NHS Informatics Workforce in England: Phase 1 Project Report

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Report compiled by:

Don Liu
National Workforce Planner, Workforce Planning and Intelligence Directorate

Rupert Milsom
Workforce Analyst, Workforce Planning and Intelligence Directorate

Nicola Calder
Workstream Lead, Digital Supply and Capacity, Building a Digital Ready Workforce Programme

Gabriel Harry
Data Modeller, Workforce Planning and Intelligence Directorate

Paru Patel
Deputy Head of Workforce Planning, Workforce Planning and Intelligence Directorate

Contact:
Workforce Planning and Intelligence Directorate
Health Education England
Stewart House
Russell Square
London WC1B 5DN
Contact: don.liu@hee.nhs.uk

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ACRONYMS

AfC	Agenda for Change
AI	Artificial intelligence
BAME	Black, Asian and minority ethnic
BDRW	Building a Digital Ready Workforce programme
ESR	NHS Electronic Staff Record
FTE	Full-time equivalent
HEE	Health Education England
HEFT	HEE Electronic Staff Record Flow Tool
IT	Information technology
LTFT	Less than full-time
NQ	Newly Qualified
NWISDN	North West Informatics Skill Development Network

1. SUMMARY

This report has been produced for the Digital Supply and Capacity Workstream within the Building a Digital Ready Workforce (BDRW) programme set up by Health Education England (HEE)[1]. The report presents information on the size of the informatics workforce – in terms of full-time equivalent (FTE) and headcount – and its characteristics and trends based on 2014 to 2019 data from the NHS Electronic Staff Record (ESR). This is Phase 1 of a project focussing on understanding the NHS informatics workforce. Phase 2 (planned for 2020) will focus on modelling and planning the informatics workforce in the health and social care sectors.

Key findings from Phase 1 include:

1.1 Size of the NHS informatics workforce

The NHS informatics workforce was identified in the ESR dataset via a standardised search using area of work and job title values listed in guidance issued by NHS Digital[2]. The **observed workforce size** for informatics was derived from the search and formed the sample for analysis for the Phase 1 study. Due to the limitations of the search strategy, the size given is likely to be an underestimate. Therefore, an attempt has been made, through mitigating some of the search limitations, to determine the **actual workforce size** for informatics in the NHS.

Observed workforce size

Phase 1 of the project identified in ESR and extracted the records for 29,739 FTE NHS staff members working in informatics in 2014 and 34,754 FTEs in 2019. This represents a 17% increase in workforce size over five years, 3.4% on average per year. During the same five-year period the size of the non-medical workforce in the Agenda for Change (AfC) pay system increased by 10% and the NHS overall by 12%.

Actual workforce size

The estimated actual size of the NHS informatics workforce in 2019 is in the region of 40,640 FTEs to 53,936 FTEs. The range accounts for a level of uncertainty resulting from the methodology in identifying informaticians.

Projected workforce size in 2024

In 2024 the size of the NHS informatics workforce is projected to be between 48,199 FTEs and 63,968 FTEs. The projection is based on a continuation of average rates of inflows to and outflows from the workforce seen in the five years leading up to 2019 and a scenario of no policy change whereby any forthcoming policy intervention is not factored in.

1.2 Limitations of data and methodology

The identification of the observed workforce in ESR, and subsequent analysis and reporting of data, all had their limitations and challenges. These limitations relate to conceptualisation and coverage of who should and should not be included in the informatics workforce, categorisation of job roles, and data quality and consistency in ESR. Addressing or mitigating some of these limitations will be necessary in Phase 2 of this project.

1.3. Areas of work in informatics

Seven areas of work in informatics have been identified for the purposes of collating, analysing and presenting data for this report. The largest concentration of informaticians is found in clinical informatics (39% in 2019), information and communication technology (35%), and information management (18%). The largest growth in workforce size between 2014 and 2019 was in programmes and projects, which increased by 196%. The area of knowledge management experienced a decrease of 19% in the number of staff members.

1.4. Characteristics and trends found in the informatics workforce

The informatics workforce is not homogeneous, but instead is diverse with areas that are quite discrete from one another. This is reflected in the characteristics and trends identified in the workforce, which varies considerably across the different areas of work in informatics. Variations can be seen in the types of contract on which informaticians are employed, the extent of less than full-time working, attrition and retirement rates, and gender, age, ethnicity and disability status in the composition of the workforce. This will have implications when it comes to workforce modelling and planning, as different assumptions will need to be used for different areas of work in informatics.

1.5. Diversity

Imbalances in gender and ethnicity ratios exist to a certain extent in some parts of the informatics workforce. The study sample showed that women form the majority in the informatics workforce overall, but not so in the information and communication technology area of work. Women are overrepresented in informatics jobs classified in lower AfC bands and underrepresented in middle and higher bands. In terms of ethnicity, those in black, Asian and minority ethnic (BAME) groups comprise 15% of the informatics workforce, compared to 20% in the NHS overall. In some areas of work in informatics this proportion is significantly less. Recent reports from the Royal Society (2019)[3] and UK government (2017)[4] have called for a diverse workforce in digital and information technology, across all sectors and not just healthcare, in order to fully understand and interpret real-world problems and mitigate against any inherent bias resulting from technological and digital processes.

1.6. Increasing skill and knowledge levels

The size of the informatics workforce has been increasing since 2014 and much of this increase can be accounted for by jobs classified in middle and higher AfC bands. The bands not only determine levels of pay, but also reflect levels of knowledge and skills required for a job. As technology is becoming more sophisticated and central to healthcare delivery, NHS organisations are having to employ more people with higher levels of knowledge and skills. This trend is being replicated in other sectors of the economy. From using labour market data, the Royal Society (2019) in a report on data science found that qualification levels requested for the data scientists and advanced analysts have broadly increased. In 2013, 34% of such postings required Level 6 (first degree) or Level 7 (MSc degree or upwards) skills, but by 2017/18 this had increased to 42%[3].

It has also been noted that the number of jobs in informatics in lower AfC bands has slightly decreased between 2014 and 2019 due, perhaps, to these jobs being automated or deleted when people leave, and market pressures making it difficult to recruit at this level.

1.7. Critical job roles and shortages in informatics

Recent reports on digital and information technology in healthcare and other sectors have highlighted the issue of critical and shortage job roles[3, 5-8]. This potentially represents a recruitment challenge for health and social care. Roles specified include data scientists and analysts, artificial intelligence (AI) and machine learning specialists, and database and network professionals. Identifying staff members in these job roles working in the NHS and other health and social care organisations is challenging and further work is required. Phase 2 of the project will need to undertake this work, as well estimate future growth in critical and shortage job roles in order to build the policy direction informing on workforce models.

2. INTRODUCTION

2.1. Purpose of this report

This report has been produced for the Digital Supply and Capacity Workstream within the Building a Digital Ready Workforce (BDRW) programme set up by Health Education England (HEE) in May 2019[1]. The work undertaken for this report is intended to be the first phase of a project in understanding, modelling and planning the informatics workforce. Phase 1 is about understanding the informatics workforce in the NHS, including key characteristics and trends useful for workforce modelling, planning and policymaking.

Phase 1 is also intended to bring to light any methodological challenges and limitations in attempting to understand the informatics workforce. The challenges and limitations that did emerge were conceptual (for example, in scoping the occupations in informatics and whether certain job roles are to be included or not) and methodological (for example, due to quality of data about the workforce). It is important to fully recognise and then address these challenges and limitations if we are to reliably estimate the number of staff members in informatics and examine for characteristics and trends.

2.2. The need for reliable workforce information

Recent reports on digital and information technology in health and social care have highlighted the importance of a knowledgeable and skilled informatics workforce, and some have called for an increase in staff numbers, particularly in critical and shortage job roles. Increasing the workforce, in terms of size and capacity, in the right areas and over a realistic timeframe will require modelling, planning and investment, which in turn relies on reliable information about the workforce. The aims of the Digital Supply and Capacity Workstream are to collate and present this information to inform on the planning and investment decisions of the BDRW programme, and to ensure that we are better able to understand if we have the right informatics and digital professions, with the right skills in the right place at the right time.

Table 2.1: Reports informing on the work of the Digital Supply and Capacity Workstream

Report	Key points made relevant for workforce planning
Topol Review (2019)[9]	Specific recommendations made to the Secretary of State for Health and Social Care to increase capacity and improve capability within the workforce to meet the need to evaluate and implement state-of-the-art digital, genomic, artificial intelligence (AI) and robotics technologies. An urgent call for action to educate and develop the existing workforce, and to assess the requirement for the evolution of existing and new clinical roles. Within the recommendations was a reference to increasing the number of data scientists, informaticians and knowledge management specialists.
Department of Health and Social Care (2019)[10]	In response to the Topol Review, HEE's mandate and business priorities for 2019/20 set out by the Department of Health and Social Care are to deliver: • An audit to assess and plan for future digital roles and skills requirements, building on the Topol Review.

	• Flexible career pathways, particularly for scarce roles, and establish early pathway initiatives for the future digital talent.
NHS Interim People Plan (2019)[11]	Important to increase the capacity of digital skills within the workforce to enhance and embed scientific and technological developments at pace and scale. Recognise the need to have a high-quality supply of digital leaders (including chief clinical information officers, chief information officers and chief nursing information officers) with the right technical staff so that: • NHS boards understand the value of data and technology in the delivery of healthcare. • Healthcare workers have the digital tools and understanding to meet their needs.
NHS Pay Review Body (2019)[12]	Makes specific reference to staff groups in information management and technology, including the need for clear identification of the information technology (IT) roles and levels affected by recruitment and retention difficulties and the specific skills in short supply.

2.3. Coverage and scope

The focus of Phase 1 of this project, and consequently this report, is NHS staff members in a job role where their primary function is related to informatics. The scoping of informatics and informaticians was done by referring to the Informatics Area of Work Guidance (Version 2.2) issued by NHS Digital in 2014[2]. The guidance lists and maps indicative job titles to area of work values (or categories) covering informatics (Table 3.1). These job titles and area of work values were then used to extract information from the NHS Electronic Staff Record (ESR) dataset to derive the observed informatics workforce, covering the period 2014 to 2019, for further analysis. Through this process 29,739 FTE members of staff were observed as working in informatics in 2014 and 34,754 FTEs in 2019.

The observed workforce for this study and report should therefore be regarded as a sample of the actual NHS workforce in informatics. Estimates are given for both the observed and actual sizes of the workforce in Section 4. The reliability of the sample in generalising any identified characteristics, attributes, trends and patterns to the actual workforce is discussed in Section 3.4.

3. METHODOLOGY

3.1. Identifying the informatics workforce in ESR

The NHS Electronic Staff Record (ESR) provides an integrated human resources and payroll system to NHS organisations. It is used by approximately 99% of NHS trusts and holds the data for about 1.4 million staff (6% of the working population in the UK)[13]. The ESR dataset was used to identify and extract data about informaticians working in the NHS between 1 April 2014 and 31 March 2019. The dataset consists of numerous fields, including occupation, area of work and job title. Due to its comprehensibility, national coverage and level of detail, the ESR dataset is an appropriate resource for identifying informaticians working in the NHS.

It must be noted from the outset that ESR does not contain information on all healthcare professionals, including informaticians, working in England. This report excludes those with a health informatics role working in primary care, social care, universities, the independent sector, professional bodies, and local government public health teams. The limitations of the methodology and this study are detailed in Section 3.3.

The process of identifying and extracting information from the ESR dataset was undertaken in October 2019. Informaticians, regardless of job, career or pay level, were identified having met one of two criteria relating to their staff record in the dataset:

1. Where the secondary or tertiary area of work field contains one of nine values covering informatics (Table 3.1). The nine values (which incorporate formerly used values) are listed in the Informatics Area of Work Guidance (Version 2.2) issued by NHS Digital[2]. The guidance is intended to standardise how staff working in informatics are coded and categorised in ESR.

2. Having a job title value listed in the Informatics Area of Work Guidance (Version 2.2). There are 362 indicative job titles listed covering job roles in informatics (examples provided in Table 3.1).

Applying these criteria will mean staff members with an NHS Digital-listed job title but not a listed area of work value in their ESR record will be identified for this study. Similarly, those with a listed area of work value but not a listed job title will also be identified. Through application of these criteria 29,739 full-time equivalent (FTE) staff were observed as working in informatics in 2014 and 34,745 FTEs in 2019, and formed the sample for further analysis for this report.

3.2 Analysing and reporting on the informatics workforce

The reliability of the sample (observed workforce) was assessed through boxplot, normal probability and margin of error analyses. Segments of the sample were compared to data from external, non-ESR sources of information to assess the accuracy of figures given for workforce size in this report. Microsoft Excel was used to enter data from ESR, collate into tables and produce graphical charts. Projections of the size of the workforce expected in 2024 were undertaken using the HEE Electronic Staff Record Flow Tool (HEFT).

Through discussions within the Digital Supply and Capacity Workstream project team, seven categories of informaticians were derived for the purposes of analysing and presenting data in this report (Table 3.1). Each category was mapped to one or more of the areas of work values listed by NHS Digital. Individuals identified in ESR as having an NHS Digital-listed job title but not a listed area of work value were designated one by the project team. Doing so allowed all 29,739 FTE staff

members in 2014 and 34,745 FTEs in 2019 observed as working in informatics to be allocated to one of the seven reporting categories.

Table 3.1: Reporting categories – area of work values and job titles

Reporting categories	NHS Digital Guidance and ESR area of work value	Indicative job titles – examples
Clinical Informatics	Clinical Informatics	• Architect – Knowledge • Clinical Trials Data Coordinator • Facilitator – Clinical Audit • Specialist – Clinical Informatics
	Coding (formerly Clinical Coding)	• Administration Support – Clinical Coding • Clinical Coder • Head of Clinical Coding Services
	Health Records	• Assistant – Case Notes • Clerk – Ward • Head of Medical Records • Officer – Patient Administration
	Informatics*	
Informatics Education and Training	Informatics Education and Training	• Facilitator – Information • Head of IM&T Training & Development • Lecturer in Health Informatics • Trainer - Informatics
Informatics Strategy and Development	Informatics Strategy and Development	• Capability Consultant • Director of Information Services • Health Informatics Development Manager • Informatics Workforce Development Lead
Information and Communication Technology	Information and Communication Technology (formerly Information & Communication Technology)	• Analyst – Systems • Assistant – IT Helpdesk • Developer – Web • Engineer – Networks • Head of Information Technology
Programmes and Projects	Programmes and Projects	• Administrator – Programme • Head of IM&T Programmes • Manager – Systems Development • Officer – Project Support
Information Management	Information Management (formerly Information Services)	• Administrator – Information Governance • Analyst – Senior Information • Developer – Data Warehouse • Head of Information Management
Knowledge Management	Knowledge Management (formerly Library Services)	• Librarian • Manager – Knowledge and Information Service • Patient Information Assistant
*'Informatics' is not listed as a work value in the NHS Digital guidance, but is used to categorise people in the secondary and tertiary area of work fields of ESR.		

Source: NHS Digital – Informatics Area of Work Guidance (Version 2.2)[2]

3.3. Limitations

There are several limitations with the methodologies used for identifying, analysing and reporting on the informatics workforce. These limitations relate to:

- Concept: Differing perceptions and understanding of the boundaries and definition for this workforce could possibly lead to relevant job roles, and therefore people, not being identified and reported for this initial (and any future) study. For example, should archivists be included to extend the knowledge management area of work in informatics?

- Coverage of health sector: The methodology used for the study omits those working in the social care sector, which has a workforce 1.48 million. Some of these staff members work in the area of informatics. The results of two surveys carried out by Skills for Care in 2014/15 identified 388 informatics staff members working in 29 social care-related organisations (local authority and private and voluntary sector providers)[14]. Excluding the social care sector is a major oversight as many staff are now employed in roles that cover both social and healthcare[15]. Mitigating this limitation (in Phase 2 of the project) could be achieved through partnering with Skills for Care[16] and commissioning an analysis of the informatics workforce in adult social care.

- Coverage of NHS staff: The ESR dataset contains details of those directly employed by the NHS and, as such, excludes contractors and those working for companies providing services that NHS organisations have outsourced. Also excluded and not captured by ESR are informaticians working in primary care, universities, the independent sector, professional bodies and local government public health teams. Those excluded being, for example, the 640 to 940 staff estimated by the Centre for Workforce Intelligence in 2015 to be working in local authority public health knowledge and intelligence services[17]. These people may well be providing services to or working alongside NHS organisations and seen as possible recruits into the NHS.

- Primary job role function in informatics: The focus of the study is on job roles where the primary function is related to informatics. This excludes staff members whose primary function is nursing, medicine, public health and so on, but will or are required to have some or significant skills in informatics. A recent study by Public Health England (2019) mapped 1,270 FTE members of staff in public health teams in 14 sustainability and transformation partnership areas to different levels of population health intelligence skills, including statistical analysis, predictive analysis, data science and database design[18]. Accounting for such skills held by all those working in health and social care will provide for a rounded picture of the role and extent of informatics found in the workforce.

- Data quality and consistency in ESR: The ESR records for some NHS staff working in informatics have area of work values and a job title that are not listed by Informatics Area of Work Guidance (Version 2.2) issued by NHS Digital[2]. If this is the case, these informaticians will have been excluded from this study. Examples include bioinformaticians and data scientists working in clinical bioinformatics (healthcare science area of work). Conversely, some people may have been identified for inclusion when they should not be, due to an incorrect use of an informatics area of work value in their ESR record.

- Categorisation: There are different approaches in deriving and framing occupational or job role categories used to collect, collate, analyse and report workforce data in informatics. An example, in terms of framing, is that coding has been mapped to 'Clinical Informatics' in this study. The North West Informatics Skills Development Network's annual survey maps clinical coding to a higher category of 'Information Management', while the Information Management and Technology section of the NHS Corporate Services data collection tool has this area of work mapped to 'Other'.

- Specificity of categories: The ESR area of work categories and reporting categories used in this study may both be too broad in generating information that is useful for effective workforce modelling, planning and policymaking. The North West Informatics Skills Development Network's survey employs 19 area of work categories (compared to the nine categories covering informatics in ESR), resulting in greater sensitivity and specificity, which in turn encourages greater confidence in the mapping of job roles.

- Critical and shortage job roles: The use of occupational categories, irrespective of how broad or specific they are, will group together more than one job role. This may be detrimental when trying to focus on a specific job role known to be critical to the delivery of healthcare services or in short supply in the NHS. An example is data science, which can often be grouped together with different skillsets (depending on the job title) and currently has no designated Standard Occupational Classification code or a mechanism to report on workforce supply through data from the Higher Education Statistics Agency[3].

- Knowledge and skill levels: This study focuses on job roles and areas of work in informatics (details held on ESR) rather than the knowledge levels, skills and attributes (not found in ESR) required for these roles and areas. The different types and levels of knowledge and skills are particularly important considerations in any workforce modelling and planning endeavours.

The project team undertaking this initial study for the Building a Digital Ready Workforce (BDRW) Digital Supply and Capacity Workstream recognises the need to address or mitigate some of these limitations if we are to provide further insight about the informatics workforce in any next-stage study. We are particularly seeking to mitigate the limitations relating to detail, level and depth of information about the informatics workforce with a discovery project utilising a labour market data analysis for the job roles and titles currently being used. The project will then benchmark the most in-demand roles to an ontology of digital skills. Lack of traditional labour market data for these roles has created an information gap that is unhelpful to educators, employers and policymakers who are attempting to build a workforce with the skills needed across the breadth of health informatics. Exploring the use of big data through job adverts can help develop an alternative taxonomy of occupations by grouping jobs into occupations that require similar skills.

3.4. Reliability of sample

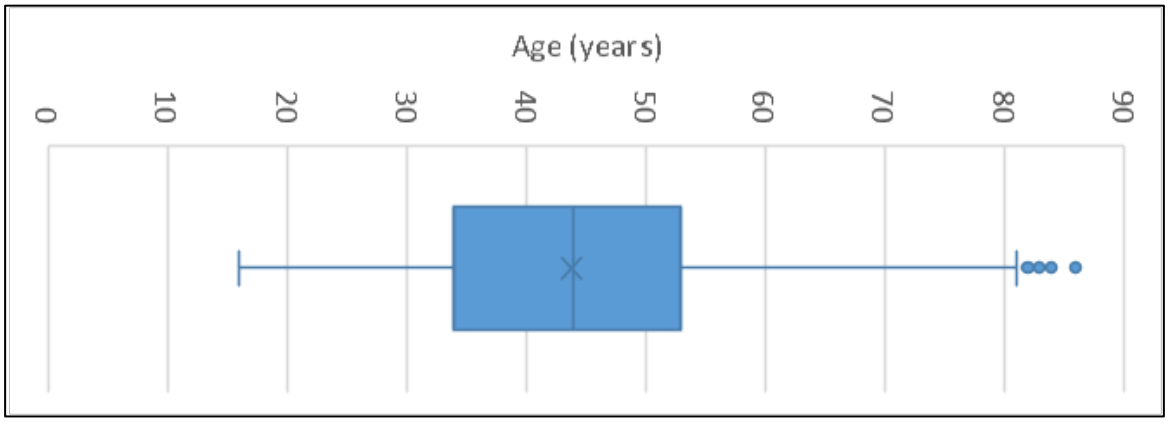
As mentioned, 29,739 FTE staff members in 2014 and 34,745 FTEs in 2019 were observed in ESR as working in informatics in the NHS and formed the sample for further analysis for this report. It is recognised that the sample is likely to be an underestimate of the actual size of the informatics workforce for 2014 and 2019 due to the limitations of the methodology employed in extracting data from ESR. The total, actual, size of the workforce in 2019 is estimated to be between 40,640 FTEs and 53,936 FTEs (see Section 4.3).

We sought to assess and quantify the confidence with which assumptions and patterns observed within the sample, and set out in this report, can be applied to estimates of the total, actual,

informatics workforce. Taking the 34,745 FTE staff members (the headcount is 38,236) observed in 2019, we contrasted this sample against estimates of the total, actual, workforce size. This assessment used the age of staff field (containing values representing number of years) in ESR as an indicator, being one of the few fields in ESR limited to numerical values.

Using a boxplot analysis[19] it can be demonstrated that only four abnormal values exist, regarding age of staff, within the observed sample of 34,745 FTE staff members (Figure 3.1). These four values fall more than is considered normal away from the median (median + 2.5 x inter quartile range), but they represent a very small outlier incidence rate of approximately 0.01%. This suggests that the sample is not unduly affected by anomalous information.

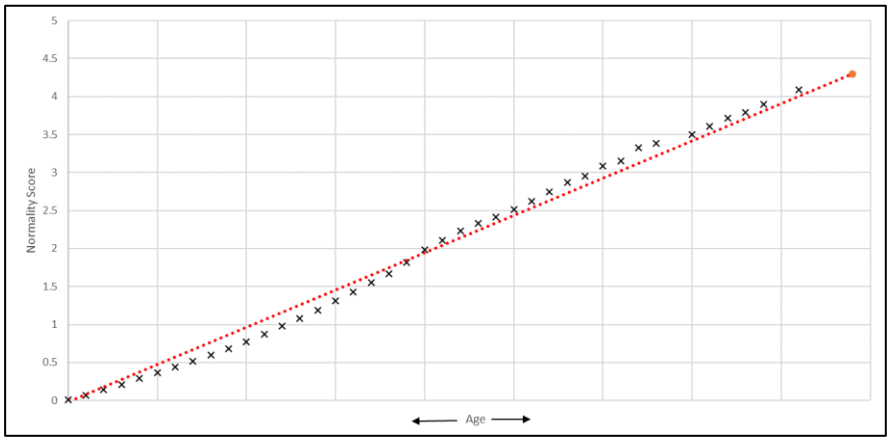
Figure 3.1: Boxplot analysis of sample – distribution chart



Source: NHS Electronic Staff Record

We also assessed the normality of the age variable in the sample through a normal probability plot[20] (Figure 3.2). The red dotted line represents the normality line, to show that should a dataset follow this line exactly it would present as a perfect bell-shaped curve. In this instance, there are small natural variations that are consistent with a non-artificial dataset. This suggests that there is no portion of the total population (i.e. the total, actual, informatics workforce) that is disproportionately excluded from the sample.

Figure 3.2: Age variable in the sample of 34,745 FTE informaticians – normal probability plot



Source: NHS Electronic Staff Record

On the basis that the sample of 34,745 FTE staff members in informatics is unlikely to be affected by either outliers or disproportionate representation, we then assessed for margin of error (or sample validity). Table 3.2 sets out different margin of error values in scenarios with different estimated actual workforce sizes in informatics (Section 4.3). These values have been calculated based on a confidence level of 99%. Therefore, where the mean age of the sample is known, through ESR, to be 43.83 years, it is with 99% certainty that the mean age of the estimated actual workforce of 55,000 FTEs (to use one example) is between 43.74 years and 43.93 based on a margin of error of ± 0.22%.

Table 3.2: Margin of error values based on different estimates of actual workforce sizes in informatics

Estimated actual workforce size	Margin of error
45,000	± 0.16%
50,000	± 0.19%
55,000	± 0.22%
60,000	± 0.24%

The findings from the boxplot, normal probability and margin of error analyses of the age variable in the sample of 34,745 FTE members of staff show that the sample data has few outlining data points, appears to represent the workforce evenly, and has a small margin of error. The margin of error is specific to each variable, but it is not estimated to vary greatly within a sample of this size. In conclusion, it would not be unreasonable to consider that some of the characteristics and trends stated in this report for the observed sample of informaticians to be applicable to the whole, actual, informatics workforce, and can be used in workforce modelling and planning activities.

