes[10]. The adaptive process relies on human behaviour and can be influenced through training and education. Resistance from staff can be overcome by mindful persuasion of the benefits of technology through a considered approach to education and training. The approach will need IT education and training professionals to engage with the concerns of staff through the principles of adult education and learning.

Job roles and skills

Those taking part in the demand-forecasting exercise provided an indication of IT education and training job roles and skills required in NHS organisations in the 10 years leading up to 2030. These requirements are particularly applicable in a Data Driven Future. The suggestions made as to these job roles and skills correspond with those found in reports looking at the future of digital technology and informatics in health services nationally and internationally.

In-demand, emerging and new job roles

The composition of the IT education and training staff group in terms of job roles and skills required will be quite different in 2030 compared to what is seen today. Some existing job roles and skills may be made redundant by advances in technology such as AI, or superseded by new roles and skills as the result of digital or organisational transformation of NHS trusts. Based on an analysis of reports in this area, in-demand, emerging and new job roles are identified in Table 6I.1. Some of these job roles will also be found in other areas of the digital technology and informatics workforce in 2030.

Table 6I.1: In-demand, emerging and new job roles in IT education and training in a Data Driven Future – summary of roles and skills required and links to further information

Job role	Summary of role and skills required	Job role – link	Skills – link
Technology enhanced learning specialist	Core skills and emphasis on domain knowledge and emotional intelligence. Online courses will be developed from advances in augmented reality, virtual reality and AI, so an understanding of the application and implementation of mixed realities is required.		DHCI
Product owner and implementation facilitator	Emerging, new roles. Core skills and emphasis on domain knowledge and emotional intelligence. Implementation facilitators share many of the same capability requirements as product owners, who are usually domain specialists such as a physiotherapist, engaged in a temporary, project-related role as part of an Agile software development team. While both roles entail working with the end users of an emerging software or other technology or innovation, the role of implementation facilitators is much broader and requires more in-depth knowledge of the innovation than the product owners. This ranges from involvement in a project during its planning and design stages, all the way through to its implementation and the training of the end users. Therefore, there is significant overlap into education and training with these key digital roles.		DHCI

Investment in IT education and training

The demand-forecasting exercise and a review of reports on digital technology in healthcare have highlighted areas where investment is needed over the next 10

years to develop the capacity and capability of IT education and training staff in the NHS. These areas of investment are particularly required in a Data Driven Future.

Building capacity

Investment in digital transformation and change should take into account the cost of change management and staff training. These costs are often seen as factors hindering digital change in organisations but are necessary if technology is to be successfully implemented. Work carried out by Monitor Deloitte, a consultancy service, estimated that for every £1 spent on clinical software solutions in the NHS, £1 is spent on associated staff training and change-related elements[71]. Investment will be required if the IT education and training staff group is to expand over the next 10 years, as forecasted in the Data Driven Future. It must be remembered that this staff group currently makes up just four per cent of the digital technology and informatics workforce, and the forecasted required increase will result in an additional 180 WTEs or so across the NHS. Some of this increase might be mitigated by the availability of effective online learning materials developed or accredited by the NHS Digital Academy or other national bodies.

Training and continuing professional development

Work carried out during the Topol Review recognised that delivering IT education and training to the NHS workforce will require investment in training the trainers (or educating the educators) and CPD programmes[14]. Those acquiring formal qualifications as educationalists or in adult learning and education will have a pivotal role in designing and developing training and CPD programmes and tools in their NHS organisation.

Salary and employment on-costs

The salary and employment on-costs for the IT education and training staff group of 210 WTEs in 2020 was estimated to be around £13 million. If the number of staff increases to 390 WTEs, as projected in the demand forecast for the Data Driven Future scenario, the costs will be in the region of £30 million in 2030 (Figure 6I.6). These calculations are based on a mean salary pay point corresponding to the top of NHS Agenda for Change band 7 and the assumption that salaries will increase by 2.7 per cent per annum, and employment on-cost at 34.9 per cent (21 per cent for the NHS pension and 13.9 per cent National Insurance contribution). The projected salary and employment on-costs for a Data Driven Future does not factor in any changes by job level to the composition of the staff group. Therefore, the figure of £30 million should be regarded as the minimum estimate for 2030. It is worth contrasting the figure of £30 million with the £17 million (baseline costs) that represents the salary and employment on-costs of a workforce remaining at 210 WTEs in 2030.

Figure 6I.6: Change in salary and employment on-costs in a Data Driven Future for the IT education and training staff group

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cost (Millons)	£13	£10	£14	£17	£21	£25	£26	£27	£28	£29	£30
Baseline Cost (Millons)	£13	£13	£13	£14	£14	£15	£15	£15	£16	£16	£17

7. Conclusions

The conceptual framework described at the beginning of this report shapes the Building our Future Digital Workforce workstream, and therefore this project and report. The framework acts as the basis for explaining the changes in demand and composition of the NHS digital technology and health informatics workforce (the 'digital workforce'), and the emergence of new job roles and skills required in the next 10 years. These changes are the reasons why further investment is needed in this workforce to help build capacity, embed in-demand, emerging and new job roles and skills, provide training and CPD, and to support the recruitment and retention efforts of NHS trusts.

Digital transformation and maturity

Key conclusion: an increase in staffing levels and the embedding of new skills and capabilities in the digital workforce is a requirement for NHS trusts progressing through the levels or stages of digital transformation.