4. OBSERVED AND ACTUAL WORKFORCE SIZE

4.1. Observed workforce size

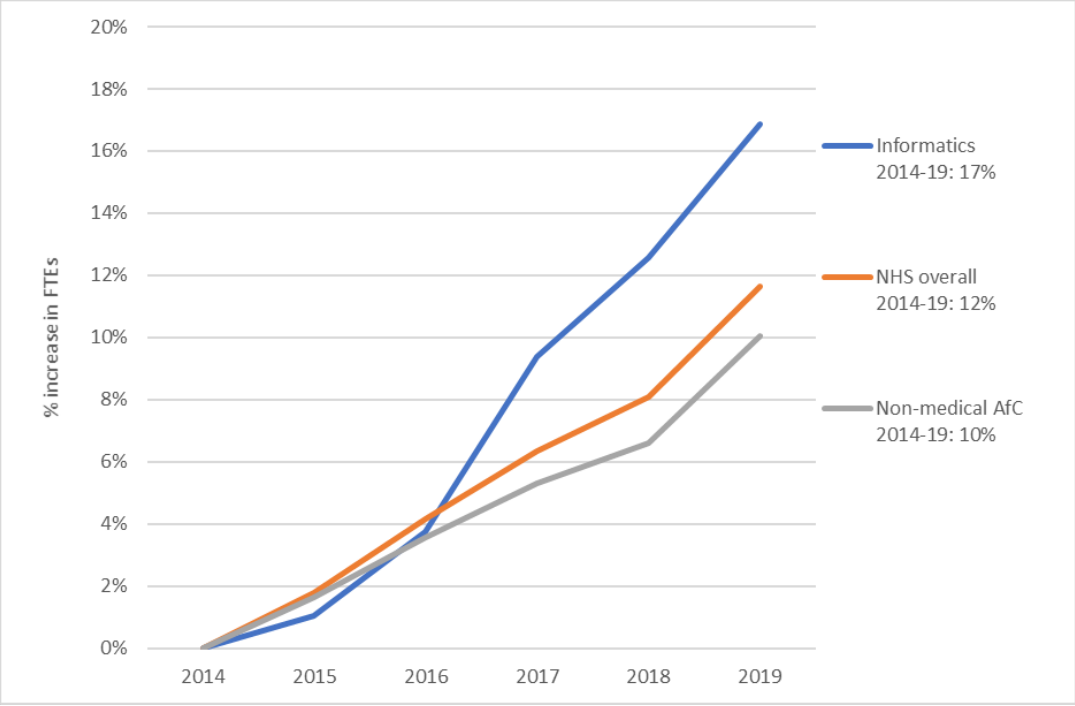
There has been an increase in the overall size of the NHS informatics workforce in terms of full-time equivalents (FTEs) and headcount, as observed in the NHS Electronic Staff Record (ESR) when using a standardised search based on NHS Digital's Informatics Area of Work Guidance (Version 2.2). In the five-year period between 2014 and 2019 the informatics workforce increased by 14–17%, an average of 3% per year. This represents an additional 5,015 full-time equivalent (FTE) staff members (1,003 per year) or 4,814 by headcount (963 per year). During the same five-year period the size of the non-medical workforce in the Agenda for Change pay system increased by 10% (from 0.94 million FTEs to 1.04 million FTEs) and the NHS overall by 12% (1.07 million FTEs to 1.19 million FTEs).

Table 4.1: Informatics workforce size in England as observed in ESR, 2014 to 2019

	Full-time equivalents	Headcount
2014	29,739	33,422
2015	30,050	33,645
2016	30,858	34,296
2017	32,531	36,026
2018	33,478	36,973
2019	34,754	38,236
5-year change	**5,015**	**4,814**
5-year change (%)	**16.9%**	**14.4%**
Average yearly change	**1,003**	**963**
Average yearly change (%)	**3.4%**	**2.9%**

Source: NHS Electronic Staff Record

Figure 4.1: Percentage increase in workforce size by FTEs between 2014 and 2019 – informatics, non-medical and NHS overall



Source: NHS Electronic Staff Record

The overall increase in the observed informatics workforce is possibly due to a combination of two factors:

- An increasing number of informaticians being employed by the NHS reflecting the recognition of the growing importance of informatics in the delivery of healthcare services and the impact of adopting digital technologies. Reports, such as the Wachter Review (2016)[21], have highlighted the current and potential impact informatics can have in the delivery of effective and optimised healthcare to populations. Initiatives such as NHS England's Digital Maturity Assessment (introduced in 2015/16)[22], measuring the digital readiness, capabilities and infrastructure of healthcare organisations, and the Global Digital Exemplars programme (2016)[23], encouraging organisations to share learning and good practice, may also have been influential.

- Existing staff being re-coded or re-categorised as informaticians in ESR when they were not previously. The NHS Digital Informatics Area of Work Guidance was updated to version 2.2 to provide advice on managing staff records in ESR, and issued in 2014[2]. In subsequent years the guidance may have acted as a spur, at both national and local levels, in re-coding or re-categorising existing staff into informatics from, for example, purely clerical and administrative codes and areas of work.

4.2. Estimating the actual workforce size

The figures on observed workforce size presented in Table 4.1 are likely to be an underestimate of the actual size of the informatics workforce in the NHS. The methodology used in structuring and standardising the search for this workforce in ESR has its limitations (Section 3.3) and evidence suggests the actual size of the informatics workforce is larger. This suggestion has been backed up by the results of searching in the job title field in ESR using job titles not listed by the NHS Digital Informatics Area of Work Guidance (Version 2.2) and benchmarking the findings to recent survey data collected on the workforce. To determine the extent of the underestimation we focused on two subsets of the informatics workforce: those working in library and knowledge services (part of the knowledge management area of work in this report), and clinical coding services (part of clinical informatics).

4.2.1. Library and knowledge services

We used the following steps in determining the actual size of the knowledge management workforce in the NHS:

- Step 1: Staff records were searched for in the ESR dataset using the knowledge management area of work and job title values listed in the NHS Digital Informatics Area of Work Guidance (Version 2.2). This standardised search resulted in the identification of 616 FTE members of staff as of 31 March 2019, i.e. the observed workforce size in ESR.

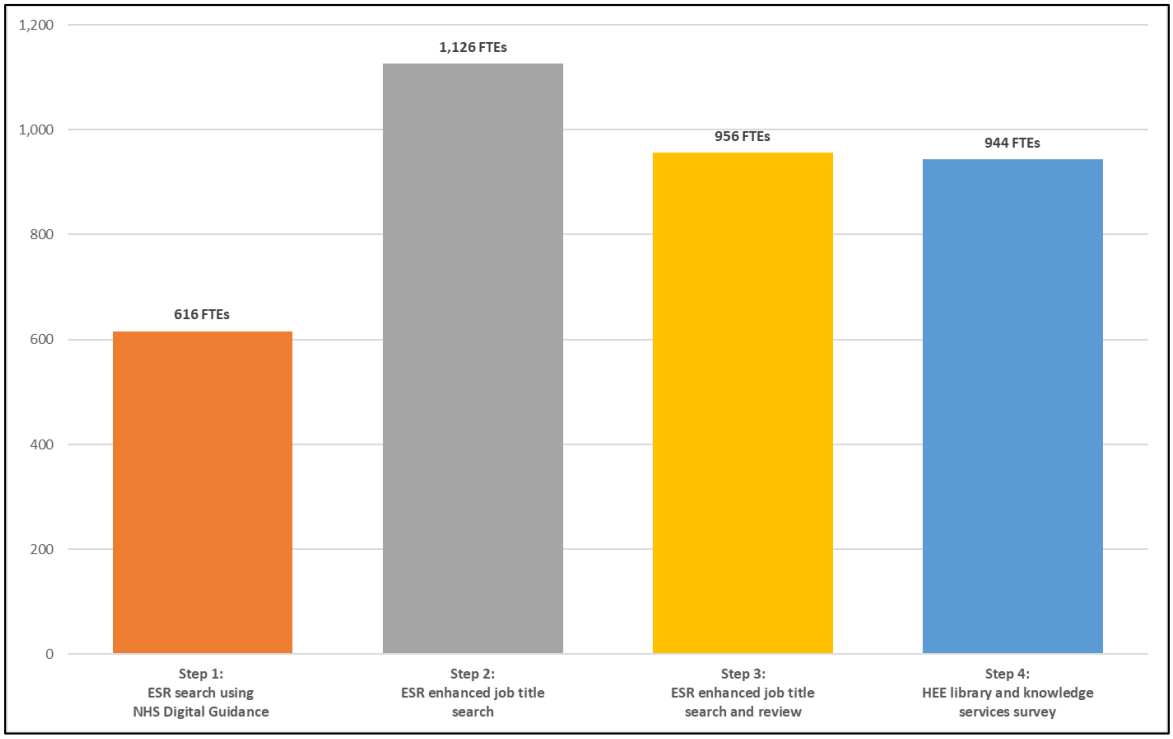
- Step 2: The job titles of these staff members were then examined to create an ontology identifying key text character strings that occur. The character string *lib*r** was derived as an enhanced search term for job titles because it contains wildcard characters (the * symbol represents one or more characters), accounts for spelling errors and represents extended words and terms such as *library clerk*, *library administrator* and *librarian*. Using the *lib*r** character string in a job title search in ESR resulted in the identification of 1,126 FTE staff members.

- Step 3: The job titles of these 1,126 FTE staff members were then reviewed and using professional judgement any erroneous values were excluded – for example, *medical equipment library staff*. This resulted in the identification of 956 FTE staff members as an estimate of the actual workforce size in knowledge management.

- Step 4: To assess the reliability of the estimate we compared the figure of 956 FTEs identified in ESR to the 944 FTEs identified by the 2019/20 workforce survey carried out by the Health Education England (HEE) Library and Knowledge Services and Technology Enhanced Learning Team. The survey is carried out annually among all NHS organisations that provide library and knowledge services, and usually has a very high response rate (99% in 2019/20). The results of the survey are therefore deemed appropriate for checking on the reliability of any estimates made about the size of the workforce through ESR. There is only a 1.2% difference between the two figures of 956 FTEs and 944 FTEs and therefore the enhanced ESR job title search and review can be regarded as being reliable in deriving an estimate of the actual workforce size in ESR.

Figure 4.2 sets out the FTE figures derived from each of the steps described above. The observed informatics workforce size (Step 1) of 616 FTEs is around 55% lower than the estimated actual workforce size of between 944 FTEs and 956 FTEs (Step 4).

Figure 4.2: Library and knowledge management services in England – observed and actual workforce sizes in 2019



Source: NHS Electronic Staff Record and HEE Library and Knowledge Services and Technology Enhanced Learning Team 2019/20 workforce survey

4.2.2 Clinical coding services

A similar step-by-step process was used in determining the variance between the observed and estimated actual number of clinical coders in the NHS. Unlike the knowledge management example, which has a national focus, the analysis of data for clinical coders focused on those working in North West England.

- Step 1: Staff records were searched for in the ESR dataset using the coding (formerly clinical coding) area of work and job title values listed in the NHS Digital Informatics Area of Work Guidance (Version 2.2). This resulted in the identification of 496 FTE members of staff working in North West England as of 31 March 2019, i.e. the observed workforce size in ESR.

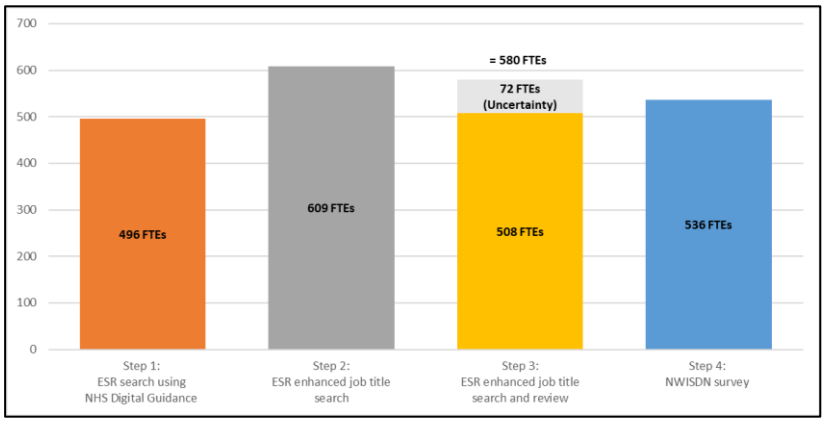
- Step 2: The job titles of these staff members were then examined to create an ontology identifying key text character strings that occur. The character strings **code** and **coding** were derived as enhanced search terms for job titles. Using these character strings in a job title search in ESR resulted in the identification of 609 FTE members of staff.

- Step 3: Of the 609 FTEs identified in Step 2, 383 did not have an area of work value of coding in their ESR record. The job titles of these staff members were then examined and using professional judgement any clearly erroneous values, for example *Warehouse Operative* and *Porter Team Leader*, were excluded. This process led to the identification of between 508 and 580 FTEs in ESR as an estimate of the actual workforce size in clinical coding in North West England. The range given accounts for 72 FTEs with job titles where there is uncertainty as to whether these people are clinical coders, for example *Admin & Clerical Band 4* and *Clerical Assistant*. These people have been retained and marked as uncertain for the purposes of further data analysis.

- Step 4: To assess the reliability of the estimate we compared the figures of 508–580 FTEs identified in ESR to the 536 FTE clinical coders identified by the North West Informatics Skill Development Network (NWISDN) survey in 2018. The survey has been carried out among NHS organisations in the region annually since 2013 and usually has a high response rate. It is therefore appropriate to use the survey results to check on the reliability of any estimates made about the size of the workforce through ESR. There is a 5%–7.8% difference between the 536 FTE figure derived from the NWISDN survey and that of the 508–580 FTEs derived from ESR. The range in the difference accounts for a level of uncertainty. In some ways, the difference of only 5% to 7.8% means that an enhanced ESR job title search and review can be regarded as being reliable in providing an estimate of the actual workforce size in ESR.

Figure 4.3 sets out the FTE figures derived from each of the steps described above. The observed clinical coding workforce size (Step 1) of 496 FTEs is 17% lower than the highest estimated actual workforce size of 580 FTEs (Step 4).

Figure 4.3: Clinical coding services in North West England – observed and actual workforce sizes



Source: NHS Electronic Staff Record and North West Informatics Skill Development Network 2018 survey

4.3. Actual workforce size

As mentioned, 34,745 FTE staff members were observed in ESR as working in informatics in 2019. Increases of 17% (based on the difference between the observed and estimated actual workforce size for clinical coding in North West England) and 55% (difference between observed and estimated actual workforce size for knowledge management nationally) on the observed 34,754 FTEs suggest that the actual size of the informatics workforce in the NHS is currently between 40,640 FTEs and 53,936 FTEs.

Even these figures may still be an underestimate as not all NHS organisations, including those in primary care, use ESR for their human resource management and payroll system. However, the estimate of between 40,640 FTEs and 53,936 FTEs does correspond with other estimates reported for this workforce (Table 4.2).

Table 4.2: Reported estimates of workforce size for informatics

Source	Estimate	Notes
Department of Health and Social Care (2018)[24]	60,000 (headcount)	Approximate number of informaticians or digital experts in the NHS, from clinical coders to librarians, IT helpdesk staff to clinical information officers.
The Health Foundation (2016)[25]	>50,000 (headcount) 44,519 (FTEs)	UK estimate. Based on audits carried out by the NWISDN, with results extrapolated to whole of UK by resident population assuming the North West is typical of the rest of the UK.
National Information Board (2014)[26]	>47,000 (headcount)	Number of health informatics staff employed by the NHS in England and Wales.

4.4. Workforce characteristics and trends

The information presented in Sections 5 to 14 of the report is based on the observed, rather than the actual, workforce for the period 1 April 2014 to 31 March 2019. The observed workforce is therefore a sample of the actual. Some of the characteristics and attributes, and trends and patterns, found in the sample may be extrapolated and/or applied to the actual workforce, although further data analytical work will need to be undertaken in reporting this extrapolation with any great confidence.

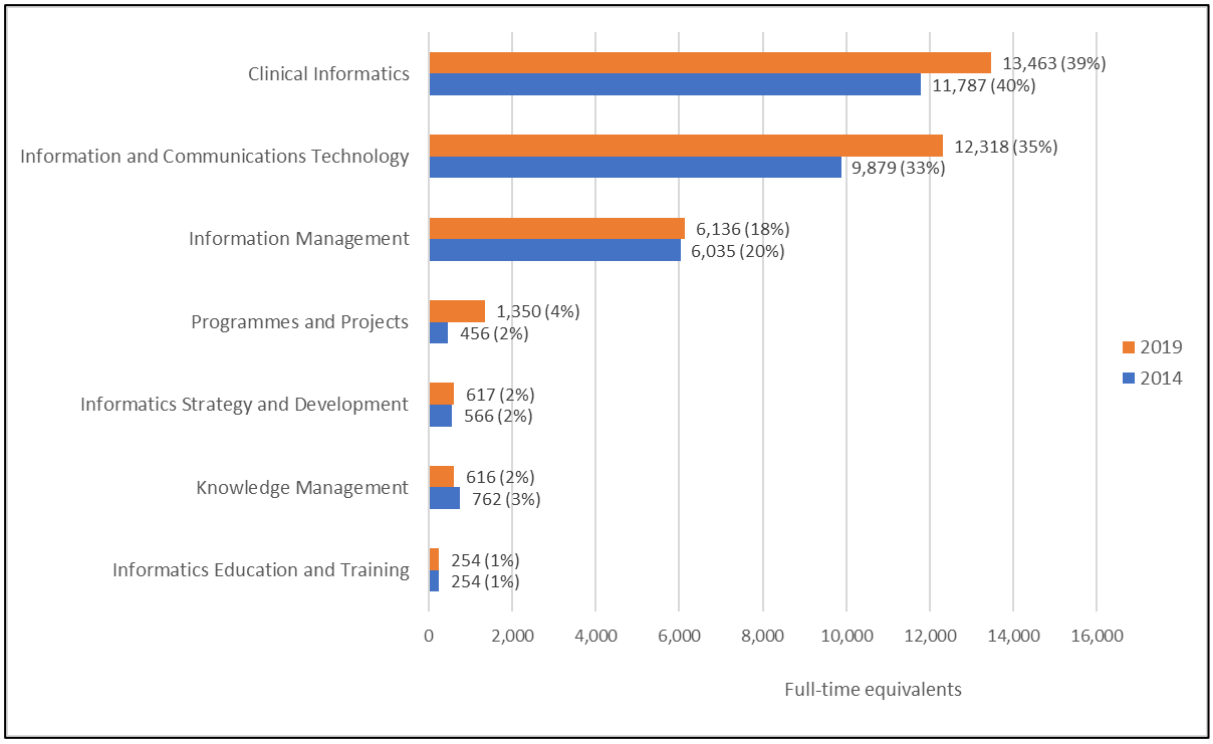
5. AREAS OF WORK IN INFORMATICS

5.1. Workforce size by areas of work

The biggest concentration of informaticians is in the area of clinical informatics (39% in 2019) and information and communication technology (35%), and to a lesser extent information management (18%). This is partly due to the broad scope of these areas of work and subsequently larger number of associated job roles. This is reflected in the number of indicative job titles, in the NHS Digital Informatics Area of Work Guidance (Version 2.2)[2], mapped to NHS Electronic Staff Record (ESR) area of work and, subsequently, the reporting categories being used in this study (Table 3.1).

Other possible reasons for this concentration of informaticians is that some job roles are more labour intensive than others, the variable demand for certain skills by NHS organisations, whether an area of work is predominantly a front-line service or one that support others, and so on. The reasons suggested, and that some areas of work are broad or narrow in scope, does have implications for workforce planning. Modelling and planning the workforce for each of the areas of work in informatics will be based on different assumptions. The informatics workforce is not homogeneous, but instead is diverse with areas that are quite discrete from one another.

Fig 5.1: Workforce size by area of work in informatics – FTE (and percentage) for 2014 and 2019



Source: NHS Electronic Staff Record

Table 5.1: Number of job titles listed in the NHS Digital Informatics Area of Work Guidance (Version 2.2) and mapped to reporting categories for this study

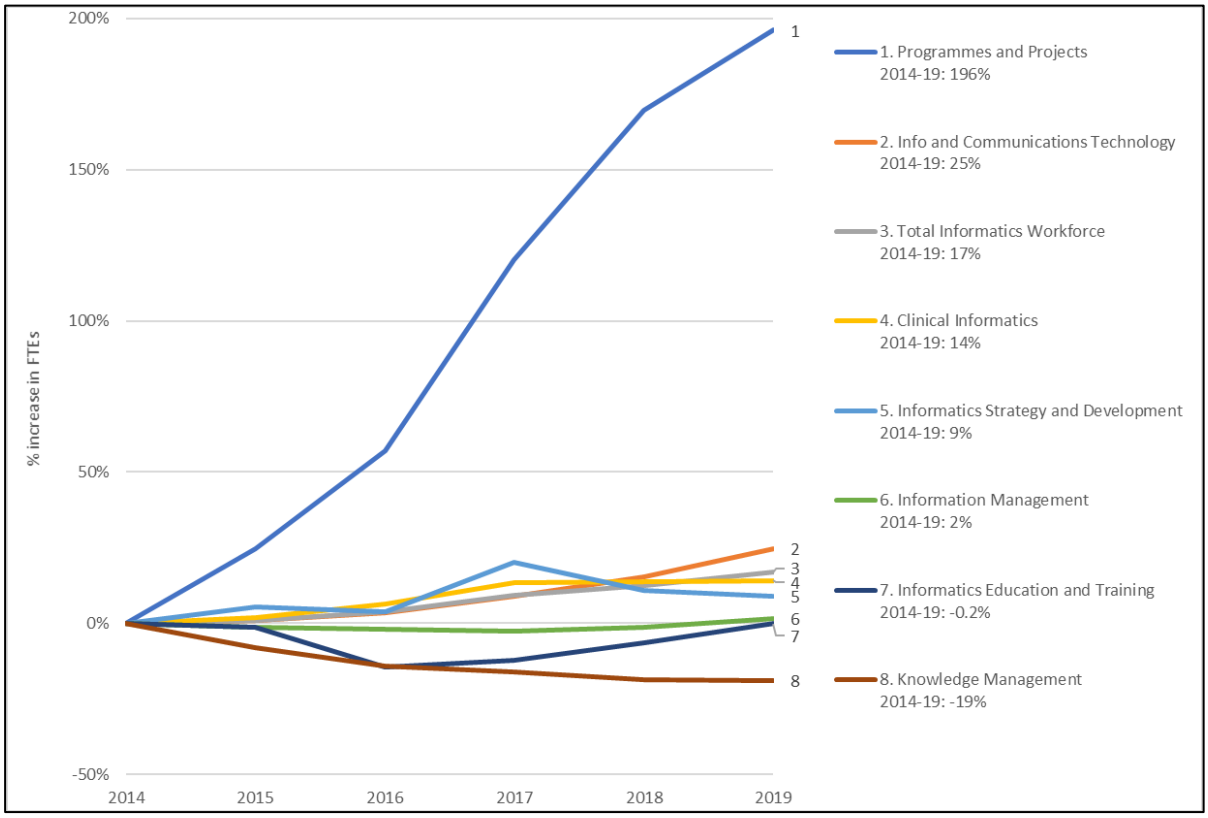
Area of work – reporting categories	Number of job titles
Clinical Informatics	76
Information and Communication Technology	75
Information Management	66
Programmes and Projects	64
Informatics Strategy and Development	36
Informatics Education and Training	28
Knowledge Management	17
Total	**362**

Source: NHS Digital Informatics Area of Work Guidance (Version 2.2)[2]

5.2. Growth in workforce size by areas of work

The biggest percentage growth in the size of workforce has been in the area of programmes and projects. The number of NHS staff in this area of work increased by 196% (from 456 full-time equivalents (FTEs) to 1,350 FTEs) between 2014 and 2019. Coincidently, it is this area of work that also has the highest proportion of staff employed on fixed-term contracts, 19% in 2014 and 25% in 2019. These observations may be due to focused efforts made by NHS organisations in recent years to strengthen and improve digital capabilities and infrastructure, and make better use of information.

Fig 5.2: Five-year percentage change in workforce size (FTEs) in each informatics area of work, indexed to 2014



Source: NHS Electronic Staff Record

The next biggest growth in workforce size was in the information and communication technology area of work, which saw an increase of 25% between 2014 and 2019. The growing importance and application of digital technology in the work environment generally, and initiatives such as NHS England's Digital Maturity Assessment (introduced in 2015/16)[22] and Global Digital Exemplars programme (2016)[23], may be reasons in explaining this growth in workforce size.

The figures from ESR also show a substantial decrease in the number of staff working in knowledge management. This workforce saw a 19% drop, from 762 FTEs in 2014 to 616 FTEs to 2019. It will be important to examine, together with the Health Education England (HEE) Library and Knowledge Services and Technology Enhanced Learning Team (during Phase 2 of the project), whether these figures are an accurate representation of what has happened and, if so, the reasons for the trend. Knowledge management, currently, is an outlier as the other areas of work in informatics are either retaining or increasing the size of their workforces.

6. TYPES OF EMPLOYMENT CONTRACTS

6.1. Permanent and fixed-term contracts

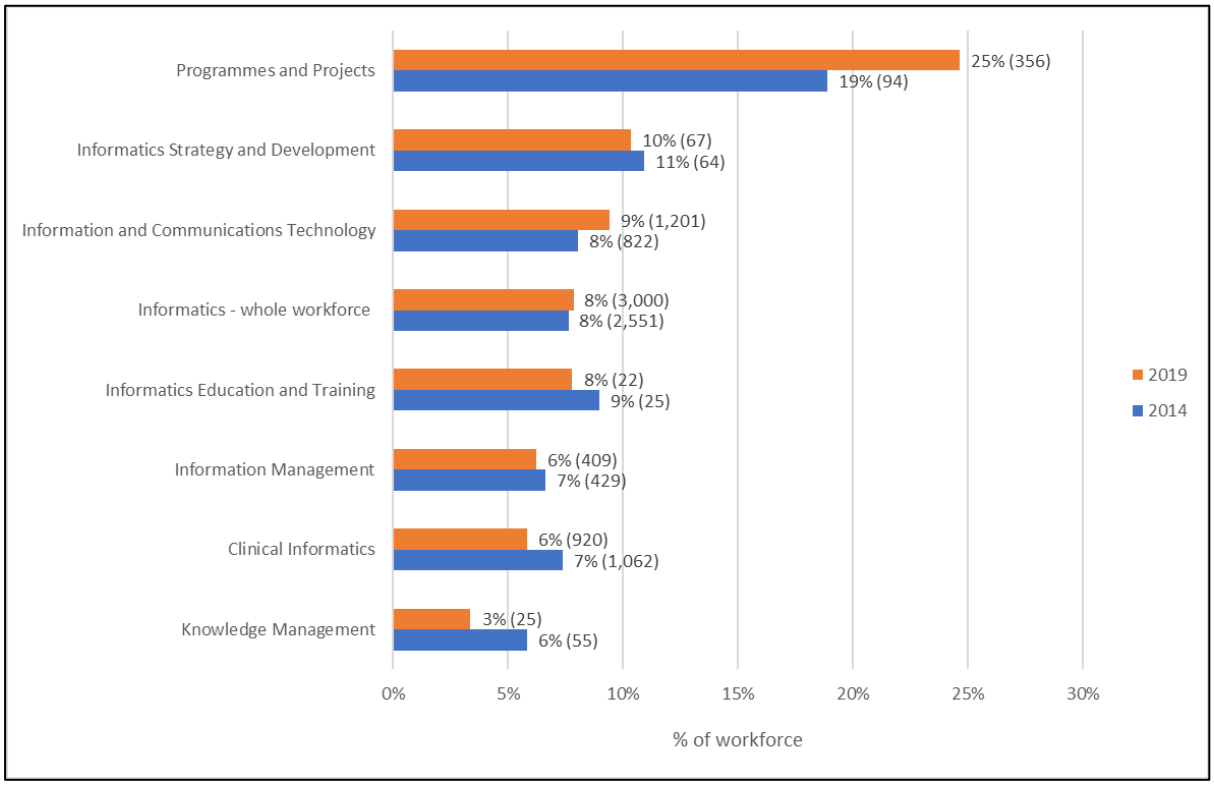
Most NHS staff working in informatics are employed on a permanent contract. Less than one-in-10 are employed on a fixed-term contract and this has not changed to any extent since 2014. When examining the workforce by the different areas of work there is variance in the proportion of permanent and fixed-term staff employed. Programmes and projects make the greatest use of fixed-term contracts and are doing so to an increasing extent (19% in 2014, increasing to 25% in 2019). The main reason being the nature of work that is often defined with a fixed endpoint. Knowledge management makes the least use of fixed-term contracts with only 3% of staff being employed in this way in 2019. A possible reason is the need for continuity of service by staff members in this area of work.

Table 6.1: Headcount and percentage of staff in informatics with fixed-term and permanent contracts, 2014 and 2019

	Fixed-term contract	%	Permanent contract	%
2014	2,551	8%	30,871	92%
2019	3,000	8%	35,236	92%

Source: NHS Electronic Staff Record

Figure 6.1: Percentage (and headcount) of staff with a fixed-term contract in each area of work, 2014 and 2019

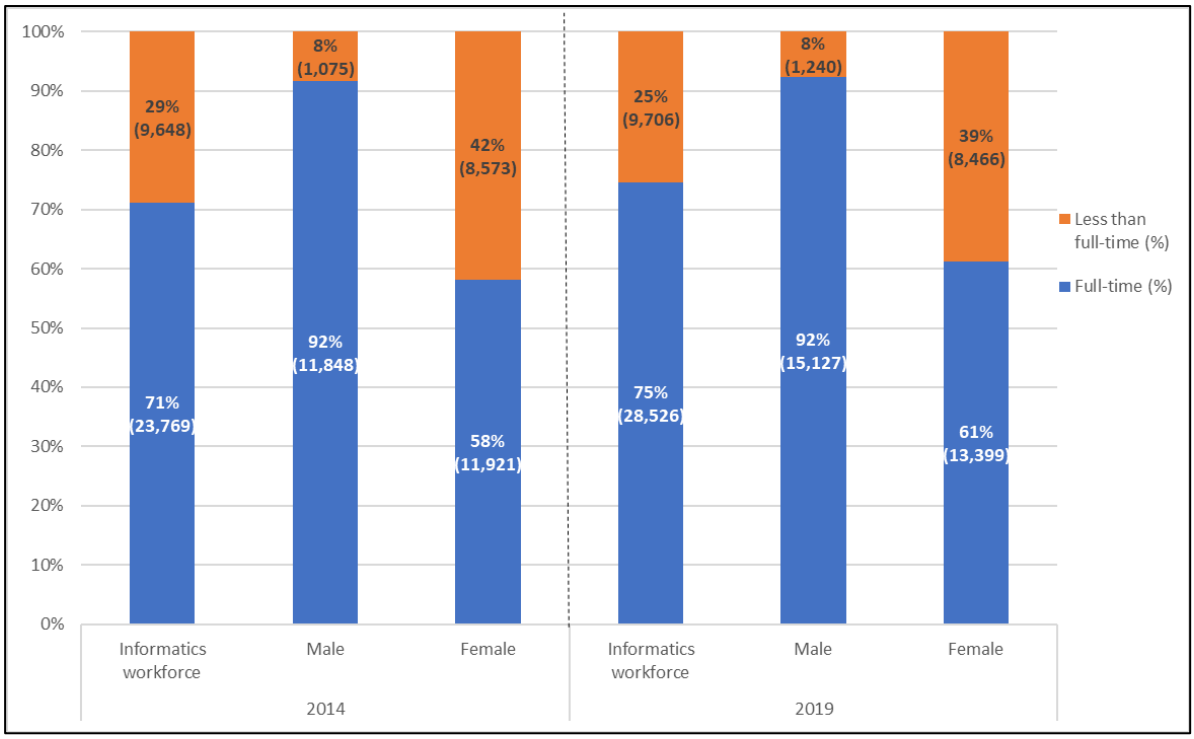


Source: NHS Electronic Staff Record

6.2. Less than full-time working

Figure 6.2 presents information on how many people in informatics work less than full-time (LTFT), i.e. fewer than 37.5 hours per week. In a few cases, some individuals may be working in two or more jobs in different organisations totalling 37.5 hours or more per week. Those working LTFT made up a quarter of the informatics workforce in 2019. The extent of LTFT, as a proportion of the workforce, has slightly decreased since 2014. Women are far more likely than men to work LTFT, with 39% of women compared to 8% of men doing so in 2019.

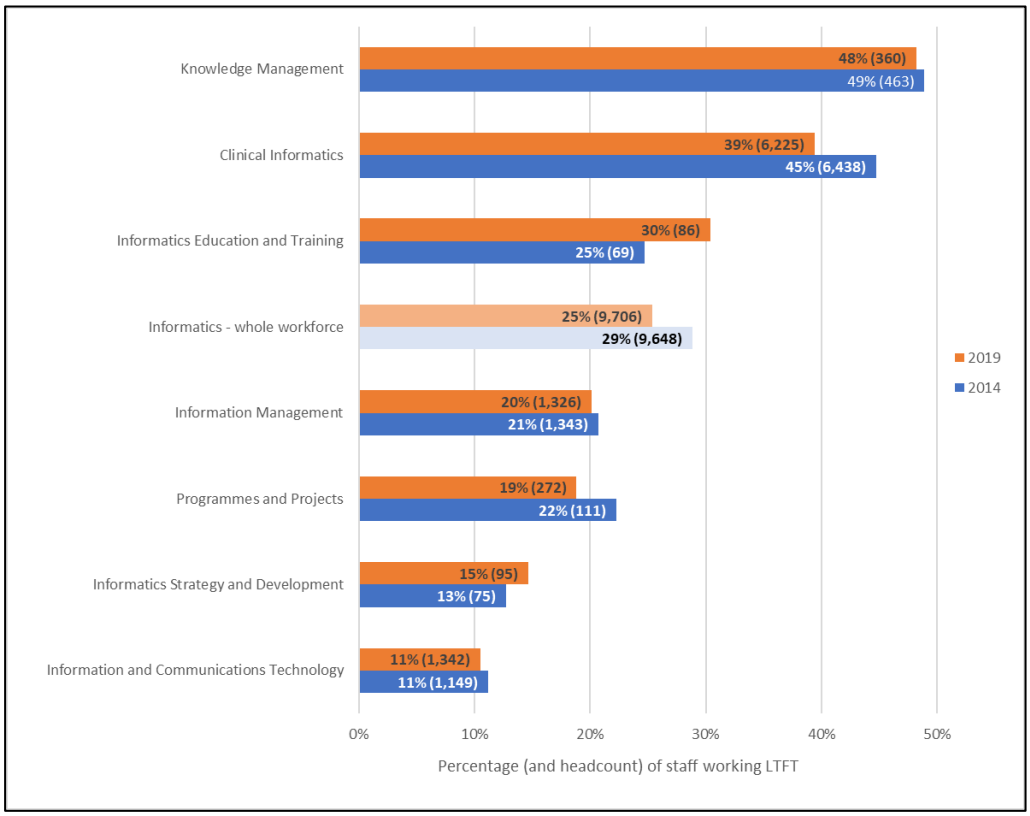
Figure 6.2: Percentage (and headcount) of the informatics workforce and female and male staff working full- and less than full-time, 2014 and 2019



Source: NHS Electronic Staff Record

LTFT working in 2019 is more prevalent in the areas of knowledge management (48%) and clinical informatics (39%), while least prevalent in information and communication technology (11%) and informatics strategy and development (15%). It is noticeable that knowledge management is also the area of work that has the highest proportion of female members of staff (Section 8) and those aged 55 and over (Section 9), while information and communication technology had the highest proportion of male staff members. A possible reason for these observations is the impact of predominant gender leadership on culture, whereby men are less inclined to support and work LTFT, and women are less attracted to that culture that may pervade.

Fig 6.3: Percentage (and headcount) of the workforce in each area of work in informatics working less than full-time, 2014 and 2019



Source: NHS Electronic Staff Record

6.3. Participation rate

The extent of LTFT working does have implications for workforce planning. The participation rate is a calculation of the ratio of full-time equivalents (FTEs) to headcount, giving an indication of the number people required to be trained and/or employed to provide the services of, for example, 100 FTE posts. Across the whole informatics workforce in 2019 the participation rate was 0.91, meaning a headcount of 110 people was required for 100 FTE posts. Detailed workforce modelling and planning in informatics will need to account for participation rates in each area of work (Table 6.2).

Table 6.2: Participation rate of the workforce – calculation of ratio of full-time equivalents to headcount in 2019

	Participation rate	Headcount required for 100 FTEs
Information and Communication Technology	0.97	103
Informatics Strategy and Development	0.95	105
Programmes and Projects	0.93	107
Information Management	0.93	107
Informatics Education and Training	0.90	111
Clinical Informatics	0.85	117
Knowledge Management	0.83	121
Informatics – whole workforce	**0.91**	**110**

Source: NHS Electronic Staff Record

7. AGENDA FOR CHANGE BANDING

7.1. Informatics workforce by Agenda for Change banding

Agenda for Change (AfC) is the main national pay framework for NHS staff, except doctors, dentists and senior managers. It is the pay framework for non-medical staff. The vast majority of informaticians in the NHS are employed within this framework. Band 1 is the lowest and Band 9 the highest in terms of pay and knowledge levels, responsibilities and skills required for a job[27]. An AfC banding is not stated for around 2% of the informatics workforce in ESR. These staff members are likely to be very senior managers or on terms and conditions that pre-exist AfC or on Transfer of Undertakings (Protection of Employment) Regulations contracts.

7.2. Increased knowledge and skill levels in the informatics workforce

There has been a slight decrease (-1%) in the headcount of informaticians employed in the lower AfC bands 1 to 4 between 2014 and 2019. The number informaticians in the middle bands 5 to 7 increased by 27%, and in the higher bands 8a to 9 by 52%. These increases are noticeable when compared to the increase of 14% in the overall size of the informatics workforce and figures for non-medical staff across the NHS. For example, the workforce in informatics employed at AfC bands 8a to 8d increased by 46% to 59% compared to 18% to 28% for all non-medical NHS staff in these bands (Figure 7.1).

Table 7.1: Headcount of the informatics workforce by Agenda for Change banding, 2014 and 2019

	2014	2019	Change	% Change
Bands 1 to 4	17,643	17,513	-130	-1%
Bands 5 to 7	12,227	15,482	3,255	27%
Bands 8a to 9	2,955	4,499	1,544	52%
Not stated	597	742	145	24%
Total	**33,422**	**38,236**	**4,814**	**14%**

Source: NHS Electronic Staff Record

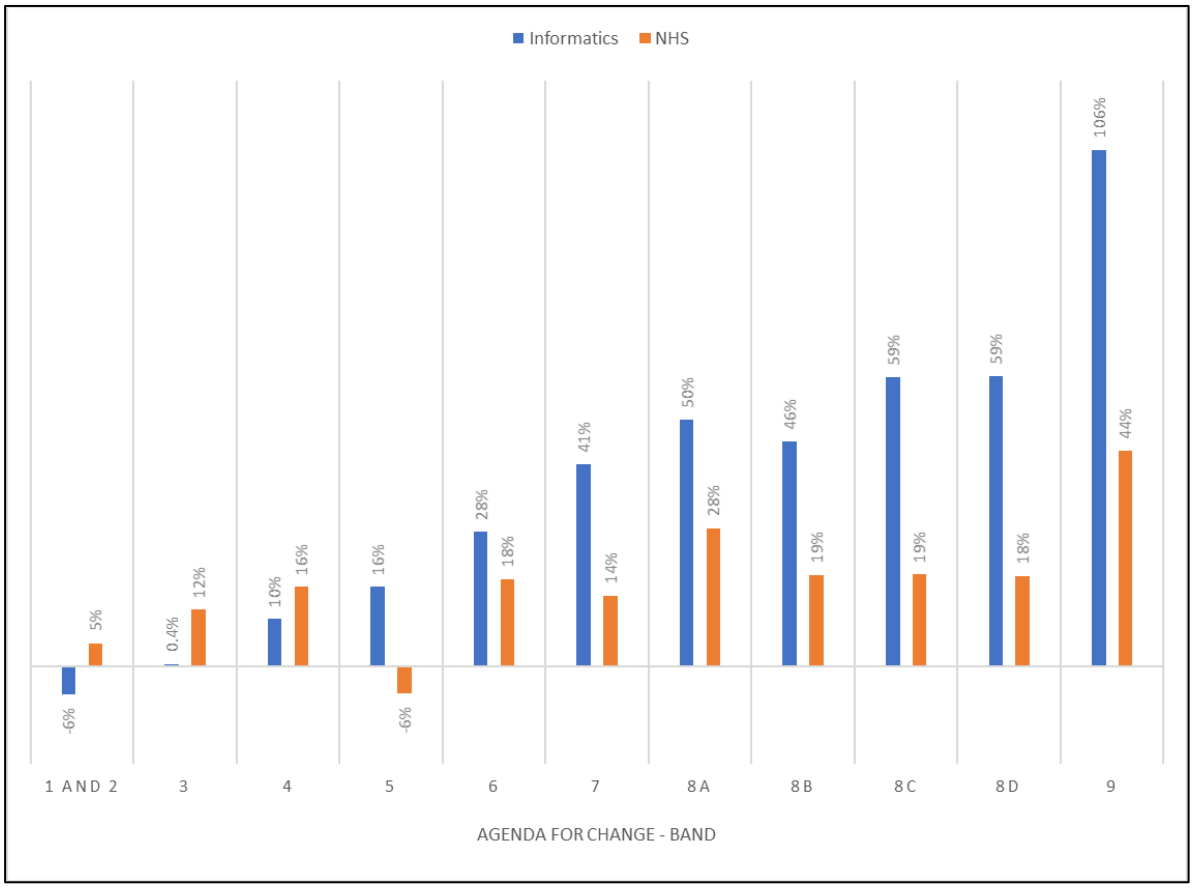
It is possible that the trends just described may be due to following:

1. Staff members in the lower AfC bands are likely to be administrators, clerks or assistants in jobs that possibly have been impacted by technological automation. As people leave their jobs they are generally not being replaced and these lower-skilled jobs are being deleted or automated. Market pressures may also be making it difficult to recruit at this level.

2. More jobs are being created in informatics and these jobs tend to be at a higher level in terms of responsibilities, knowledge and skills required.

3. NHS organisations are having to advertise informatics jobs at higher pay levels (and therefore in higher AfC bands) in order to attract applicants in a competitive market for their services.

Figure 7.1: Percentage change in informatics and NHS workforce sizes (headcount) between 2014 and 2019 in each Agenda for Change band



Source: NHS Electronic Staff Record

The increasing sophistication and application of information technology, hardware and software in supporting and delivering healthcare services require staff with certain knowledge and skills, often at a level higher than previously needed. This trend is being replicated in other sectors of the economy. Research findings from the Royal Society show that skills in data science, scripting languages, big data, structured query language (SQL) databases and machine learning are the most frequently needed by employers, and increasingly required for data specialists, compared to five years ago. Qualification levels requested for the Data Scientists and Advanced Analysts category, used in the Royal Society (2019) report, have broadly increased. In 2013, 34% of such postings required Level 6 (first degree) or Level 7 (MSc or upwards) skills, but by 2017/18 this had increased to 42%[3].

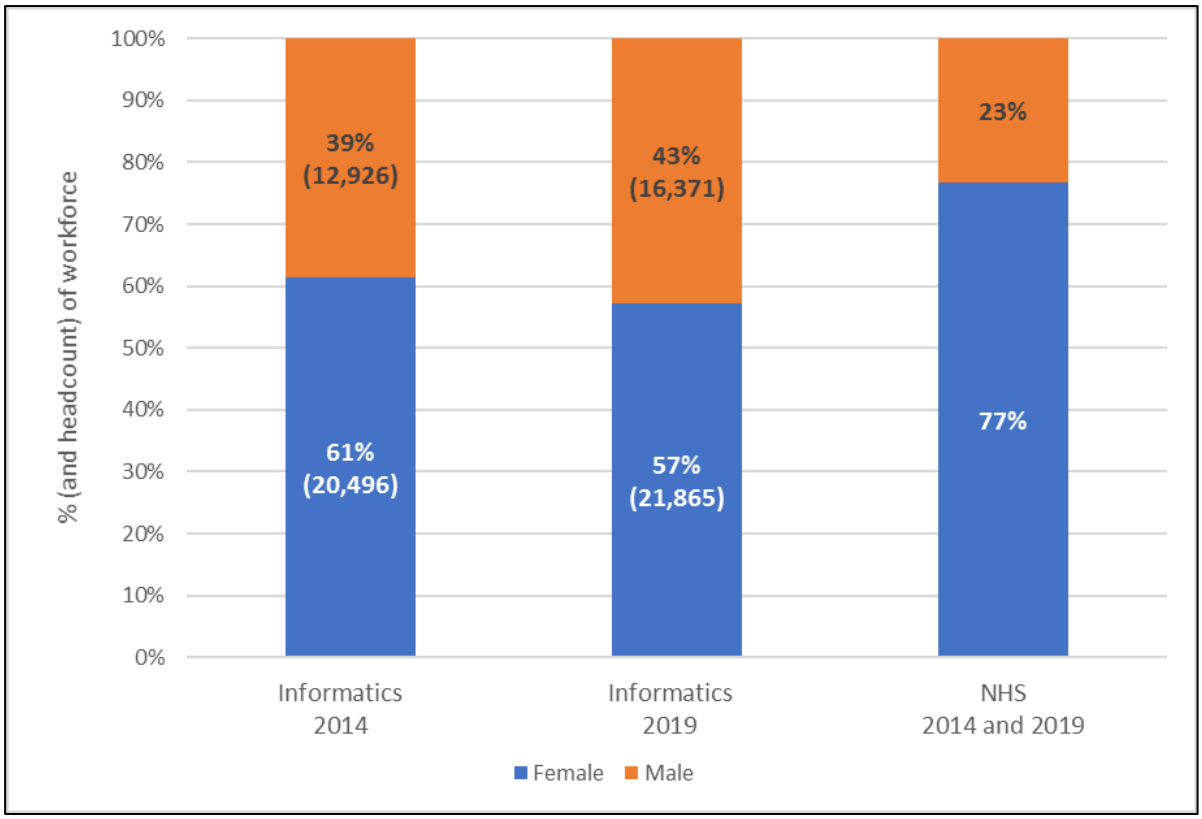
These observations will have financial implications for future funding of the NHS informatics workforce. The size of the workforce is likely to increase if the trend seen for the previous five years continues, but it will do so through more jobs being paid at a higher level. It is important to take this into account in any workforce modelling and planning.

8. GENDER

8.1. Gender and areas of work

Women make up most of the informatics workforce (57% in 2019), but not to the same extent as found in the NHS overall (77%). This majority is decreasing, as women comprised 61% of the informatics workforce in 2014 and 57% in 2019. During this five-year period the workforce saw 3,444 more men compared to 1,369 women (a difference of 2,075). This equates to seven men for every two women in the expanding workforce. This may be explained, in part, by a rapid increase in jobs found in information and communication technology (Section 5), an area of work traditionally dominated by men. Just over half of the 16,371 men in informatics now work in information and communication technology, resulting in a 65% male to 35% female ratio in this area of work.

Figure 8.1: Percentage and headcount of female and male staff in informatics and the NHS, 2014 and 2019



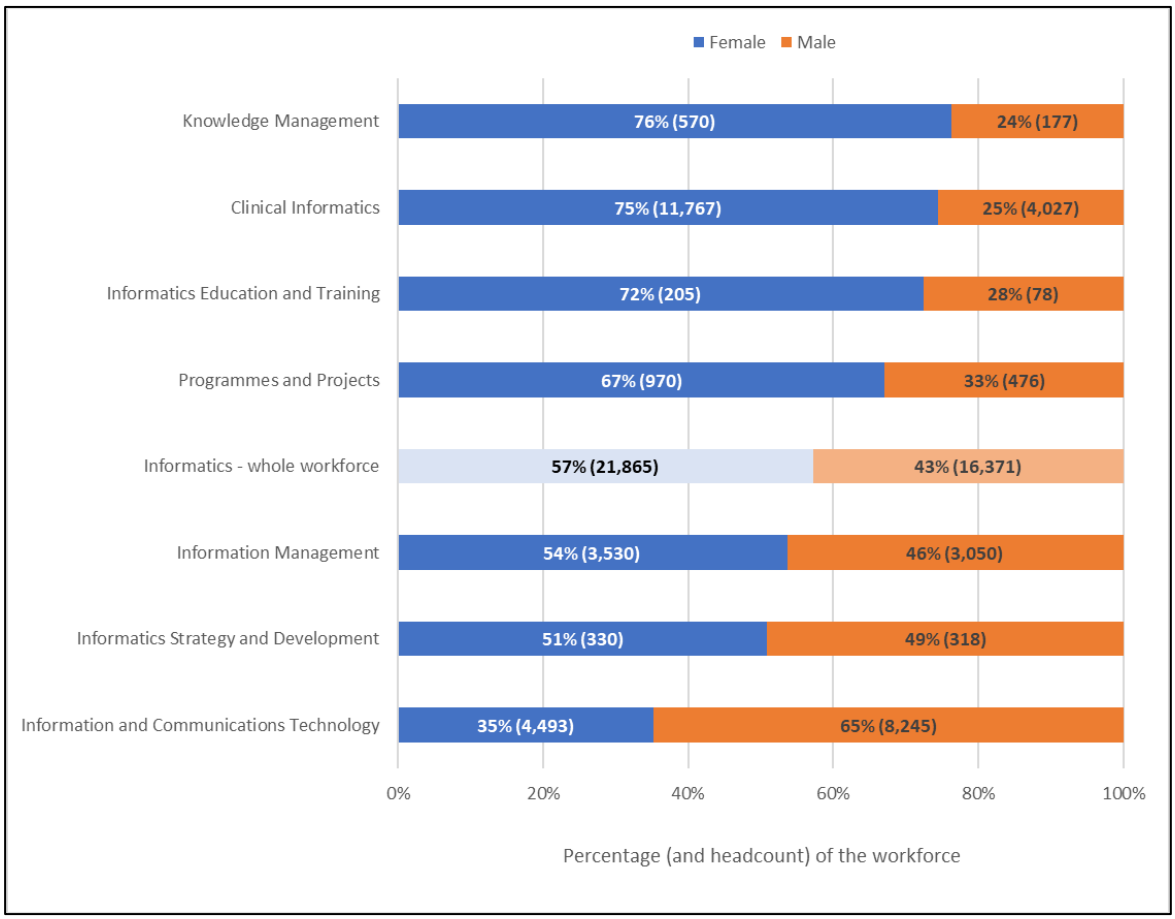
Note: Between 2014 and 2019 the NHS workforce increased from 1.24 million to 1.38 million, but the proportion of female (77%) and male (23%) staff remained the same.
Source: NHS Electronic Staff Record

The male to female ratio imbalance in information and communication technology can be found in other sectors, and not just healthcare. Latest figures from Tech Nation (2018), a national network of digital technological entrepreneurs, reveal that only 19% of the digital technology workforce is female, compared to 49% across all UK jobs[28]. The digital technology industry is very much underrepresented by females and this can lead to a perception that the industry is more geared towards men, deterring women from the desire to enter the industry. This compounds the gender imbalance issue in the NHS, which is essentially competing with industry when recruiting staff with digital and information and communication technology skills. The issue of gender imbalance and the need for diversity in the workforce has been highlighted in a report on data science by the Royal Society (2019)[3]. The report called for a diverse workforce, in terms of both gender and ethnicity, as a

pre-requisite in fully understanding and interpreting real-world problems and using digital technology to provide balanced solutions. A report on the artificial intelligence (AI) industry published by the UK government in 2017 recognised the importance of gender and ethnic diversity in the workforce[4]. It was argued that a more diverse workforce will help ensure that the inherent bias of programmers does not transfer to code, and should lead to equitable and credible results from technology processes.