The required increase in demand and changes in composition of the digital workforce in a Data Driven Future are aspects already being observed in healthcare organisations undergoing digital transformation. NHS trusts that have scored highly in NHS England's Digital Maturity Assessment (DMA) exercise, and have acquired or are seeking Global Digital Exemplar status, have taken significant actions including recruiting individuals to new technical, data and project management roles[23]. A similar observation has been made in regard to hospitals in the United States using the Electronic Medical Record Adoption Model (EMRAM). The EMRAM encompasses seven stages of progression towards fully adopting technology and electronic patient record systems[45]. As hospitals progress through the first four stages, staffing levels in IT increase as a proportion of overall hospital staff numbers, and then level off during the later stages. The type of staff required also changes as hospitals progress through the seven stages. More programmers, network support staff and user support staff are required while progressing through the early stages. In the final stages, new job roles or those that traditionally have not been seen in healthcare, including health data analysts, are introduced into organisations.

Work carried out at one level will provide the foundations to progress to the next level of digital transformation and maturity. The adoption of AI is one ambition for a fully digital NHS, although its rollout is dependent on whether previous technologies and a technical backbone is in place, and this requires appropriately skilled staff in job roles dedicated to working in these areas. Information management and data architecture staff, for example, are required as the machine-learning aspects underpinning AI are dependent on quantities of good-quality data. Examples of job roles required include advanced-level health data analysts, machine-learning and AI engineers, data engineers and data scientists. NHS trusts need to have access to a fully rounded and integrated data team with the requisite advanced level of skills and clinical domain knowledge. Work focusing on AI by the McKinsey Global Institute has highlighted the correlation between AI adoption rates and levels of digital maturity in organisations[72].

Clinical and organisational transformation supported by technology and data

Key conclusion: managing the adaptive barriers and enablers of technology and data-driven clinical and organisational transformation can be challenging due to human-factor complexities involved. This has the employment effect of increasing the need for staff in clinician-informatician hybrid roles, as well as professionals, managers and leaders with skills in change management, optimising processes and workflows, and organisational development and design.

A report by the Digital Health and Care Institute based at University of Strathclyde, Glasgow, has identified the need for an important new emerging role: digital health implementation facilitators[35]. These specialists would support efforts to incorporate innovations into clinical practice using methods from the field of implementation science. These specialist skills could be acquired via commission from a commercial provider on a consultancy basis, the recruitment of new staff, and/or broadening the skillset of existing digital technology and informatics staff – particularly those in leadership or working in IT strategy and development, or in a programme and project management role.

The need for specialist skills around the adaptive barriers to and enablers of digital, clinical and organisational transformation is especially necessary given the cautious approaches to change in NHS organisations. Some of this caution is understandable; the value placed on patient safety by clinicians is at the forefront of their concerns. Changes in processes may be resisted because they lack an evidence base indicating they do more good than harm. One fundamental problem is credibility of technology among clinicians[20]. Facilitating clinician involvement in projects from the outset is therefore important, as is jointly working with technology staff to redesign clinical processes and realise the benefits of digital products. The emergence and embedding of clinician-informaticians in NHS trusts will be vital in this regard over the next 10 years, as will meeting the need for more individuals to manage and lead on technology and data-supported clinical and organisational transformation.

NHS digital technology and health informatics response to the Covid-19 pandemic

Key conclusion: the Covid-19 pandemic has created an innovative environment whereby the NHS has actively sought digital technology and data-driven solutions to strengthen the way healthcare can be delivered. Finding and implementing solutions in the future is dependent on the capacity and capability of the NHS digital workforce.

The pandemic has brought to the forefront the way digital technology and data should be parts of the core capacity in organising and delivering healthcare services.

An accelerated roll-out of technology to support remote healthcare monitoring, consultations and interventions was seen during 2020. The pandemic also highlighted the importance of health data and knowledge in making evidence-based decisions and this, in turn, has shifted the idea of a fully digitised NHS from being an aspiration to one that is essential and necessary in managing healthcare. Further implementation of digital technologies and data-driven solutions will have an employment effect on the NHS digital workforce in the next 10 years. The effect will determine the capacity and capability of the workforce, in managing the technical aspects of implementing technology and also in meeting the adaptive challenges in areas such as data governance, quality and application.

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Appendix: Stakeholders involved in the scenario development workshops

Scenario development workshops

Representatives from the following organisations participated in the scenario development workshops held in May and June 2020:

- Association of British Health Tech Industries
- Association of Professional Healthcare Analysts
- Alan Turing Institute
- Cabinet Office: GDS – Digital, Data and Technology Profession Team
- Cambridge University Hospitals
- Chartered Institute of Library and Information Professionals
- Health Education England
- Health Education England – North East and North Cumbria
- Health Education England – Patient Group
- Health Foundation
- Lancashire & South Cumbria NHS FT
- National School of Healthcare Science
- NHS Digital
- NHS Digital Academy
- NHS England and Improvement
- NHS South, Central and West CSU
- NHS Wales Informatics Service
- Public Health Agency NI
- Public Health England
- Tech Nation
- Keyah Consulting
- Scottish Government
- Society for Innovation, Technology and Modernisation
- Tricordant
- University College London
- University of Manchester