Those areas of work in informatics where women are in the majority have seen the number of jobs either decreasing or remaining static between 2014 and 2019. Women make up three-quarters of the clinical informatics and knowledge management workforces and these areas saw a negative growth of -0.2% and -19% in the number of full-time equivalents (FTEs). An exception to this trend is the programmes and projects area of work, which grew by 196% in terms of FTEs. This growth represents an additional 948 people by headcount, of which 624 are women.

Figure 8.2: Percentage (and headcount) of women and men in each area of work in informatics, 2019



Source: NHS Electronic Staff Record

8.2. Gender and types of employment contract

Just over nine-in-10 staff members working in informatics in 2019 are on a permanent contract. Men are slightly more likely to be employed with a fixed-term contract, whereas 9% of male staff are employed on such a basis; the figure for female staff is 7%.

Table 8.1: Headcount and percentage of female and male staff in informatics with fixed-term and permanent contracts in 2019

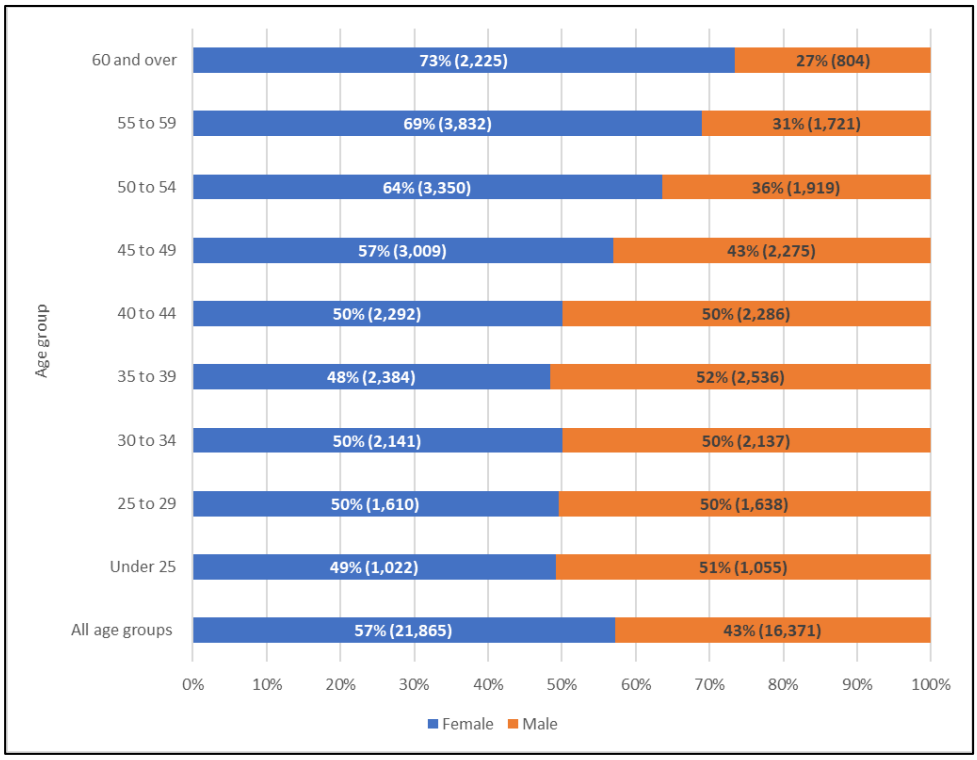
	Fixed-term contract	%	Permanent contract	%
Female	1,501	7%	20,364	93%
Male	1,499	9%	14,872	91%
Total	**3,000**	**8%**	**35,236**	**92%**

Source: NHS Electronic Staff Record

8.3. Gender and age

Those retiring soon are more likely to be women who comprise around two-thirds or more of the informatics workforce aged 50 and over. This may facilitate the trend towards a greater proportion of men in the informatics workforce overall, especially as the younger age groups coming through comprise of an even split of men and women. There is the possibility that men, who currently comprise 43% of the workforce, will soon be in the majority given that certain jobs (e.g. information and communication technology) tend to be held by younger men and it is these jobs that are rapidly increasing in number.

Figure 8.3: Informatics workforce – percentage (and headcount) of women and men in each age group in 2019



Source: NHS Electronic Staff Record

8.4. Gender and Agenda for Change banding

Table 8.2 and Figure 8.4 show the current number of women and men in the informatics workforce by AfC banding. The information does not account for the 332 women and 420 men (total 742) in this workforce because their record on the NHS Electronic Staff Record (ESR) lacks an AfC band value.

Nearly six-in-10 women, compared to a third of men, in the informatics workforce are in jobs designated in the lower AfC bands 1 to 4. Some 68% of men in this workforce are employed in the middle 5 to 7 or higher 8a to 9 bands, compared to only 43% of women.

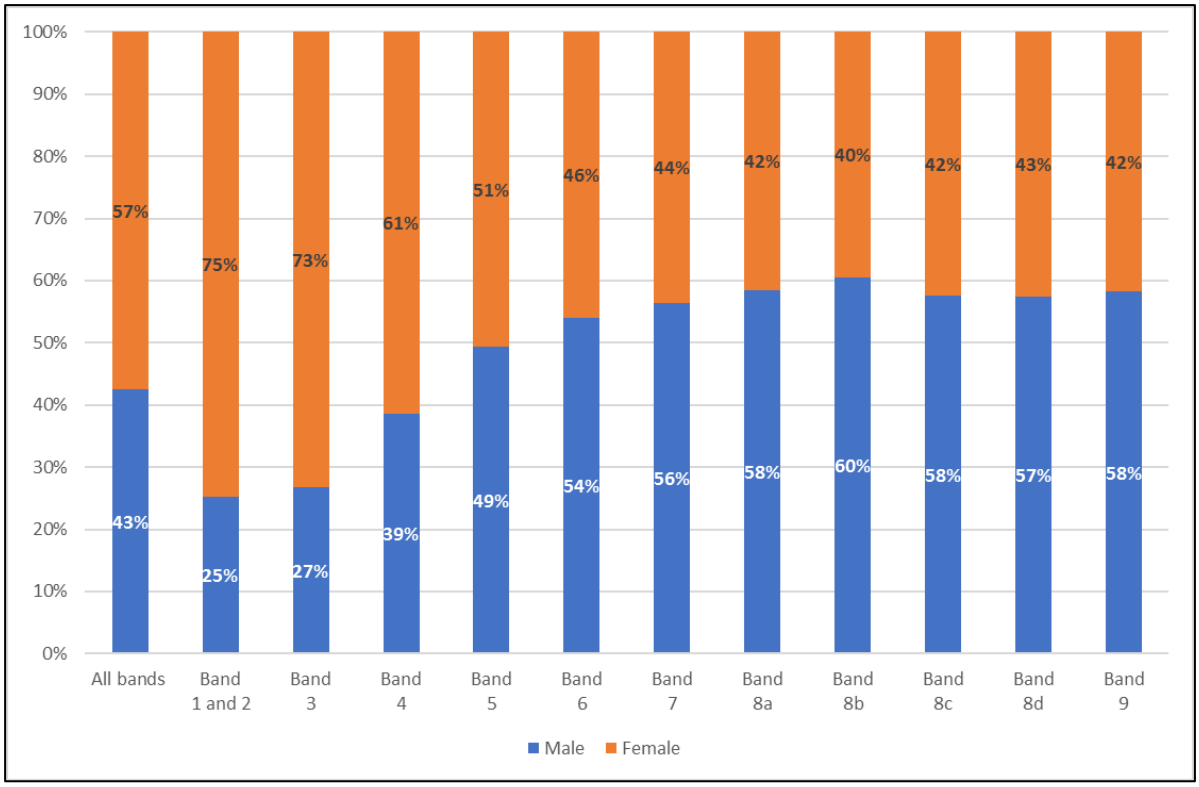
Some evidence of a 'ceiling' does seem to exist for women working in informatics. Women made up 57% of the workforce in 2019, yet from AfC band 5 onwards the proportion of women drops below this figure and does so at a decreasing rate into the higher bandings.

Table 8.2: Informatics workforce – headcount of women and men in Agenda for Change bandings, 2019

	Women	%	Men	%
AfC bands 1 to 4	12,411	58%	5,102	32%
AfC bands 5 to 7	7,277	34%	8,205	51%
AfC bands 8a to 9	1,855	9%	2,644	17%
Total	**21,543**	**100%**	**15,951**	**100%**

Source: NHS Electronic Staff Record

Figure 8.4: Informatics workforce – percentage (and headcount) of women and men in each Agenda for Change band, 2019



Source: NHS Electronic Staff Record

9. AGE

9.1. Age – overall trends

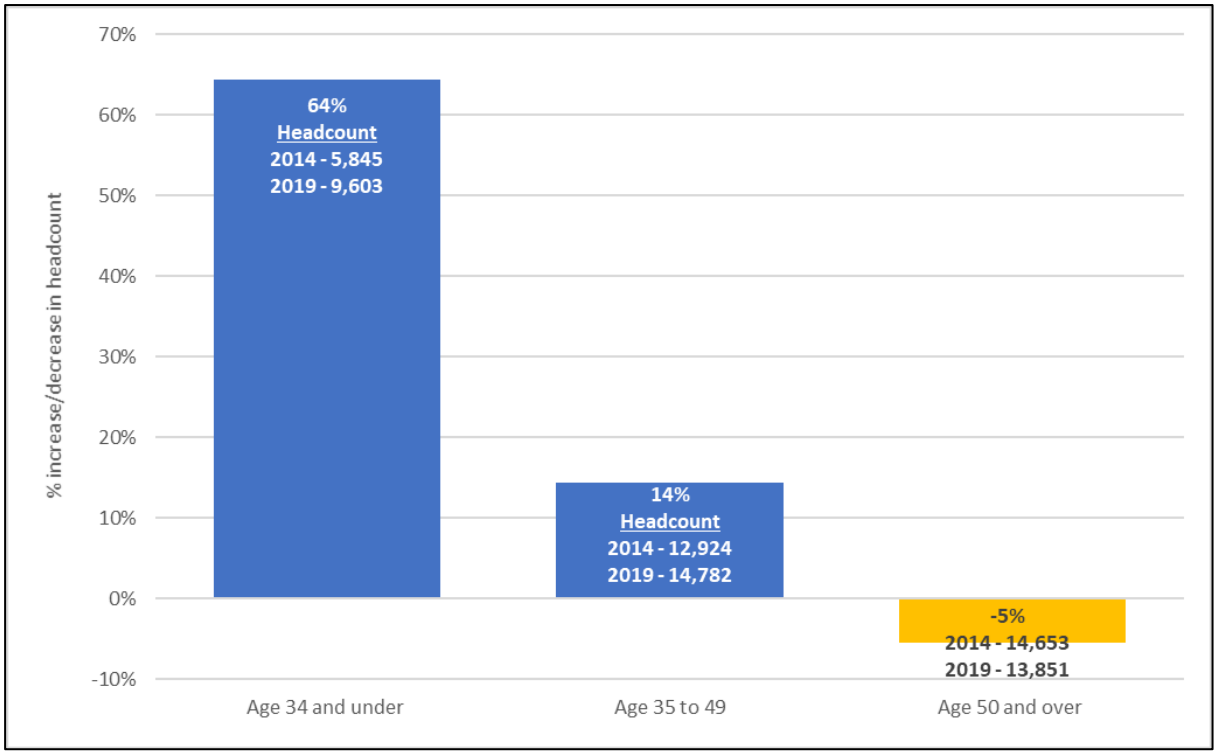
The period between 2014 and 2019 saw a 64% increase (an additional 3,758) in the headcount of those aged 34 and under, and a 14% (or 1,858) increase of those aged 35 to 49. These increases should be compared to a 5% decrease (equal to a loss of 802 staff members) of those aged 50 and over.

Table 9.1: Informatics workforce – headcount and percentage of staff in each age group, 2014 and 2019

Age group	2014	%	2019	%
24 and under	474	1%	2,077	5%
25 to 29	1,950	6%	3,248	8%
30 to 34	3,421	10%	4,278	11%
35 to 39	4,200	13%	4,920	13%
40 to 44	4,075	12%	4,578	12%
45 to 49	4,649	14%	5,284	14%
50 to 54	4,874	15%	5,269	14%
55 to 60	5,335	16%	5,553	15%
60 and over	4,444	13%	3,029	8%
Total	**33,422**	**100%**	**38,236**	**100%**

Source: NHS Electronic Staff Record

Figure 9.1: Percentage increase/decrease in headcount by age group between 2014 and 2019



Source: NHS Electronic Staff Record

Despite an influx of younger staff members, it has not been enough to prevent a slight rise in the mean and median ages of the informatics workforce over this five-year period, from around 43 to 44

years of age. The mean age is rising in all areas of work in informatics. Possible explanations include older, and not just younger, people joining the workforce as it is expanding, and those already in the workforce staying as they are getting older.

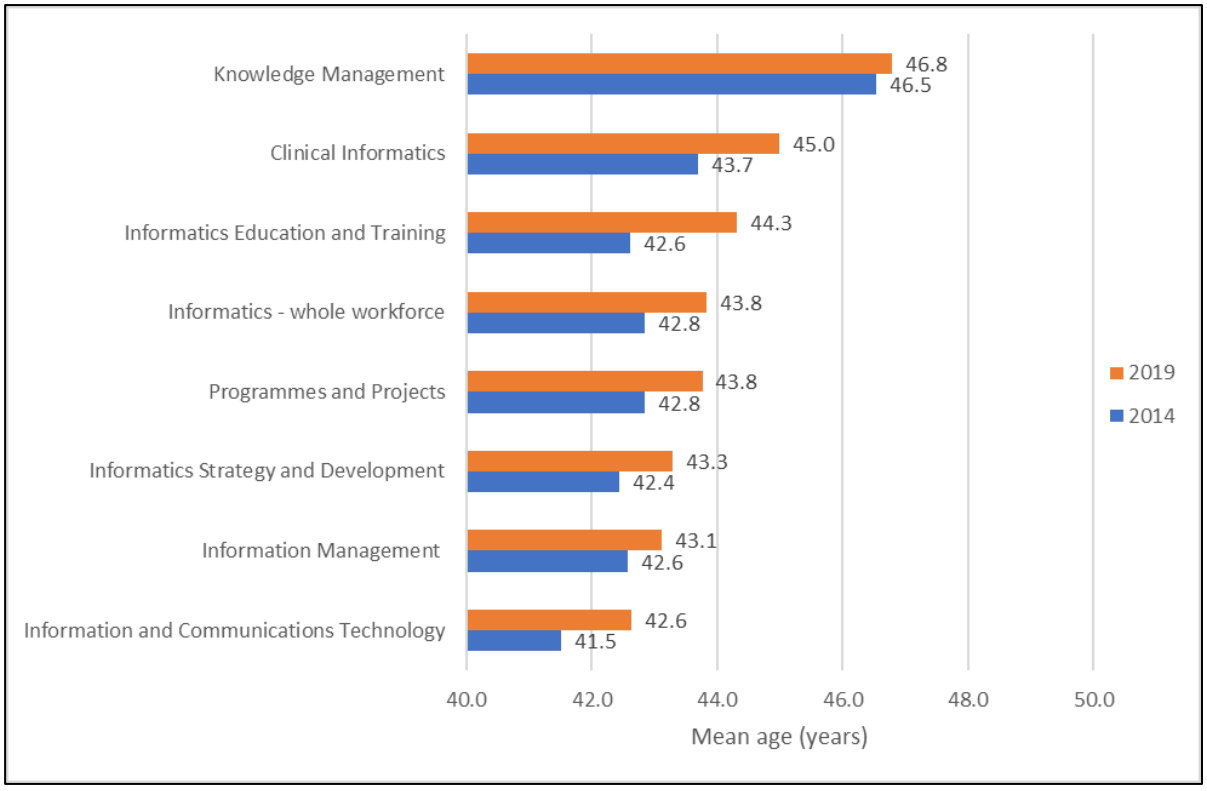
The mean age is higher in some areas of work than others. The mean age of those working in knowledge management in 2019 was 46.8, which is 4.2 years higher than the mean age of 42.6 for those working in information and communication technology. This variance is probably explained by differing recruitment and retention rates, and the age of staff when recruited.

Table 9.2: Mean and median ages of the informatics workforce, 2014 and 2019

	2014	2019
Mean age	42.8	43.8
Median age	43	44

Source: NHS Electronic Staff Record

Figure 9.2: Mean ages of the workforce in each area of work, 2014 and 2019



Source: NHS Electronic Staff Record

10. ETHNICITY

10.1. Black and minority ethnic groups

Data from the NHS Electronic Staff Record (ESR) shows that staff from a black, Asian and minority ethnic (BAME) group made up 15% of the informatics workforce in 2019 (Table 10.1 and 10.2). Staff members are asked to self-select their ethnicity from options in ESR. The figure suggests that BAME staff members are underrepresented in this workforce when benchmarked to the non-medical workforce in the Agenda for Change (AfC) pay system (17% BAME staff) and especially the NHS overall (20% BAME staff).

Table 10.1: Headcount and percentage of the informatics workforce in each main ethnic group in 2014 and 2019

	2014		2019	
	Headcount	%	Headcount	%
Asian or Asian British	2,192	7%	3,231	8%
Black or Black British	1,045	3%	1,542	4%
Mixed	385	1%	554	1%
White	27,864	83%	30,810	81%
Other Ethnic Groups	400	1%	497	1%
Not stated	1,536	5%	1,602	4%
Total	**33,422**	**100%**	**38,236**	**100%**

Source: NHS Electronic Staff Record

Table 10.2: Percentage of BAME and White ethnic groups across the NHS in 2019

	Informatics	Non-medical (Agenda for Change)	NHS overall
BAME	15%	17%	20%
White	81%	78%	75%
Not stated	4%	4%	5%
Total	100% (38,236)	100% (1,197,822)	100% (1,383,354)

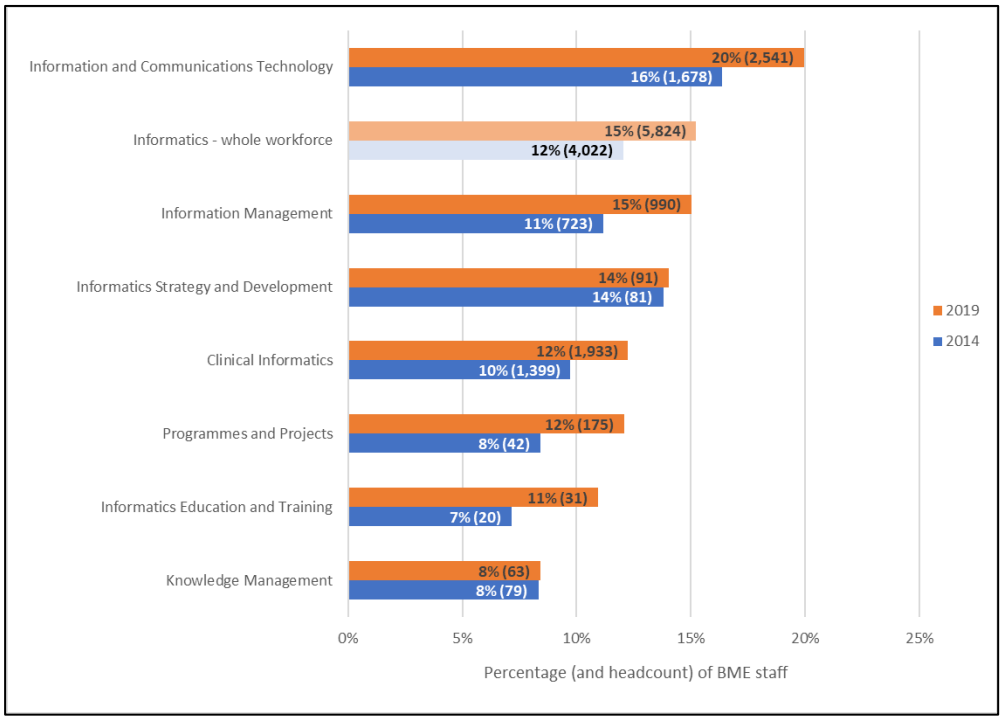
Source: NHS Electronic Staff Record

Underrepresentation of BAME staff members is more pronounced when examining the composition of the workforces for each area of work in informatics. Only the information and communication technology workforce has a BAME proportion of 20% (Figure 10.1), mirroring that found in the NHS overall. The remaining areas of work, particularly knowledge management (8%), informatics education and training (11%), programmes and projects (12%) and clinical informatics (12%), fall well short of the AfC benchmark of 17% and NHS benchmark of 20%.

However, the previous five years (2014 to 2019) have seen more BAME staff entering the informatics workforce. The proportion of BAME staff has increased from 12% to 15%, indicating that this workforce is slowly getting more diverse. Diversity is an important consideration in planning for a skilled, knowledgeable and relevant informatics workforce. A recent report from the Royal Society (2019) saw the need to address ethnic and gender diversity in data science in all sectors, not just healthcare[3]. The report argued that a diverse workforce is needed to fully identify, understand and interpret real-world problems, and is more likely to pick up or be concerned by inadvertent biases in algorithms that can impact on different types of people. The need to improve the ethnic and gender diversity of the workforce has also been recommended by a UK government report on the artificial intelligence (AI) industry published in 2017[4]. Specifically, the report highlights the need to get

serious about resolving diversity issues as “gender and ethnic exclusion has been shown to affect the equitability of results from technological processes”.

Figure 10.1: Percentage (and headcount) of the workforce in each area of work in informatics stating a BAME category in NHS Electronic Staff Record, 2014 and 2019

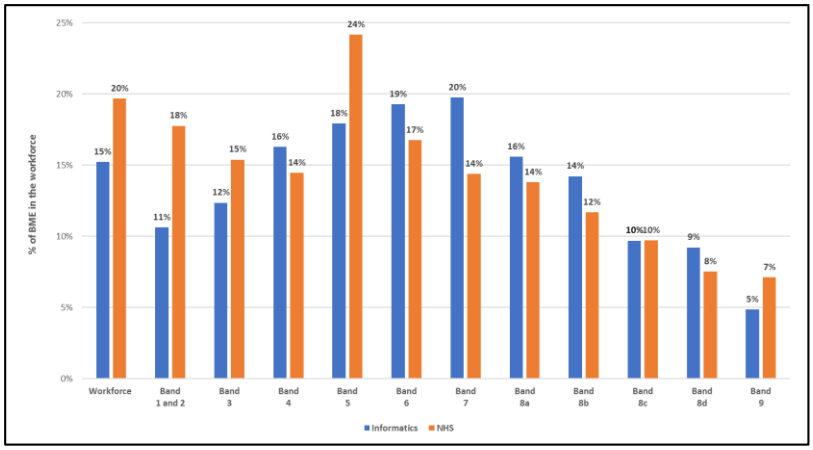


Source: NHS Electronic Staff Record

10.2. Ethnicity and Agenda for Change banding

When examining the informatics workforce data by AfC banding the issue of underrepresentation of BAME staff can be seen in the lower (1 to 4) and higher (8a to 9) bands. This underrepresentation mirrors what is happening in the NHS overall and is particularly pronounced in the highest bands, including Band 9 where only 5% of informaticians (7 of 144) are BAME staff members.

Figure 10.2: Informatics and NHS workforces – percentage of staff stating a BAME category in the NHS Electronic Staff Record in 2019

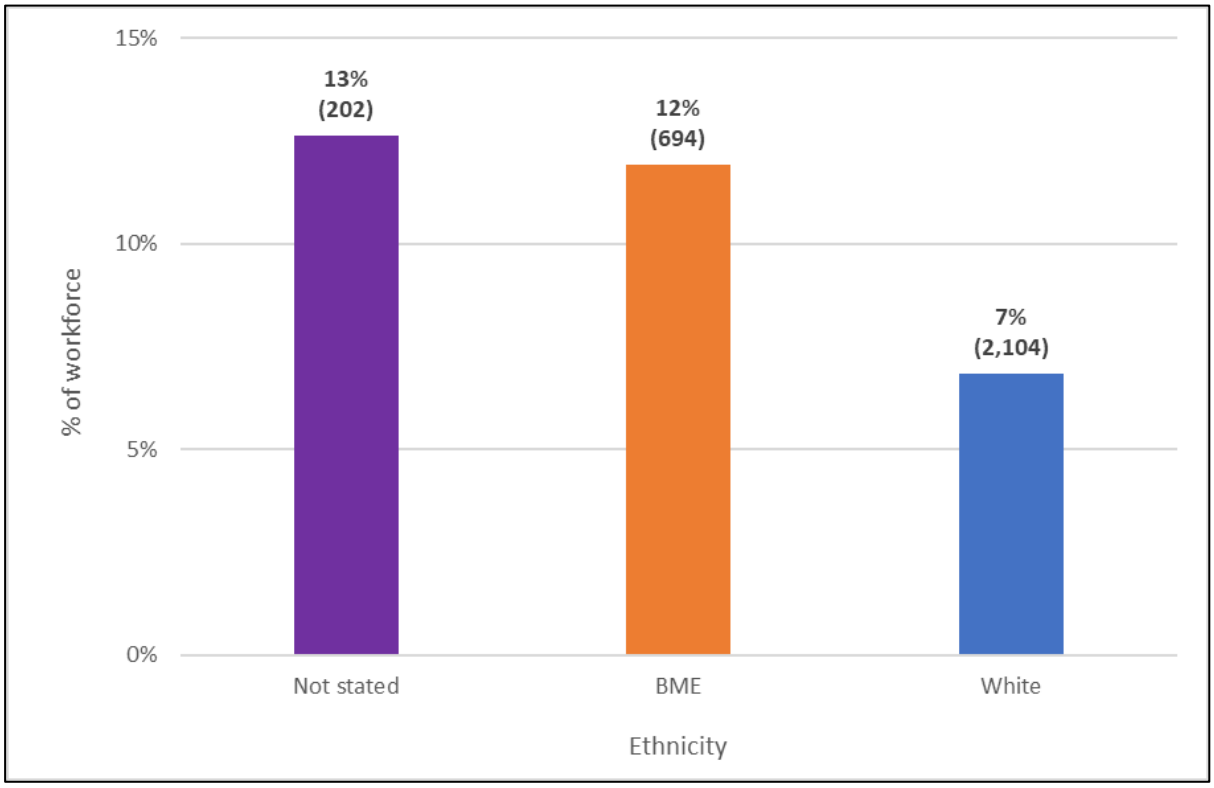


Source: NHS Electronic Staff Record

10.3. Ethnicity and types of employment contract

Members of staff from a BAME background are 5% more likely to be employed in informatics with a fixed-term contract. Whereas 7% of white staff members are employed on such a basis, the figure for BAME staff is 12%.

Figure 10.3: Percentage (and headcount) of BAME and White staff in informatics with a fixed-term contract in 2019



Source: NHS Electronic Staff Record

11. NATIONALITY

11.1. Non-UK and Irish nationals

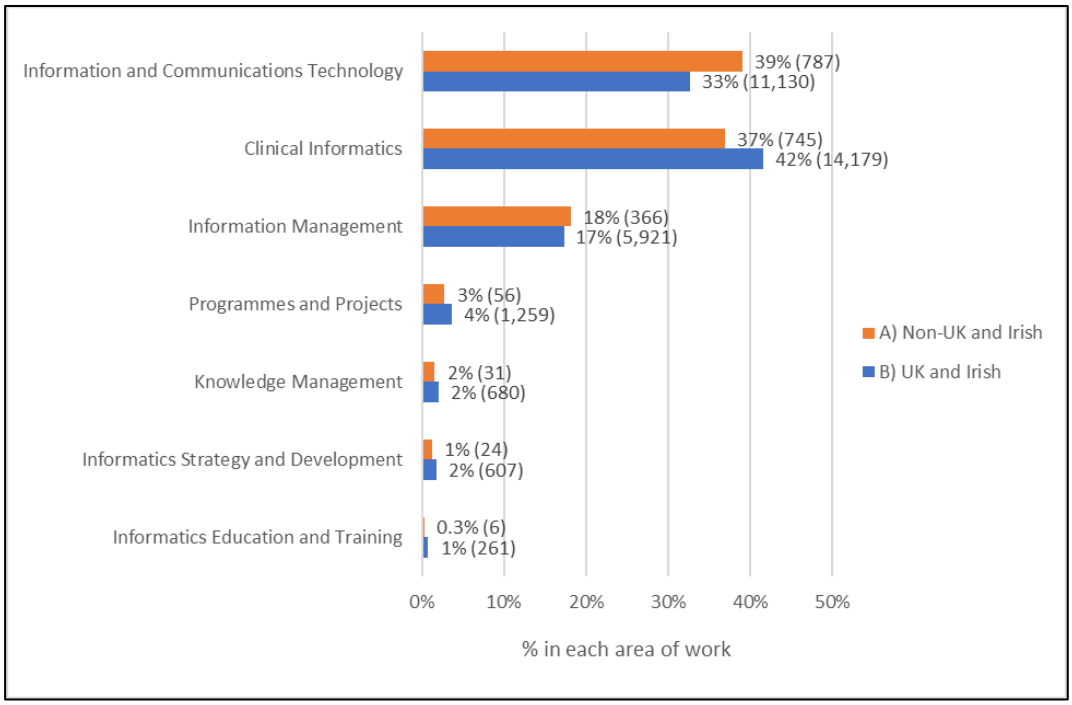
Table 11.1 provides information on the nationality of staff working in informatics. Members of staff are asked to self-select their nationality from options in the NHS Electronic Staff Record (ESR). The number of non-UK and Irish nationals has risen by 47%, from 1,369 to 2,015, between 2014 and 2019, although some of this may be due to better capture of information in ESR rather than actual recruitment efforts. The increase is broadly in line with the overall expansion of the informatics workforce during this period, meaning that the proportion of non-UK or Irish nationals has remained stable at 4-5%. Three areas of work in informatics – information and communication technology, clinical informatics and information management – accounted for 94% of non-UK and Irish nationals in the workforce in 2019. A similar concentration exists for UK and Irish nationals. In general, non-UK and Irish staff members tended to be employed in the lower (1 to 4) and middle (5 to 7) Agenda for Change (AfC) bands. The forthcoming possible exit of the UK from the European Union may have an impact on and recruitment of non-UK staff members in informatics.

Table 11.1: Headcount of the informatics workforce by nationality in 2014 and 2019

	2014	%	2019	%
EEA and EU (excl. UK and Ireland)	399	1%	805	2%
Ireland	146	0.4%	181	0.5%
United Kingdom	28,166	84%	33,856	89%
Rest of the World	970	3%	1,210	3%
Undefined	3,741	11%	2,184	6%
Total	**33,422**	**100%**	**38,236**	**100%**

Source: NHS Electronic Staff Record

Figure 11.1: Percentage (and headcount) of: A) Non-UK and Irish and B) UK and Irish nationals by area of work in informatics, 2019



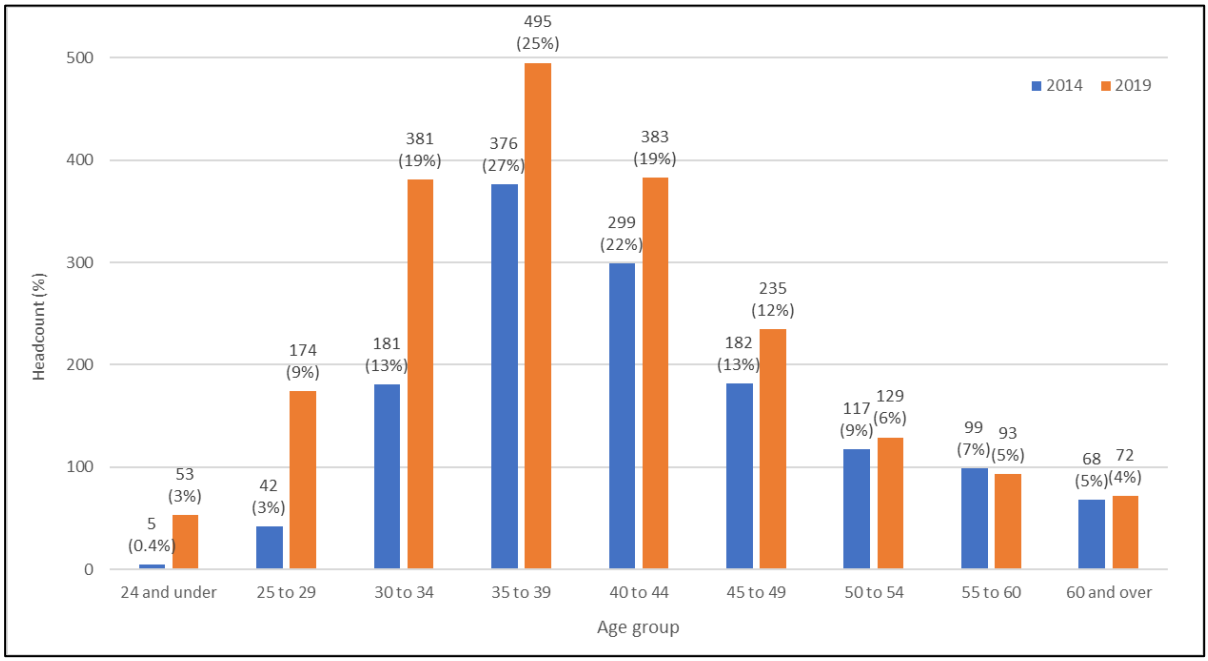
Source: NHS Electronic Staff Record

Table 11.2: Headcount and percentage of non-UK and Irish nationals in the informatics workforce by Agenda for Change banding, 2014 and 2019

	2014	%	2019	%
AfC bands 1 to 4	636	46%	814	40%
AfC bands 5 to 7	624	46%	990	49%
AfC bands 8a to 9	94	7%	182	9%
Not stated	15	1%	29	1%
Total	**1,369**	**100%**	**2,015**	**100%**

Source: NHS Electronic Staff Record

Figure 11.2: Headcount (and percentage) of non-UK and Irish nationals by age group in the informatics workforce, 2014 and 2019



Source: NHS Electronic Staff Record

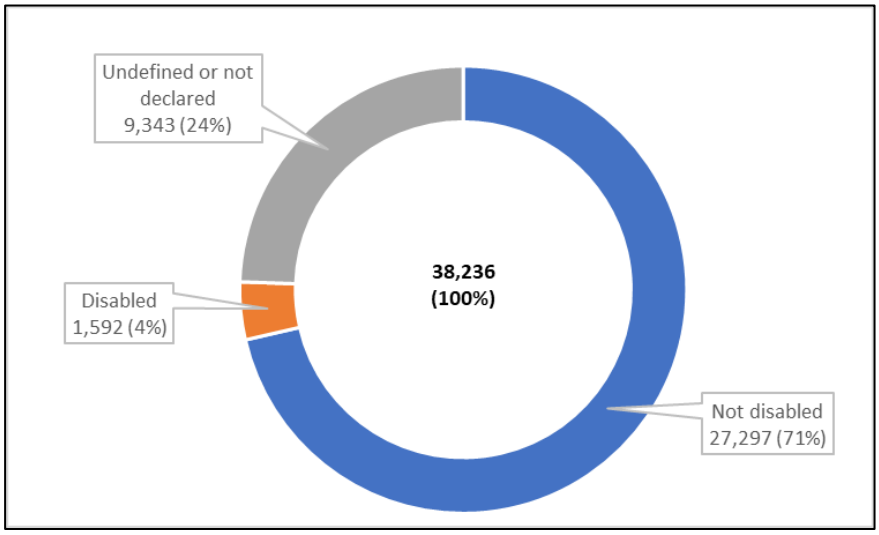
12. DISABILITY

12.1. Disability status of staff members in informatics

Data from the NHS Electronic Staff Record (ESR) shows that staff with a disability made up 4% (1,592 of 38,236) of the informatics workforce in 2019. The term disability covers all types of disabilities. Staff members are given the option to select their disability status in ESR or choose not to declare or provide information. For 24% of the informatics workforce the disability status is not declared or undefined.

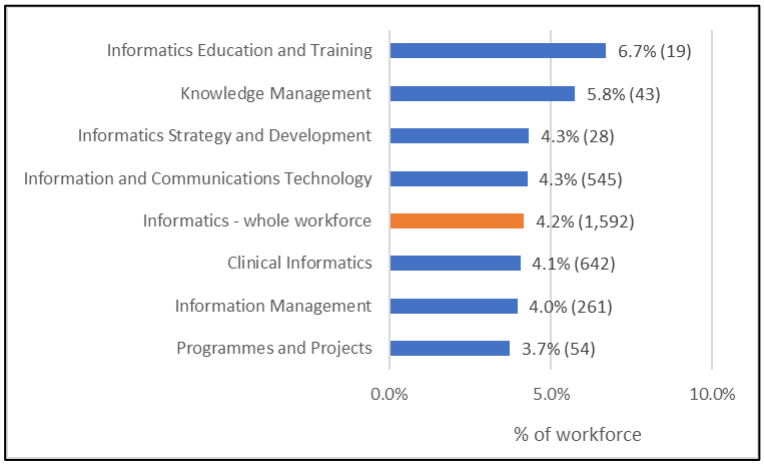
The 4% figure of informaticians with a disability should be compared to 4% for the non-medical workforce (Agenda for Change pay system) and 3% for the NHS workforce overall. These figures may be an underestimate. Work carried out by NHS Employers in 2015 showed that 17% of respondents to the NHS Staff Survey said they were disabled, compared to a reported 3% in ESR[29]. A reason given for the difference is that the NHS Staff Survey is anonymous to complete, while self-disclosure in ESR is not.

Figure 12.1: Disability status of members of staff in informatics, 2019



Source: NHS Electronic Staff Record

Figure 12.2: Percentage (and headcount) of the workforce in each area of work reporting a disability status in the NHS Electronic Staff Record, 2019



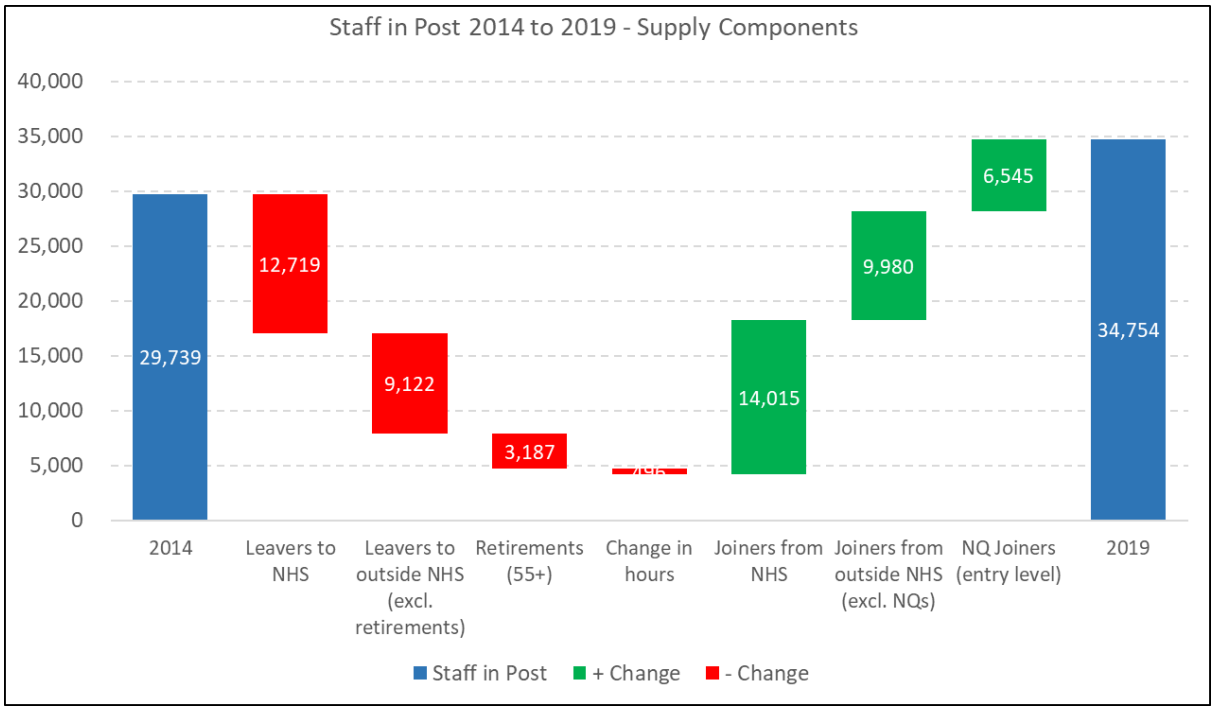
Source: NHS Electronic Staff Record

13. LEAVERS AND JOINERS TO THE WORKFORCE

13.1. Leavers and joiners between 2014 and 2019

The informatics workforce saw an overall net gain of 5,015 full-time equivalent (FTE) staff members between 2014 and 2019. This represents an increase of 17% over the five-year period, a yearly average of 3.4%. The net gain is a result of more people joining than leaving the workforce as demonstrated by the leaver and joiner components of the waterfall diagram in Figure 13.1. The diagram also accounts for those staff members staying in the informatics workforce and increasing or reducing the number of hours they worked. Separate waterfall diagrams, again based on the period 2014 to 2019, for each area of work in informatics are provided in the appendix of this report.

Figure 13.1: Leavers and joiners to the informatics workforce between 1 April 2014 and 31 March 2019 – full-time equivalents



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

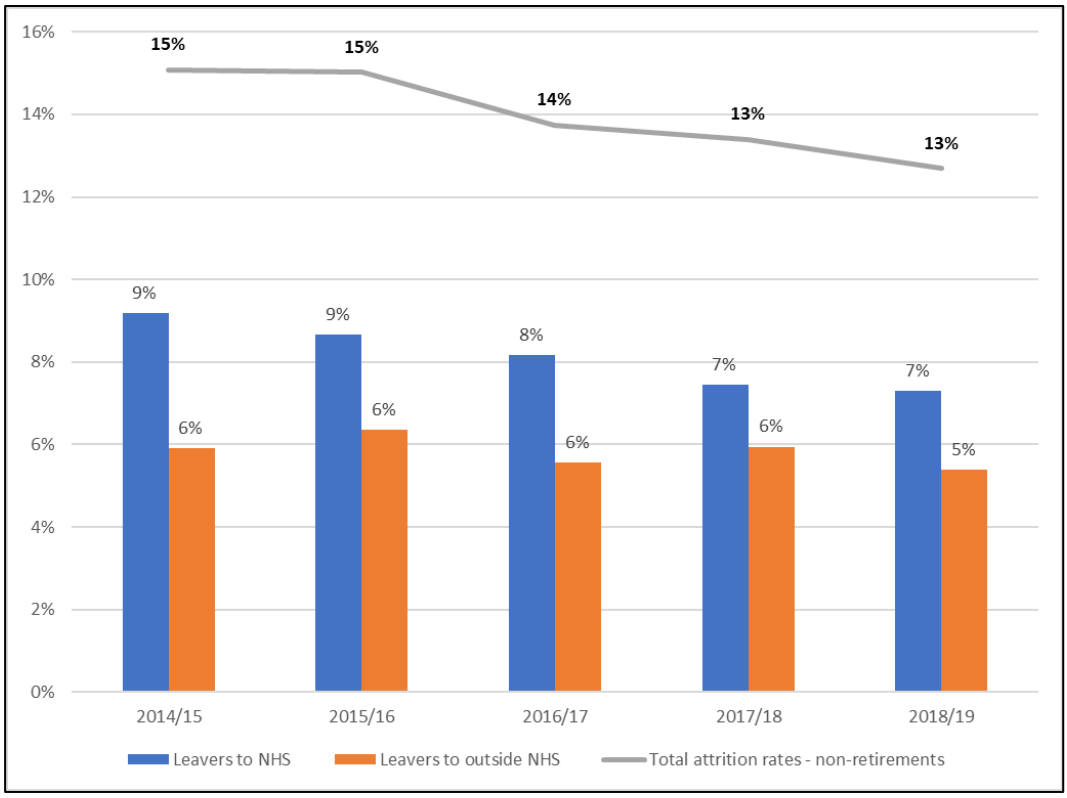
13.2. Leaving the NHS informatics workforce (non-retirements)

Figure 13.1 above shows, for the period 2014 to 2019, a total of 21,841 FTE members of staff leaving the informatics workforce for a post in the NHS in another capacity (*Leavers to NHS*) or the NHS entirely (*Leavers to Outside NHS excluding retirements*). The total attrition rates each year (1 April to 31 March), based on these leavers, has been around 13%–15% (Figure 13.2).

It must be noted that some (or many) of these *Leavers to the NHS* could be informaticians moving to another informatics-related position in the NHS, acquiring a job title and subsequent area of work value in the NHS Electronic Staff Record (ESR) that fall outside the titles and values listed by the Informatics Area of Work Guidance (Version 2.2) issued by NHS Digital[2]. When these people move, they will no longer be counted as being part of the informatics workforce being reported for this study (see Section 3.1). The annual attrition rate of between 7%–9% based on *Leavers to NHS* for 2014/15 onwards, shown in Figure 13.2, should therefore be treated with some caution.

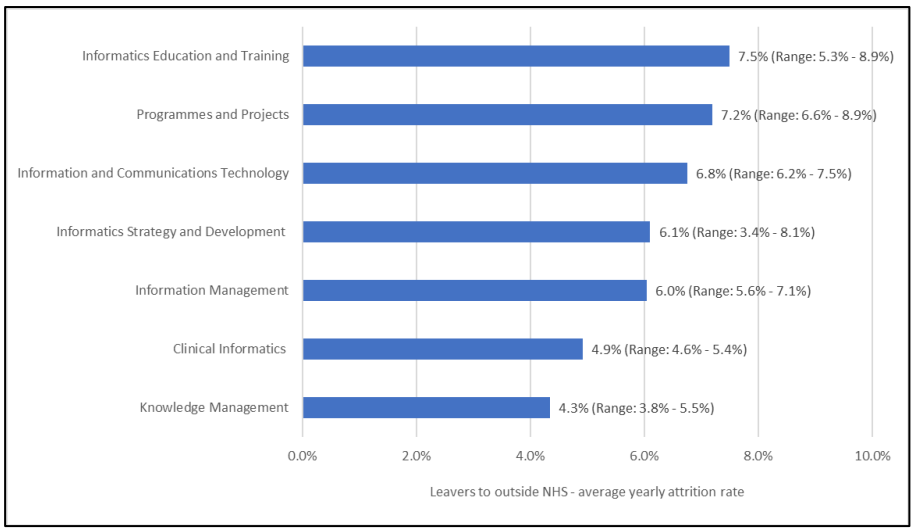
The *Leavers to outside NHS excluding retirements* bar in Figure 13.1 represents those staff members aged 54 or under who are found in ESR one year and absent the next. Some of these people may have left their informatics job in the NHS for a related job in another organisation or sector. Between 2014 and 2019 the annual attrition rates based on these leavers has been around 6% (Figure 13.2). This attrition rate has varied by area of work in informatics. An average of 7.5% (range 5.3% to 8.9%) of the informatics education and training workforce leaves (non-retirements) the NHS every year compared to only 4.3% (range 3.8% to 5.5%) in knowledge management (Figure 13.3).

Figure 13.2: Rates of non-retirement attrition from the informatics workforce between 2014 and 2019 (1 April to 31 March) – full-time equivalents



Source: Health Education England - Electronic Staff Record Flow Tool (HEFT)

Figure 13.3. Leavers (non-retirements) to outside of the NHS from each area work in informatics – average yearly attrition rates 2014/15 to 2018/19



Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

13.3. Retirements

The number of individuals aged 55 or older who have left the NHS can be used as the basis for determining the extent of retirements in the workforce. The five years between 2014 and 2019 saw a headcount of 3,951 staff members, representing 3,187 FTE posts, retiring from their full-time or less than full-time positions in informatics.

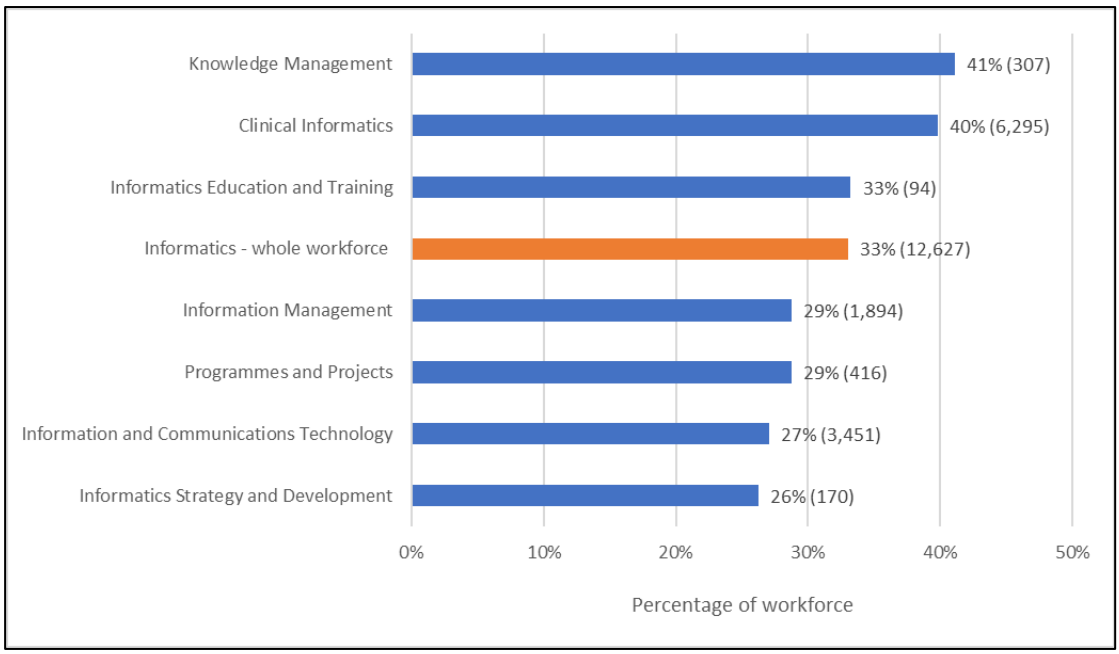
Currently, 23% (8,582 of the 38,236) of the informatics workforce is aged 55 or older. It is not predicted that all 23% will retire immediately or even in the very near future. What is possible though is that around a third of the current informatics workforce will retire within the next 10 years. This is based on 12,627 of the current 38,236 members of staff who are aged 51 or older and a likely retirement age of 61. The retirement age of 61 was determined by examining data from the leavers and joiners report held in the ESR National Data Warehouse. The report allows for extraction of staff records (in this case for informaticians) where the reason for leaving was marked as retirement (types of retirement given included early, voluntary and ill-health). Table 13.1 provides the mean and median ages of those retiring each year from 2014/15 onwards.

Table 13.1: Mean and median ages of staff members in informatics retiring from the NHS, 2014/15 to 2018/19

	2014/15	2015/16	2016/17	2017/18	2018/19
Retirements – headcount	761	811	781	756	842
Mean age	61	61	61	61	61
Median age	61	61	61	61	60

Source: NHS Electronic Staff Record

Figure 13.4: Percentage (and headcount) of staff members in each area of work in informatics reaching age 61 and over between 2019 and 2028



Source: NHS Electronic Staff Record

In some areas of work in informatics the expected proportion of the current workforce retiring between 2019 and 2028 will be greater than what is expected for the informatics workforce overall (Figure 13.4). Most noticeable are the areas of knowledge management and clinical informatics where 40% of the current workforce is expected to retire by 2028. In considering estimated retirement rates it must be remembered that many individuals continue to work into their 60s and, in some cases, 70s. This is the case for 3,029 staff members in informatics (8% of the workforce) in 2019 who are age 60 or older.

13.4. Retention and stability

A stability index has been compiled based on data from ESR as an indicator of staff retention for each area of work in informatics. The index measures the percentage of FTEs at the end of the year (e.g. 31 March 2019) who were in the same area of work and working in the same NHS organisation at the beginning of the year (1 April 2018). Overall, 77% (26,597 of the 34,754 FTEs) of the informatics workforce in March 2019 met these criteria. When examining the data by area of work, the least stable area (i.e. had the highest rates of turnover) was programmes and projects with 54%, and the most stable was knowledge management with 84%.

Extracting data from ESR to measure stability and retention is challenging and further work in Phase 2 of the project will need to be undertaken. Phase 2 will also need to consider different ways of defining and calculating stability, for example by organisation, region, staff grouping and Agenda for Change banding, leading to more insight on issues of staff retention and attrition in informatics. This is important as improving staff retention is a priority in the NHS and is part of the overall workforce policy and planning system[30].

Table 13.2: Staff retention rates for each area of work in informatics, 2014/15 and 2018/19 (1 April to 31 March)

	2014/15	2018/19
Information and Communication Technology	77%	76%
Information Management	75%	74%
Clinical Informatics	80%	80%

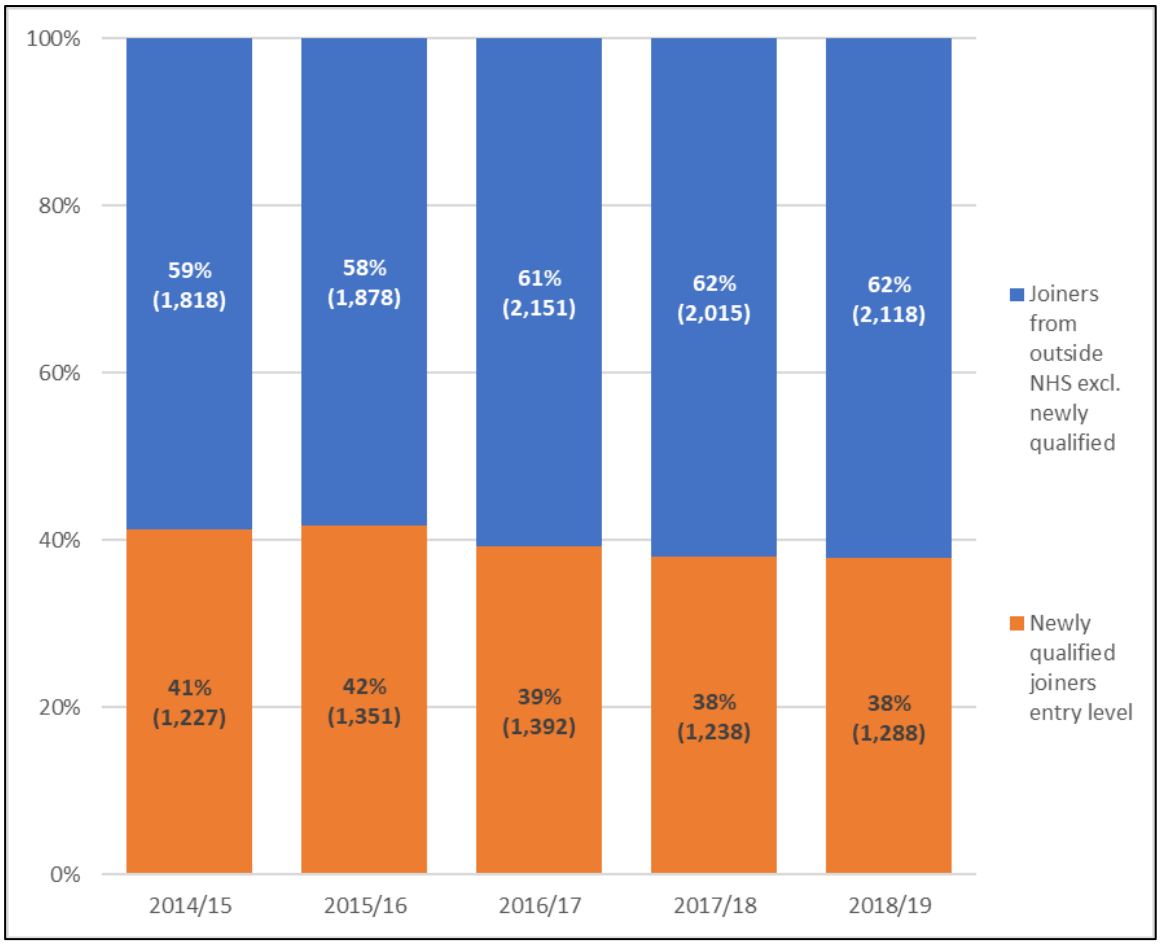
Programmes and Projects	45%	54%
Informatics Education and Training	68%	72%
Knowledge Management	87%	84%
Informatics Strategy and Development	70%	72%
Informatics – whole workforce	**77%**	**77%**

Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

13.5. Joining the NHS informatics workforce

The waterfall diagram in Figure 13.1 shows 30,540 FTE members of staff joining the informatics workforce between 2014 and 2019. Those from another occupation or role within the NHS in England – *Joiners from NHS* – made up 14,015 of the 30,540 FTEs. This figure should be treated with some caution as some (or many) of these *Joiners from NHS* could already be informaticians from another informatics-related position in the NHS, but did not have a job title and subsequent area of work value in ESR that is listed in the Informatics Area of Work Guidance (Version 2.2) issued by NHS Digital[2]. Prior to moving, these people would not have been counted as being part of the informatics workforce being reported for this study (see Section 3.1).

Figure 13.5: New joiners to the informatics workforce, 2014/15 to 2018/19



Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

Between 2014 and 2019 the NHS informatics workforce benefited from experienced staff joining from outside of the English NHS – *Joiners from outside NHS excluding newly qualified* – to the extent of 9,980 FTEs. In addition to these joiners, people early in their careers – *Newly qualified joiners entry level* – equivalent to 6,545 FTEs, entered the NHS informatics workforce. Figure 13.5 shows a breakdown of both types of joiners by year, and how recruitment into the informatics workforce is becoming more dependent on experienced staff compared to those joining early in their careers.

13.6. Vacancies

NHS Digital provides a dataset of vacancy statistics based on adverts placed on the NHS Jobs website (www.jobs.nhs.uk)[31]. This is currently the main recruitment website for the NHS in England. The statistics are labelled experimental as the methods used to collect and analyse the data are still being refined and improved, and therefore should be treated with caution. However, the statistics do provide an insight into recruitment efforts, trends and changes over time, and should be considered a minimum figure for the actual number of vacancies advertised at any time. The statistics are presented as FTEs and for permanent and fixed-term job types only.

Data was extracted from the vacancy dataset using the area of work values listed in the Informatics Area of Work Guidance (Version 2.2) issued by NHS Digital[2]. The total number of jobs in informatics advertised on NHS Jobs between 1 April 2016 and 31 March 2019 was 19,662, an average of 6,554 per year (Table 13.3). The number of vacancies in informatics advertised on NHS Jobs has been decreasing year on year. This may partly be due to employers preferring to advertise some of their vacancies on websites other than NHS Jobs, for example Trac (www.healthjobsuk.com) and LinkedIn (www.linkedIn.com).

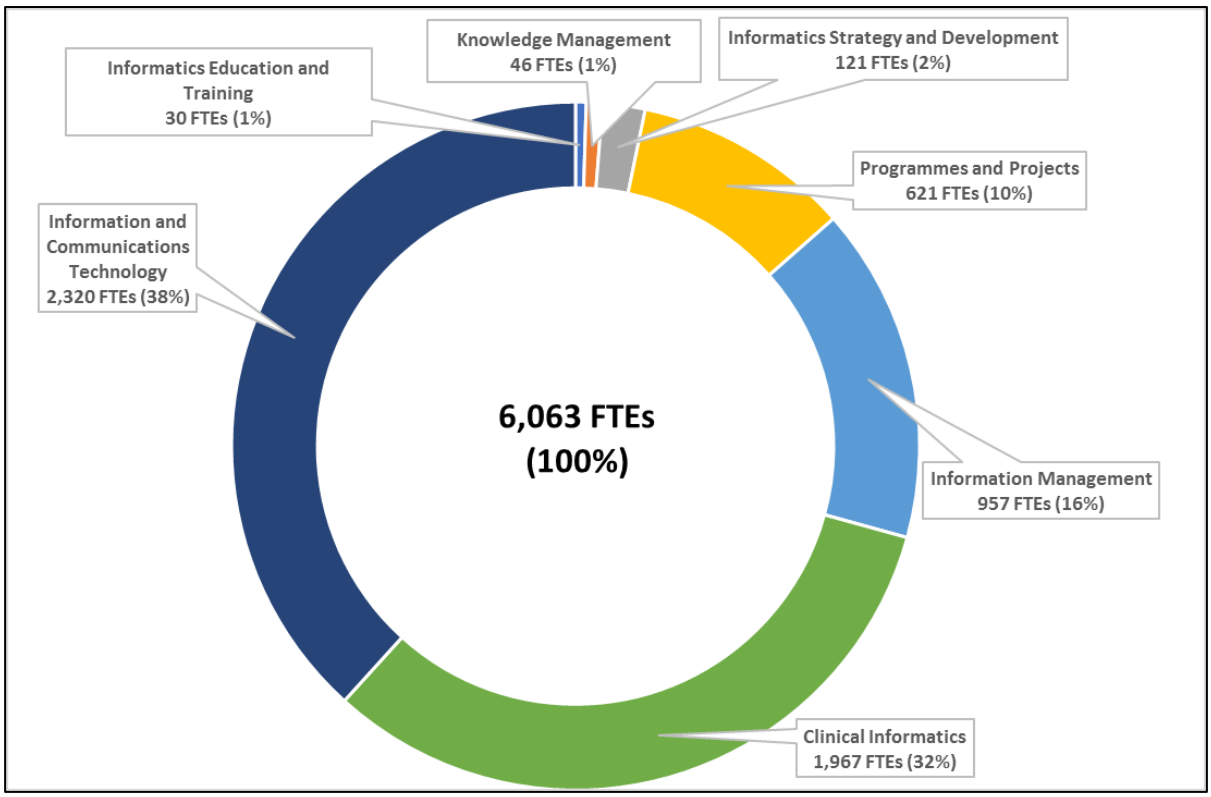
Vacancies in informatics advertised on NHS Jobs, during 2018/19, tended to be in one of two areas of work: information and communication technology (38%) and clinical informatics (32%). The number of vacancies in programmes and projects increased from 330 to 621 over the course of the year and this area of work now accounts for 10% of all vacancies in informatics. Vacancies could be found in all parts of the country, particularly so in the South East, Midlands, and North East and Yorkshire.

Table 13.3: Advertised full-time equivalent vacancies in informatics each year, 2016/17 to 2018/19 (1 April to 31 March)

Period	FTE vacancies
April 2016 to March 2017	7,251
April 2017 to March 2018	6,348
April 2018 to March 2019	6,063
Total	**19,662**

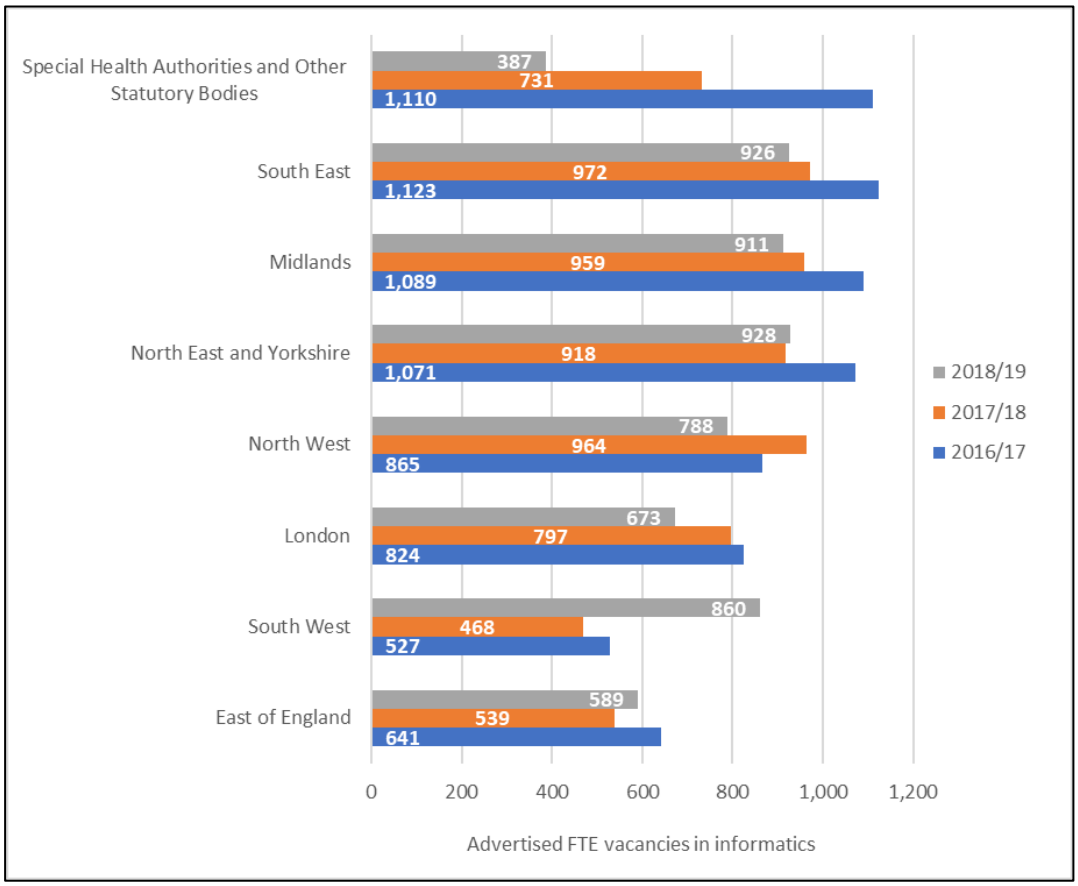
Source: NHS Digital – NHS vacancy statistics[2]

Figure 13.6: Advertised informatics full-time equivalent (and percentage of) vacancies by area of work, 1 April 2018 to 31 March 2019



Source: NHS Digital – NHS vacancy statistics[2]

Figure 13.7: Advertised informatics full-time equivalent vacancies by Health Education England region, 2016/17 to 2018/19



Source: NHS Digital – NHS vacancy statistics[2]

14. PROJECTED WORKFORCE SIZE IN 2024

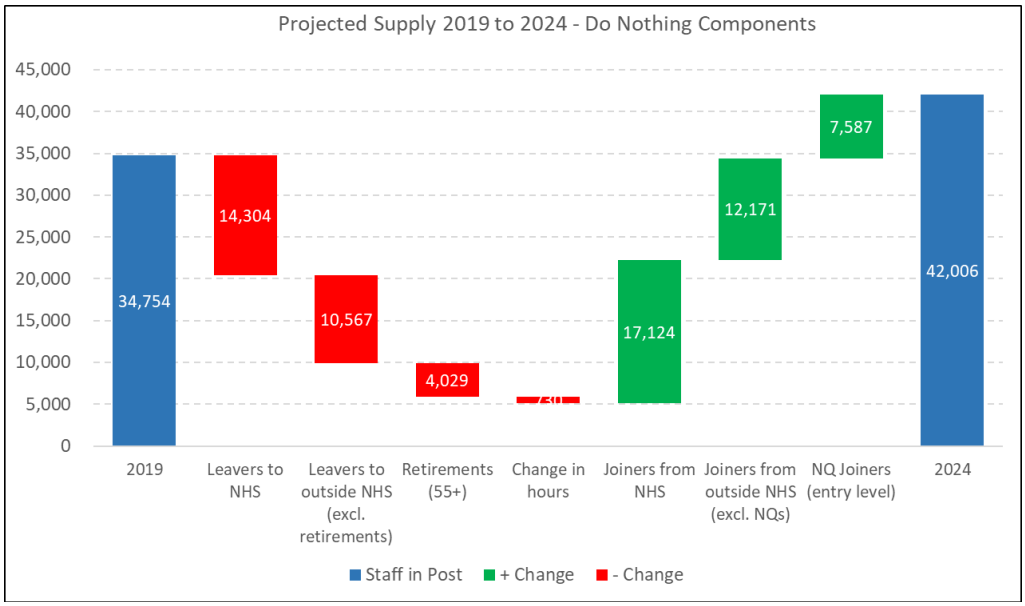
14.1. Projected workforce size – based on three-year averages and no policy change (do nothing) scenario

The observed informatics workforce in the NHS Electronic Staff Record (ESR) provides the basis for making projections of future trends and, in turn, workforce size. The Health Education England Electronic Staff Record Flow Tool (HEFT), using ESR data, provides a projection of the workforce size in 2024. The projection is based on:

- Three-year (2016/17–2018/19) average rates of outflows (those leaving the NHS workforce (except retirements) or reducing hours worked) and inflows (experienced staff joining from outside of the NHS and newly qualified staff or those early in their careers joining).
- The age profile of the workforce to determine those reaching age 55 as a probability for retirement (outflow).
- Three-year (2016/17–2018/19) average rates of staff changing the NHS organisation in which they work (leavers to the NHS and joiners from the NHS)

The three-year outflow and inflow rates, and age profile information, are applied to the workforce as of 31 March 2019 to give an indication of the size of the workforce in 2024. The projection is modelled in a no change (do nothing) scenario, whereby any forthcoming workforce policy or intervention introduced between 2019 and 2024 is not factored in. In such a scenario the informatics workforce observed in ESR is projected to increase from 34,754 full-time equivalents (FTEs) in 2019 to 42,006 FTEs in 2024. This represents a 21% increase over the five-year period (around 4% on average per year). Figure 14.1 captures the expected outflows and inflows of staff leading to the projected increase in 2024. Separate waterfall diagrams, again based on three-year (2016/17–2018/19) average outflow and inflow rates, and a no change (do nothing) policy scenario for each area of work in informatics, are provided in the appendix of this report.

Figure 14.1: Projected supply and workforce size (full-time equivalents) for the NHS Electronic Staff Record observed informatics workforce, 2019/20 to 2023/24 – no policy change (do nothing) scenario



NQ = Newly Qualified
Source: Health Education England - Electronic Staff Record Flow Tool (HEFT)

14.2. Projected workforce size – based on one- to five-year average rates of outflows and inflows and no policy change (do nothing) scenario

The projected increase of the informatics workforce size from 34,754 FTEs in 2019 to 42,006 FTEs in 2024 is based on the previous three-year (2016/17–2018/19) averages of outflow and inflow rates. Table 14.1 below shows the projected workforce size in 2024 based on one- to five-year averages of outflow and inflow rates in a scenario of no policy change (do nothing). The figures suggest that the size of the informatics workforce observed in ESR will increase to somewhere between 40,394 FTEs and 42,006 FTEs in 2024.

Table 14.1: Projected workforce size (full-time equivalents) for the NHS Electronic Staff Record observed informatics workforce in 2023/24 – no policy change (do nothing) scenario

Outflow and inflow rates leading up to 2018/19	Projected workforce size in 2023/24 – FTEs	% increase from 2018/19 workforce size of 34,754 FTEs
1 year	41,673	20%
2 years	40,587	17%
3 years	42,006	21%
4 years	41,428	19%
5 years	40,394	16%
Average	**41,218**	**19%**

Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

The starting number for these one- to five-year projections is 34,754 FTEs in 2019, which represents the staff observed in ESR as having an area of work or job title value listed in the Informatics Area of Work Guidance (Version 2.2) issued by NHS Digital[2]. As explained in Section 4.2. the figure of 34,754 FTEs is likely to be an underestimate and the actual workforce size in 2019 is estimated as being between 40,640 FTEs and 53,936 FTEs. By applying the percentage increases shown in Table 14.1 to these two figures for estimated actual workforce size, there will be around 48,199 to 63,968 FTE informaticians working in the NHS by 2024.

Table 14.2: Estimates of actual size of the informatics workforce in 2024

Outflow and inflow rates leading up to 2018/19	2018/19: 40,640 FTEs - projected workforce size in 2024	2018/19: 53,936 FTEs - projected workforce size in 2024
1 year	48,731	64,674
2 years	47,461	62,988
3 years	49,120	65,191
4 years	48,444	64,294
5 years	47,235	62,689
Average	**48,199**	**63,968**

14.3. Projected workforce size – in a scenario of policy change (do something)

The workforce projections shown above are modelled on a no change (do nothing) scenario, whereby any forthcoming workforce policy or intervention introduced between 2019 and 2024 is not factored in. The HEE HEFT Tool does allow for changes to be made in outflow and inflow rates to reflect any known or predicted impact of any current or planned changes in policy or regulations

affecting the informatics and wider NHS workforce. The policy could be focused, for example, on improving recruitment or staff retention rates.

The HEFT Tool can be applied to project workforce size for individual job roles, including those known to be critical or where staff are in short supply. Examples of these roles are found in the shortage occupation list published by the Migration Advisory Committee in 2019 and include IT business analysts, architects and systems designers, programme and software developers, web design and development professionals, and IT and telecommunication developers[6]. Further examples of critical and shortage job roles are found in Section 15.

Projecting what the workforce size in these job roles could be in 2024 (through the HEFT Tool) and comparing it against anticipated demand (determined through different scenarios for future health and social care delivery models, and changes in functions of health and social care providers) may lead to the identification of a shortage gap. Knowing this gap is important as the first step in modelling and planning for an adequate workforce. The NHS Pay Review Body (2019), in making specific reference to staff groups in information management and technology, called for a clear identification of the information technology roles and levels affected by recruitment and retention difficulties, and the specific skills in short supply[12].

15. CRITICAL JOB ROLES AND SHORTAGES IN INFORMATICS

15.1. Known critical jobs and shortages

Recent reports on different sectors in the economy, including healthcare, have highlighted specific job roles that are known to be critical in the advancement and implementation of digital and information technology. Shortages of applicants for these job roles, and competition across different sectors for a relatively small applicant pool, have also been made known in these reports. This potentially represents a recruitment challenge for health and social care.

Table 15.1: Reports on digital and information technology – examples of critical jobs and shortages

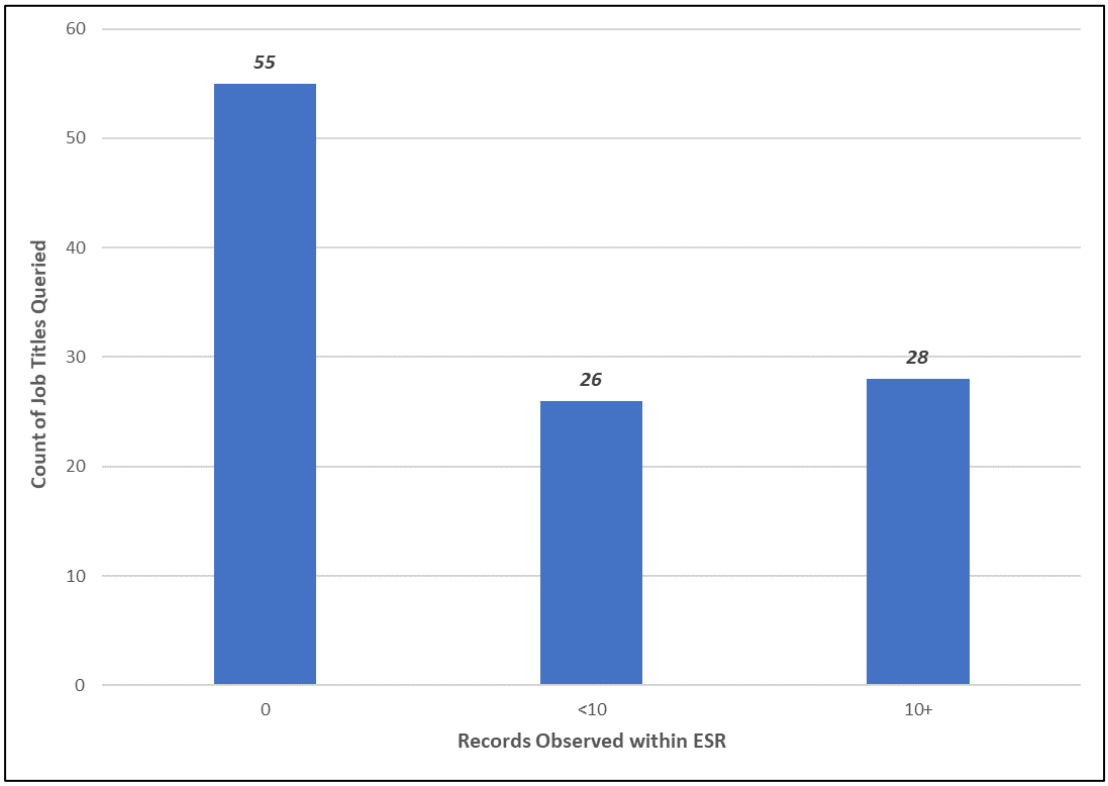
Reports	Critical jobs and shortages – examples
Royal Society (2019)[3] Digital Health and Care Institute, University of Strathclyde (2019)[5] Migration Advisory Committee (2019)[6] The Scottish Government (2018)[7] UK Government. Digital, data and technology professional capability framework (www.gov.uk/government/collections/digital-data-and-technology-profession-capability-framework)[8]	AI and machine learning specialist Big data specialist Biostatistician Business intelligence developer Chief information officer Clinical data manager Computer systems engineer Cyber security manager Data analyst Data architect Data scientist Database administrator Director of information technology Human-machine interaction designer Information security analyst IT business analyst IT and telecommunication developer IT project manager IT service manager Operations manager Programmer Robotics engineer Software developer Software engineer Statistician Systems analyst Systems engineer User experience designer VFX designer Web developer

15.2. Identifying NHS staff members in critical and shortage job areas

Table 15.1 above cites the reports that were reviewed and in turn led to the identification of 109 separate job roles (examples provided). The job role descriptors (e.g. Data scientist) were used to search the NHS Electronic Staff Record (ESR), in the job title field, for NHS staff members holding these roles as of 31 March 2019. A member of staff was identified when a specified job role descriptor exactly matched their job title.

Of the 109 job roles queried, 55 returned no result, with a further 26 returning less than 10 records of staff members with a corresponding job title. In total, only 1,436 records in ESR (a dataset covering 1.4 million staff) were identified during the search.

Figure 15.1: Results of the NHS Electronic Staff Record search for NHS staff members in critical and shortage job areas



Source: NHS Electronic Staff Record

The methodology as described raises questions about the viability of identifying the informatics workforce in ESR via searches in the job title field. The main concern was around the ambiguity and ubiquity of the terminology used to perform these searches. The findings suggest that many job titles in actual use by NHS staff members in informatics are at best different from that being cited by the reports listed in Table 15.1, and at worst are inconsistent or lack coherence with any underpinning framework. It must also be noted that searches using generic job titles, such as operations manager, returned details of staff members who probably do not work in informatics.

Identifying those NHS staff members in critical and shortage job roles will be challenging if we are to model and plan the informatics workforce. Phase 2 of the project will need to create an ontology of key and wildcard character strings for use as enhanced search terms to extract multiple job titles in ESR related to each critical or shortage job role. A similar piece of work has already been successfully undertaken in Phase 1 of this project searching in ESR for staff members working in knowledge management and clinical coding services (see Section 4.2).

16. RECOMMENDATIONS AND OPTIONS FOR FUTURE WORK

Phase 1 of the project focused on identifying and understanding the NHS informatics workforce and the methodological limitations and challenges in doing so. Phase 2, planned for 2020, will build on this earlier piece of work and focus on addressing or mitigating some of these limitations and, in turn, modelling and planning the informatics workforce across healthcare (not just the NHS) and social care. The aim is to have an informatics workforce in the future with the capacity to support the delivery of effective and optimised health and social care in England. The following are recommendations and options for future work during Phase 2 of the project planned for 2020.

16.1. Conceptualising and categorising the informatics workforce

An occupational career framework is required that categorises informaticians into job roles and areas of work at a level that is useful for workforce modelling and planning across health and social care. The framework will provide the conceptual structure for much of the work in Phase 2 of the project and one of the long-term aims is for it to be adopted for use in key workforce information resources, such as the NHS Electronic Staff Record (ESR). The framework could be based on or adapted from one that is already established, e.g. the North West Informatics Skill Development Network (NWISDN) framework. Consideration will need to be given as to whether the framework is comprehensive in covering the informatics workforce as defined and agreed by all stakeholders in the project, and the framing and specificity of the categories used for job roles and each area of work in informatics. The occupational framework will provide the basis for collecting, collating (including from ESR) and analysing data on the informatics workforce across health and social care.

16.2. Dataset of informaticians in health and social care

Phase 1 of the project draws on information from ESR that mainly covers staff members working for NHS organisations. A comprehensive dataset covering informaticians working across health and social care is required if we are to undertake robust modelling and planning of the informatics workforce. The information could be collated through existing data resources where accessible and by collecting data direct from relevant organisations. Complementing this approach could be partnerships with other organisations, such as Skills for Care[16] in commissioning an analysis of the informatics workforce in adult social care.

An initial scoping study is required to identify which sectors and organisations employ informaticians working in health and social care, and could include:

- Higher education
- Independent sector, including commercial companies
- Local authority public health teams
- Social care
- Primary care
- Professional and national bodies
- Research and development establishments

16.3. Understanding skill and knowledge requirements

This report has indicated that skill and knowledge level requirements in informatics are increasing and are set to continue to do so. This is especially the case as information and digital technology, hardware and software, and their application in health and social care are getting more sophisticated. There is a need to undertake an audit of skill and knowledge levels that are now required by employers to inform on possible levels needed by the future informatics workforce. The audit could be through accessing information on recent vacancies (advertised on NHS Jobs, Trac, LinkedIn and other job websites), including person and job specification documents.

16.4. Supporting diversity and professionalism in the informatics workforce

The Building a Digital Ready Workforce (BDRW) programme is wide in scope and considers issues of workforce diversity and professionalism. Phase 1 of this project has provided data on the gender, ethnicity and disability backgrounds of staff members in informatics. This information is not only required, but will also need to be periodically updated for the BDRW programme to monitor, influence and set targets for the health and social care sector in addressing problematic issues and areas.

16.5. Stability of the informatics workforce – staff retention and attrition

Improving staff retention has been recognised by a report from the Health Foundation (2019) as being a priority for the NHS, and part of the overall workforce policy and planning system[30]. The NHS Pay Review Body (2019) in making specific reference to information technology roles called for a clear identification of recruitment and retention difficulties[12]. Further insight is required into staff retention and attrition, and the stability of the informatics workforce, if any problematic issues are to be addressed through policy and planning initiatives. Phase 2 of the project will need to:

- Examine segments of the workforce where there is evidence of a high turnover of staff or a decrease in staff numbers, for example knowledge management, which has seen a 19% reduction in NHS staff numbers between 2014 and 2019.

- Consider different ways defining and calculating the stability of the workforce, for example, by organisation, region, staff grouping and Agenda for Change banding, leading to more insight on issues of staff retention and attrition in informatics.

16.6. Exploring different possibilities in modelling the future informatics workforce

Possible areas of work during January to April 2020 include:

- A review of models used in planning the workforce in informatics and other caring professions. The intention is to learn from best practice and derive a framework to model and plan the future informatics workforce.

- A sampled-based approach in observing workforce flows. A model can then be built to consider the different environments in which informatics might operate depending on different futures and consideration from the wider market. The model would require a review and quantification of the external vocational environment, for example consideration of labour market conditions, including pay levels outside the NHS, entrants to university courses related to informatics, recruitment of expertise internationally, and so on. This piece of work could be undertaken as part of a discovery project on labour market analysis.

- A demand-based approach through creating scenarios accounting for different future health and social care delivery models, and changes in functions of health and social care providers.

- Further analysis of data on vacancies (including number of applicants) in informatics to determine possible levels of staff shortages and critical job roles in different areas of work and regionally.

16.7. Focus on critical and shortage job roles in informatics

Recent reports on digital and information technology in the NHS and other sectors have highlighted the issue of critical and shortage job roles. This potentially represents a recruitment challenge for health and social care. These roles – identified by the Royal Society (2019)[3], Digital Health and Care Institute (2019)[5], Migration Advisory Committee (2019)[6], Scottish government (2018)[7] and UK

government[8] – include data scientists, data engineers, data analysts, big data specialists, software and applications developers and analysts, AI and machine learning specialists, robotics specialists and engineers, information security analysts, cyber security analysts and consultants, database and network professionals, and user experience and human-machine interaction designers. At the same time there is a lack of traditional labour market data for these roles, which has created an information gap. Phase 2 of the project will need to:

- Examine the recruitment challenges faced by employers in health and social care for staff in critical and shortage job roles.

- Identify existing NHS staff members in critical and shortage job roles through creating an ontology of key and wildcard character strings to be used as enhanced job title search terms in ESR. There is also a need to identify staff members in these critical and shortage job roles working across the health and social care sectors, and not just NHS organisations.

- Predict the growth in and future demand for these job roles in order to build the policy direction informing on workforce models.

- Project what the workforce size in these job roles could be in 2024 (through the HEFT Tool) and compare it against anticipated demand (determined through different scenarios for future health and social care delivery models and changes in functions of health and social care providers), which may lead to the identification of a shortage gap. Knowing this gap is important as the first step in modelling and planning for an adequate workforce.

- Explore the possibility of applying advanced data analytical techniques in examining vacancies and jobs advertised in informatics across health and social care. This may reveal the extent and prevalence of certain job role types and skills most sought after by employers. The work will also help develop a taxonomy of occupations by grouping jobs into occupations that require similar knowledge and skill types and levels, and help with the conceptualisation and categorisation of the informatics workforce.

APPENDIXES

Workforce information for each area of work in informatics

A. Clinical Informatics
B. Informatics Education and Training
C. Informatics Strategy and Development
D. Information and Communication Technology
E. Programmes and Projects
F. Information Management
G. Knowledge Management

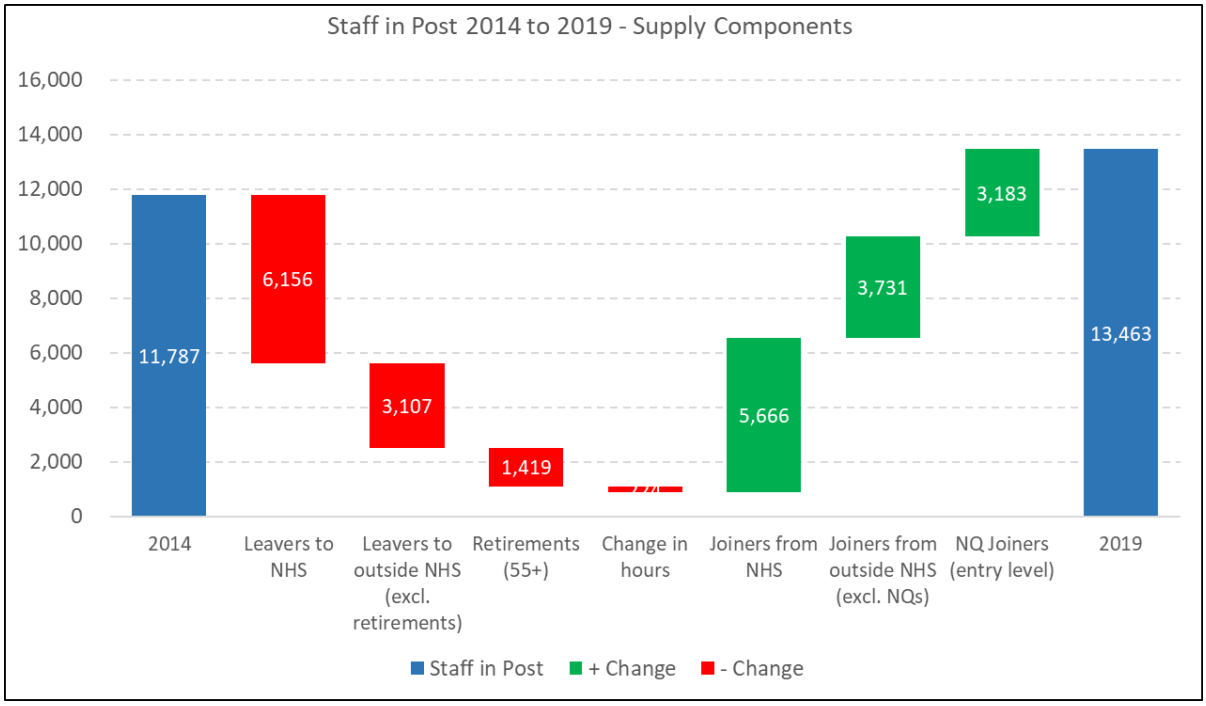
A. CLINICAL INFORMATICS

Table A1: Clinical informatics workforce size in England, 2014 to 2019

	Headcount	FTEs
2014	14,392	11,787
2015	14,510	12,014
2016	14,921	12,538
2017	15,771	13,355
2018	15,772	13,396
2019	15,794	13,463
Average yearly change (%)	**1.9%**	**2.8%**
5-year change (%)	**9.7%**	**14.2%**

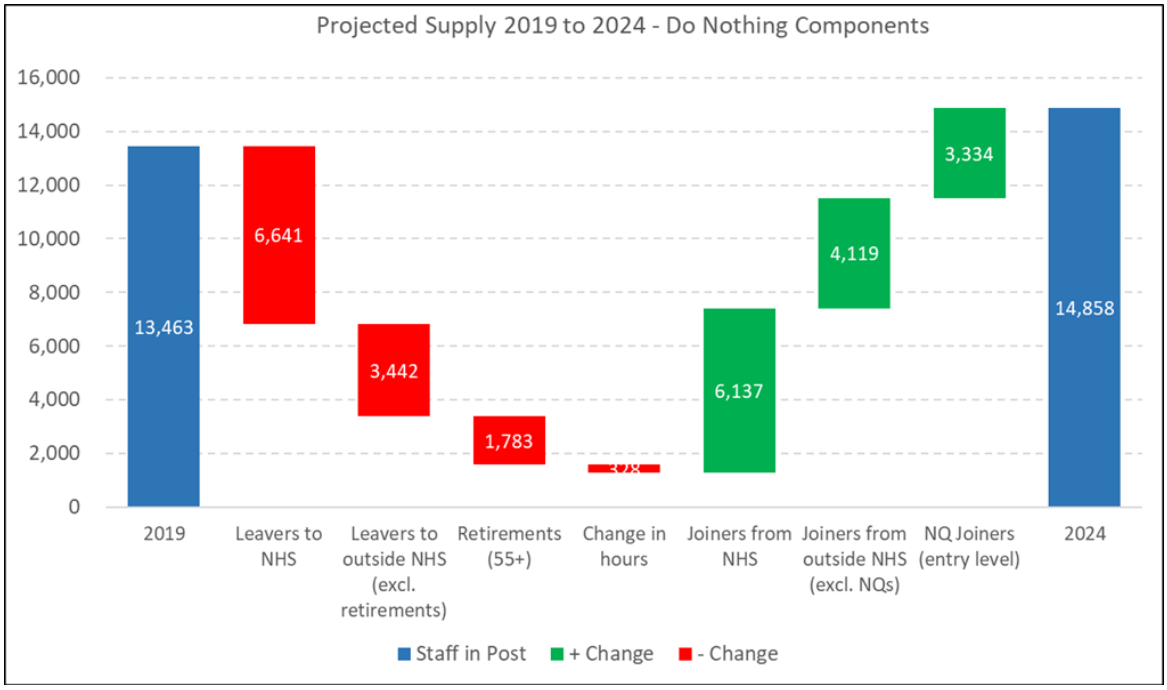
Source: NHS Electronic Staff Record

Figure A1: Leavers and joiners to the clinical informatics workforce between 2014/15 and 2018/19 (1 April to 31 March) – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

Figure A2: Projected supply and workforce size for the clinical informatics workforce, 2019/20 to 2023/24 – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England - Electronic Staff Record Flow Tool (HEFT)

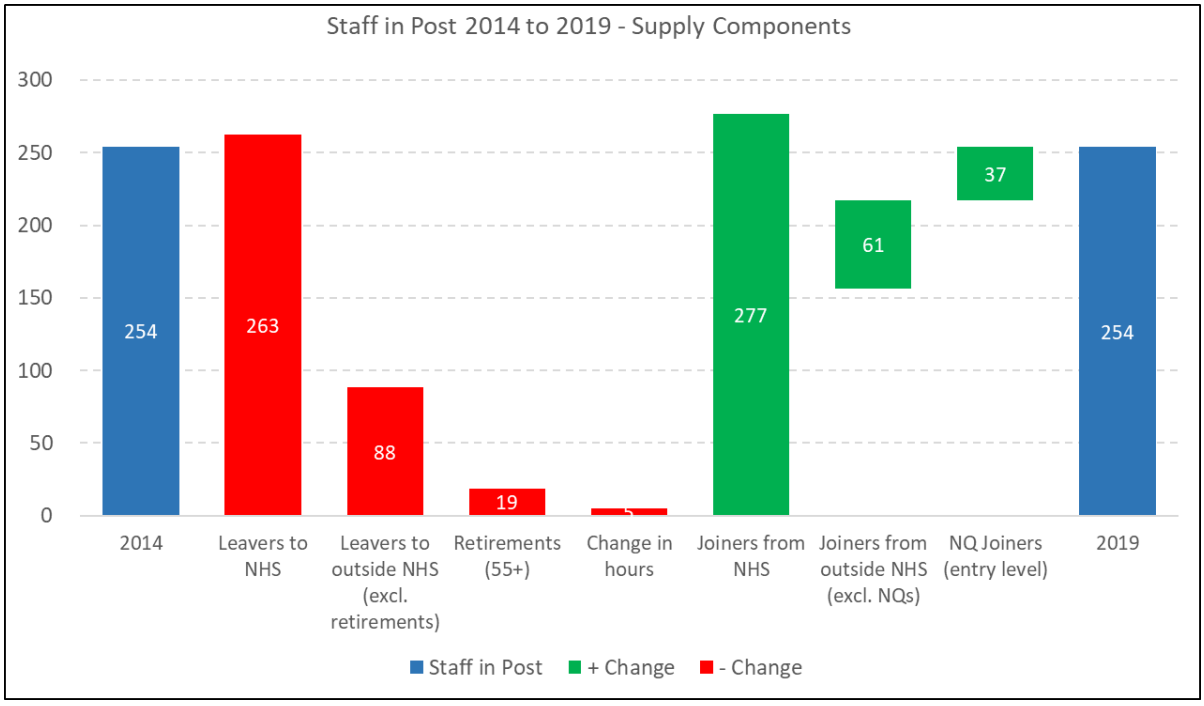
B. INFORMATICS EDUCATION AND TRAINING

Table B1: Informatics education and training workforce size in England, 2014 to 2019

	Headcount	FTEs
2014	279	254
2015	273	251
2016	235	218
2017	249	224
2018	267	238
2019	283	254
Average yearly change (%)	**0.3%**	**-0.04%**
5-year change (%)	**1.4%**	**-0.2%**

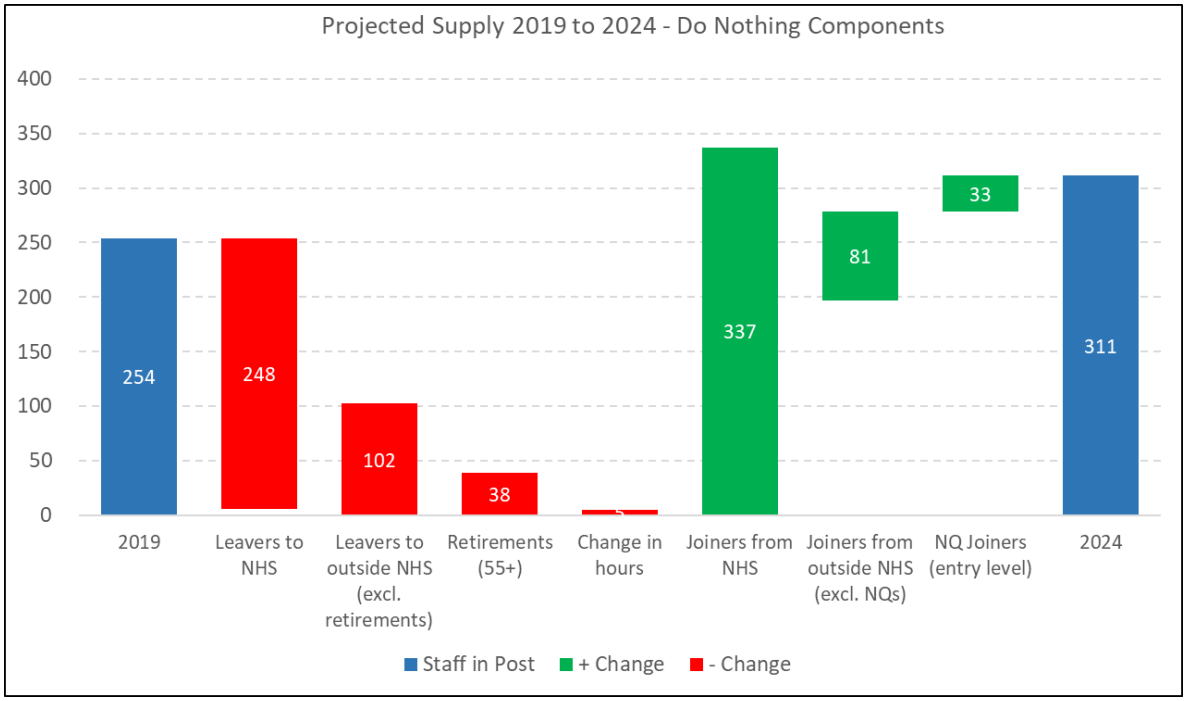
Source: NHS Electronic Staff Record

Figure B1: Leavers and joiners to the informatics education and training workforce between 2014/15 and 2018/19 (1 April to 31 March) – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England - Electronic Staff Record Flow Tool (HEFT)

Figure B2: Projected supply and workforce size for the informatics education and training workforce, 2019/20 to 2023/24 – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England - Electronic Staff Record Flow Tool (HEFT)

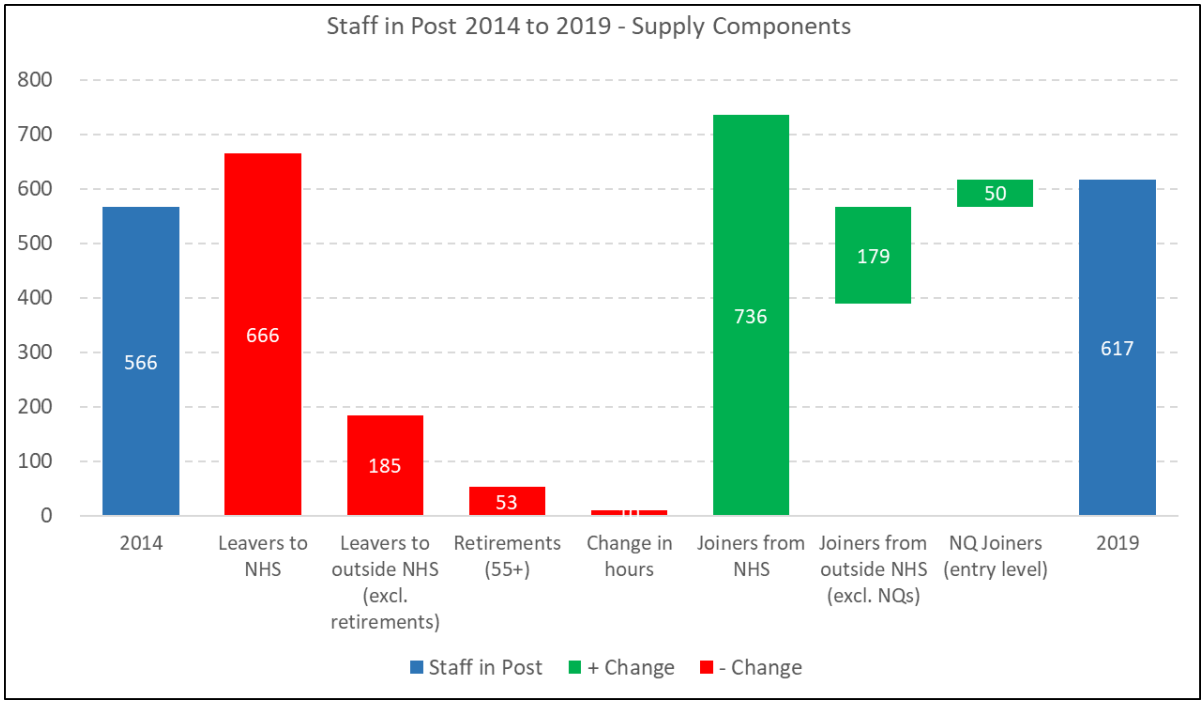
C. INFORMATICS STRATEGY AND DEVELOPMENT

Table C1: Informatics strategy and development workforce size in England, 2014 to 2019

	Headcount	FTEs
2014	587	566
2015	620	597
2016	613	588
2017	714	680
2018	655	628
2019	648	617
Average yearly change (%)	**2.1%**	**1.8%**
5-year change (%)	**10.4%**	**9.0%**

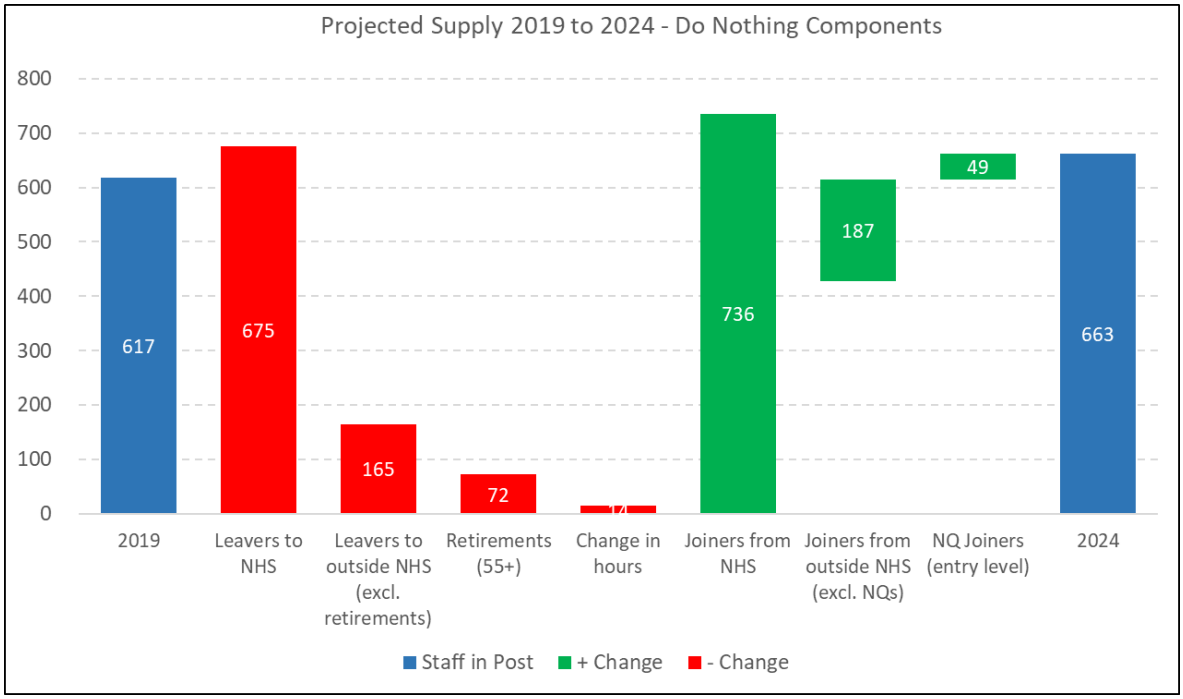
Source: NHS Electronic Staff Record

Figure C1: Leavers and joiners to the informatics strategy and development workforce between 2014/15 and 2018/19 (1 April to 31 March) – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

Figure C2: Projected supply and workforce size for the informatics strategy and development workforce, 2019/20 to 2023/24 – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

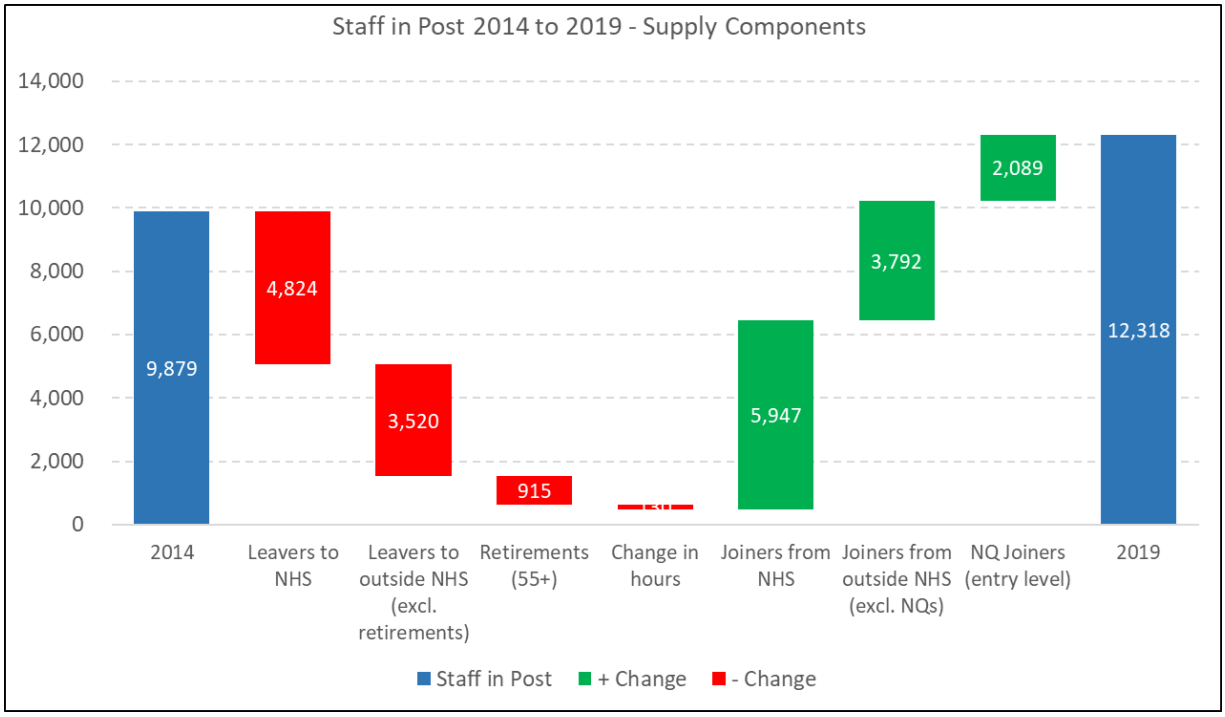
D. INFORMATION AND COMMUNICATION TECHNOLOGY

Table D1: Information and communication technology workforce size in England, 2014 to 2019

	Headcount	FTEs
2014	10,241	9,879
2015	10,347	9,961
2016	10,607	10,234
2017	11,138	10,761
2018	11,808	11,405
2019	12,738	12,318
Average yearly change (%)	**4.9%**	**4.9%**
5-year change (%)	**24.4%**	**24.7%**

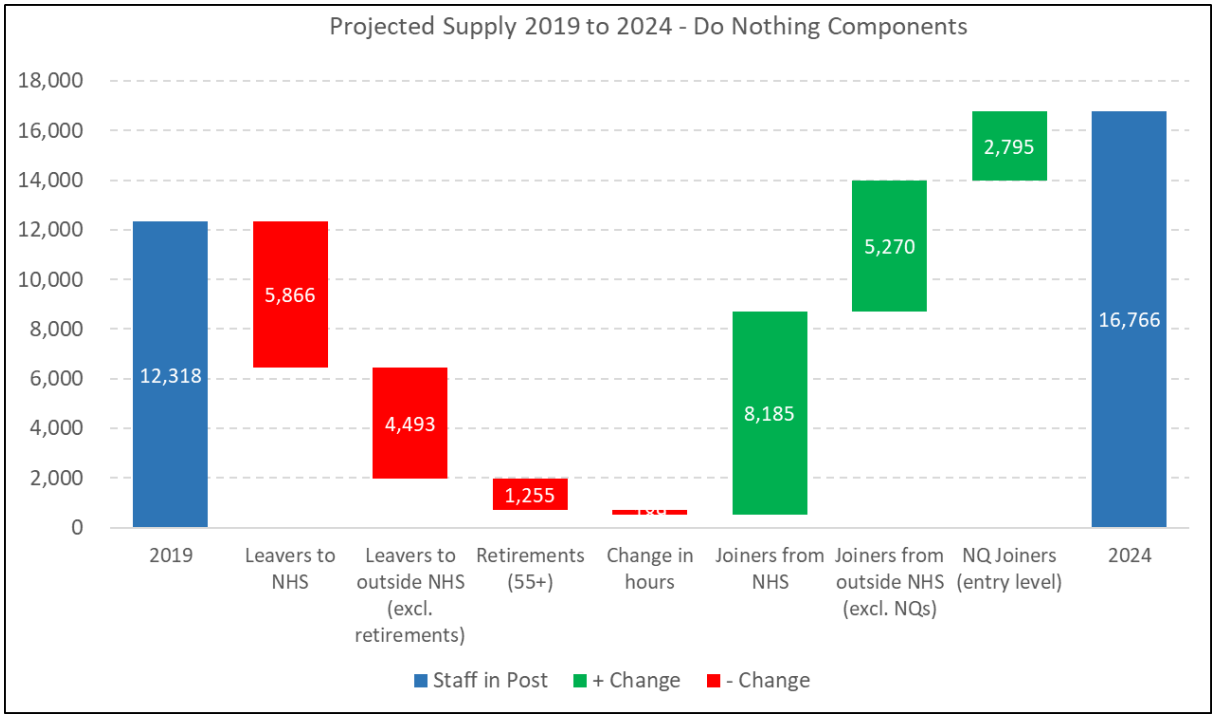
Source: NHS Electronic Staff Record

Figure D1: Leavers and joiners to the information and communication technology workforce between 2014/15 and 2018/19 (1 April to 31 March) – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

Figure D2: Projected supply and workforce size for the information and communication technology workforce, 2019/20 to 2023/24 – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

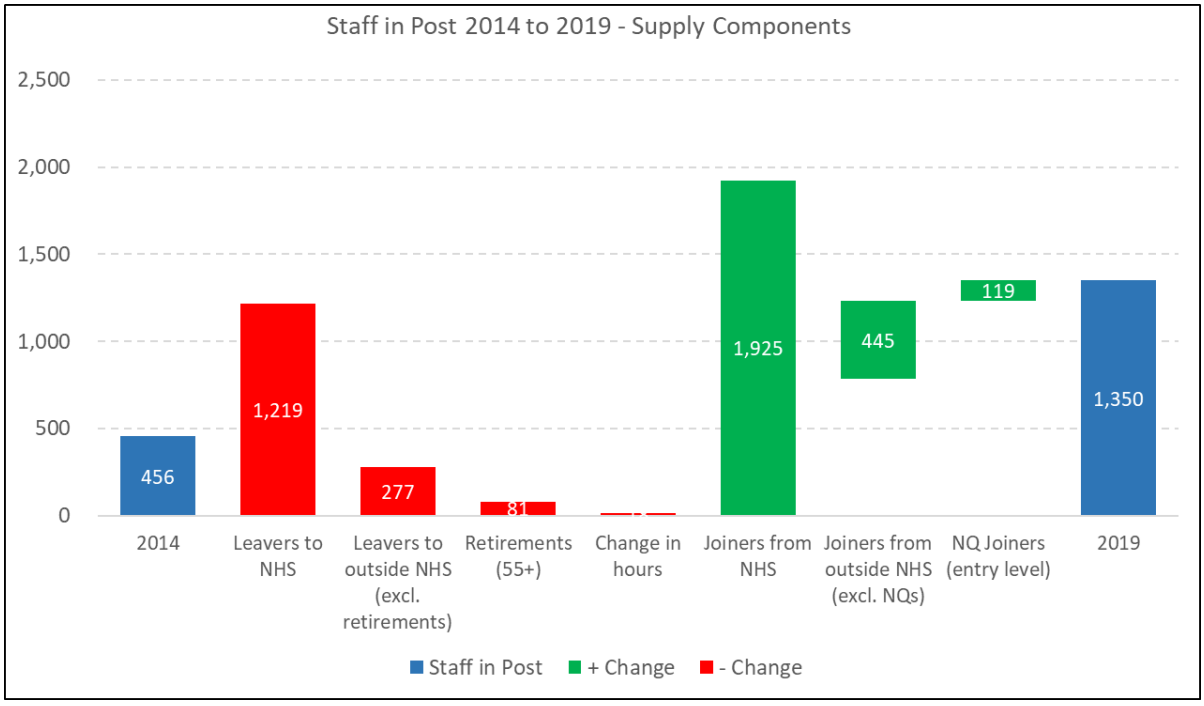
E. PROGRAMMES AND PROJECTS

Table E1: Programmes and projects workforce size in England, 2014 to 2019

	Headcount	FTEs
2014	498	456
2015	611	569
2016	767	716
2017	1,068	1,004
2018	1,305	1,229
2019	1,446	1,350
Average yearly change (%)	**38.1%**	**39.2%**
5-year change (%)	**190.4%**	**196.1%**

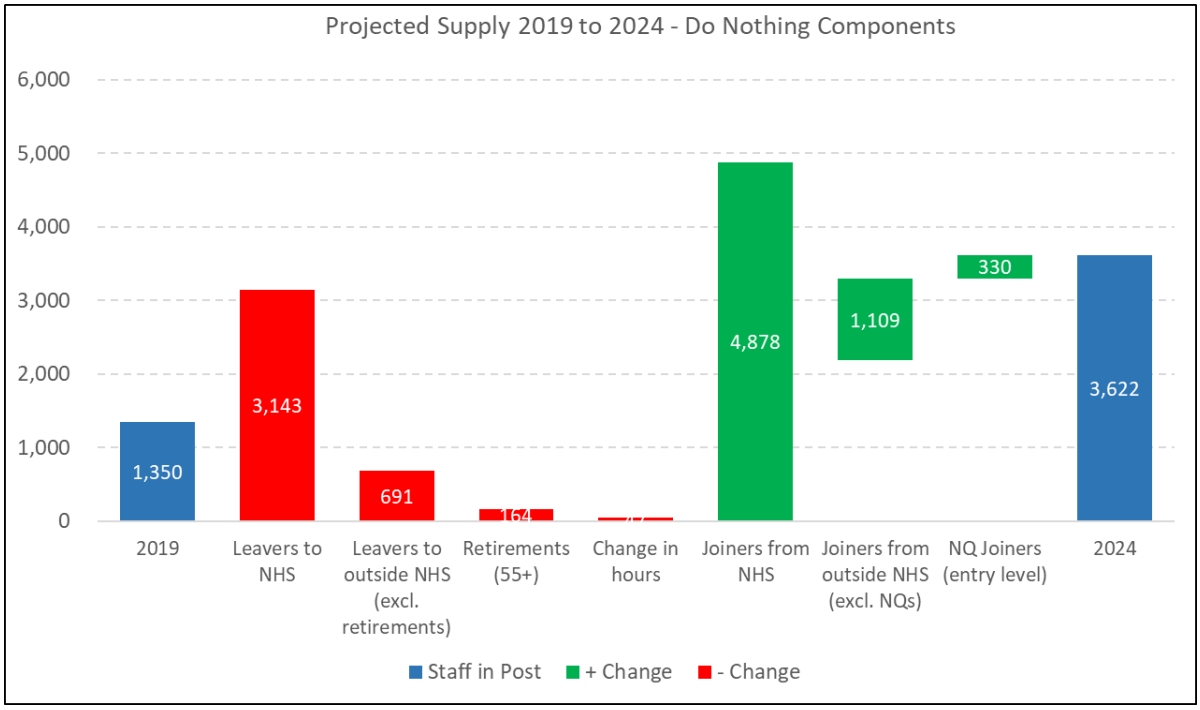
Source: NHS Electronic Staff Record

Figure E1: Leavers and joiners to the programmes and projects workforce between 2014/15 and 2018/19 (1 April to 31 March) – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

Figure E2: Projected supply and workforce size for the programmes and projects workforce, 2019/20 to 2023/24 – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

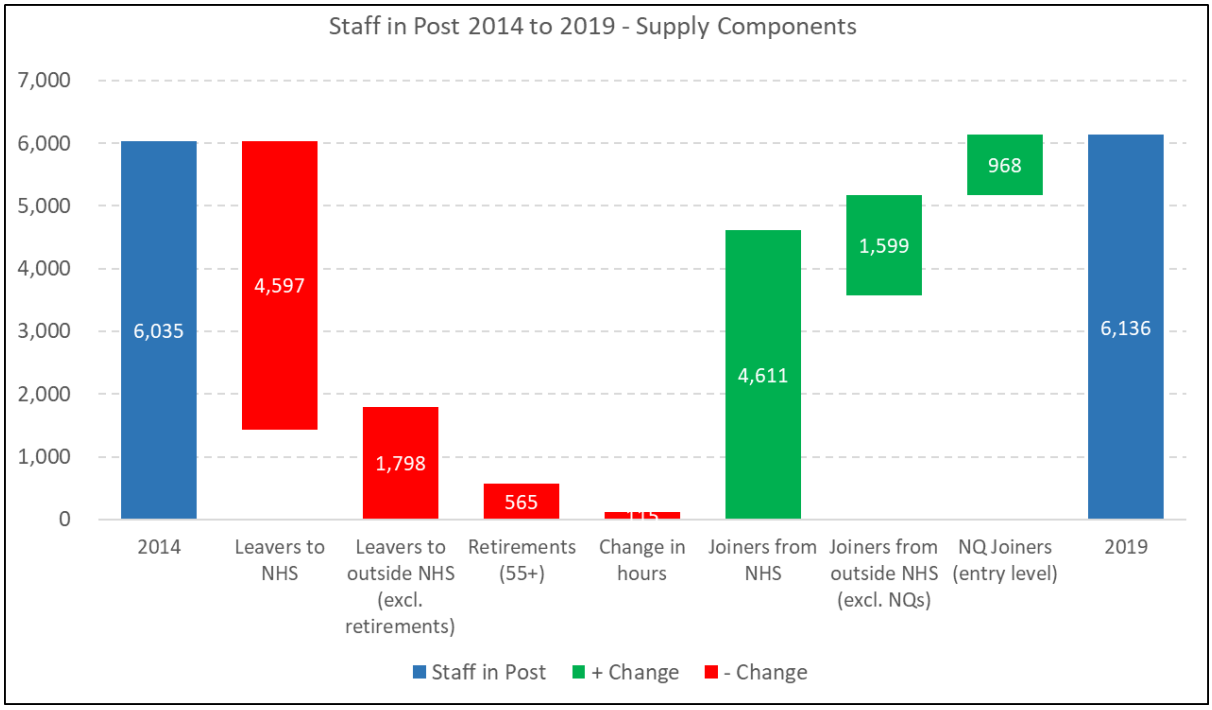
F. INFORMATION MANAGEMENT

Table F1: Information management workforce size in England, 2014 to 2019

	Headcount	FTEs
2014	6,478	6,035
2015	6,410	5,958
2016	6,340	5,910
2017	6,291	5,869
2018	6,407	5,963
2019	6,580	6,136
Average yearly change (%)	**0.3%**	**0.3%**
5-year change (%)	**1.6%**	**1.7%**

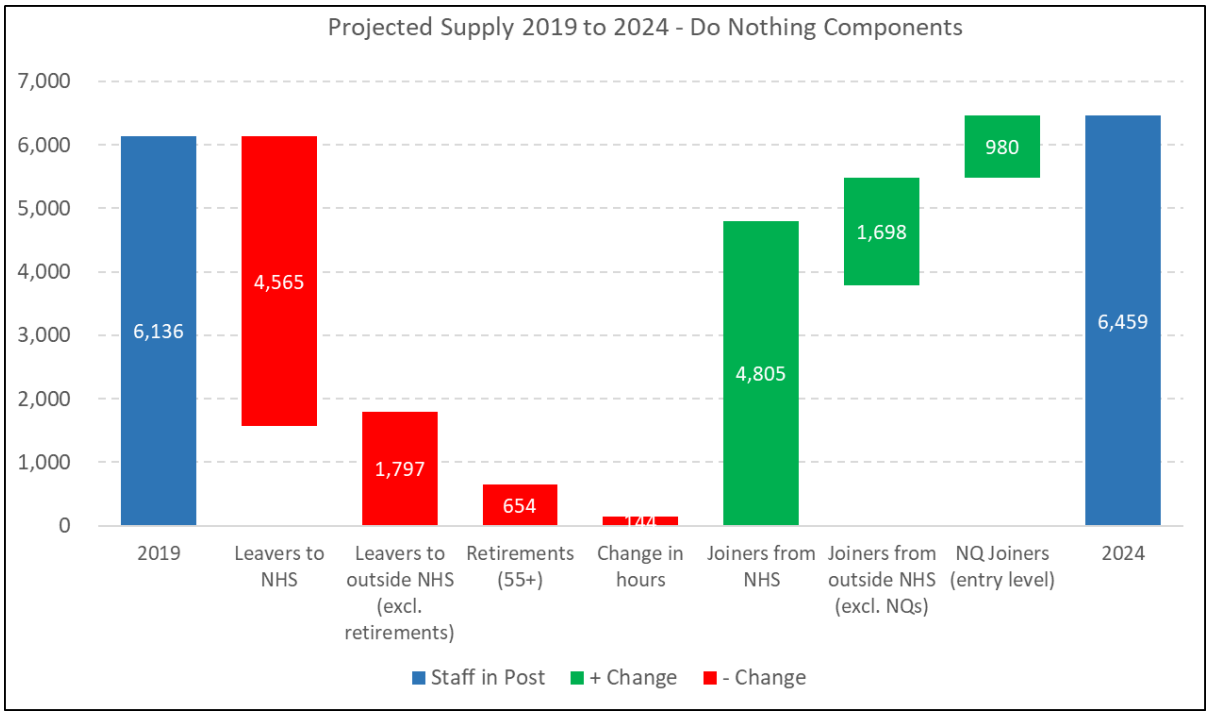
Source: NHS Electronic Staff Record

Figure F1: Leavers and joiners to the information management workforce between 2014/15 and 2018/19 (1 April to 31 March) – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

Figure F2: Projected supply and workforce size for the information management workforce, 2019/20 to 2023/24 – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

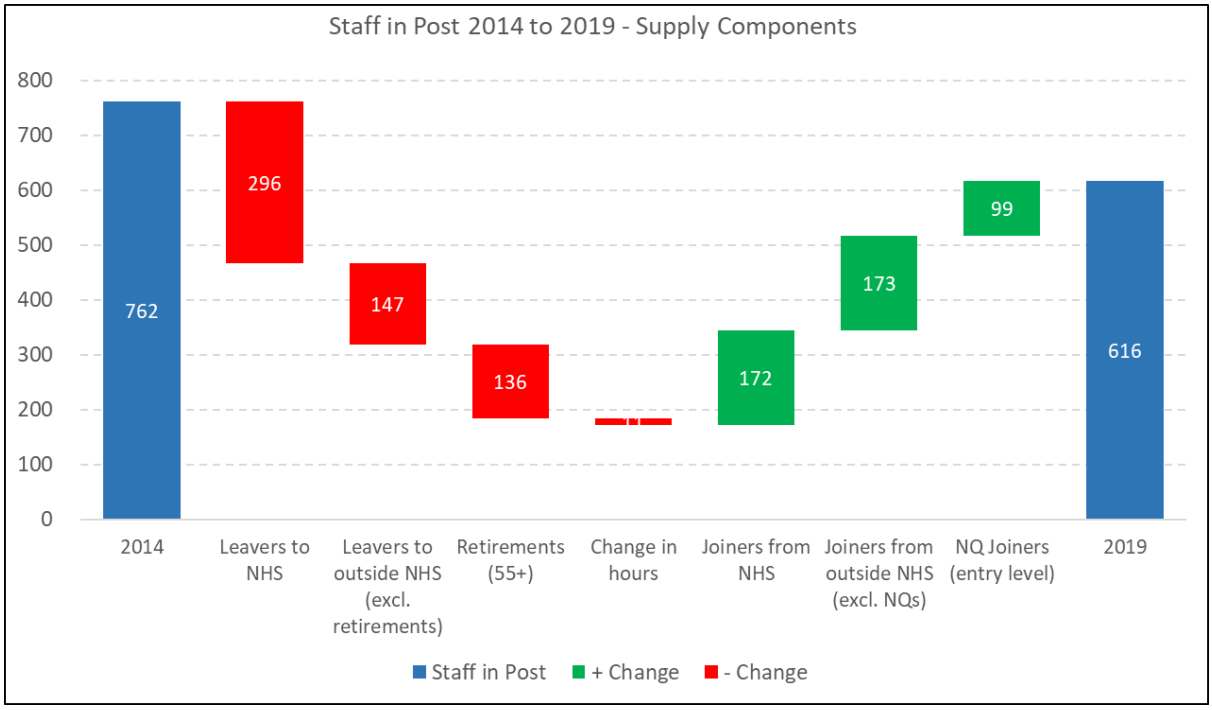
G. KNOWLEDGE MANAGEMENT

Table G1: Knowledge management workforce size in England, 2014 to 2019

	Headcount	FTEs
2014	947	762
2015	874	701
2016	813	654
2017	795	639
2018	759	620
2019	747	616
Average yearly change (%)	**-4.2%**	**-3.8%**
5-year change (%)	**-21.1%**	**-19.1%**

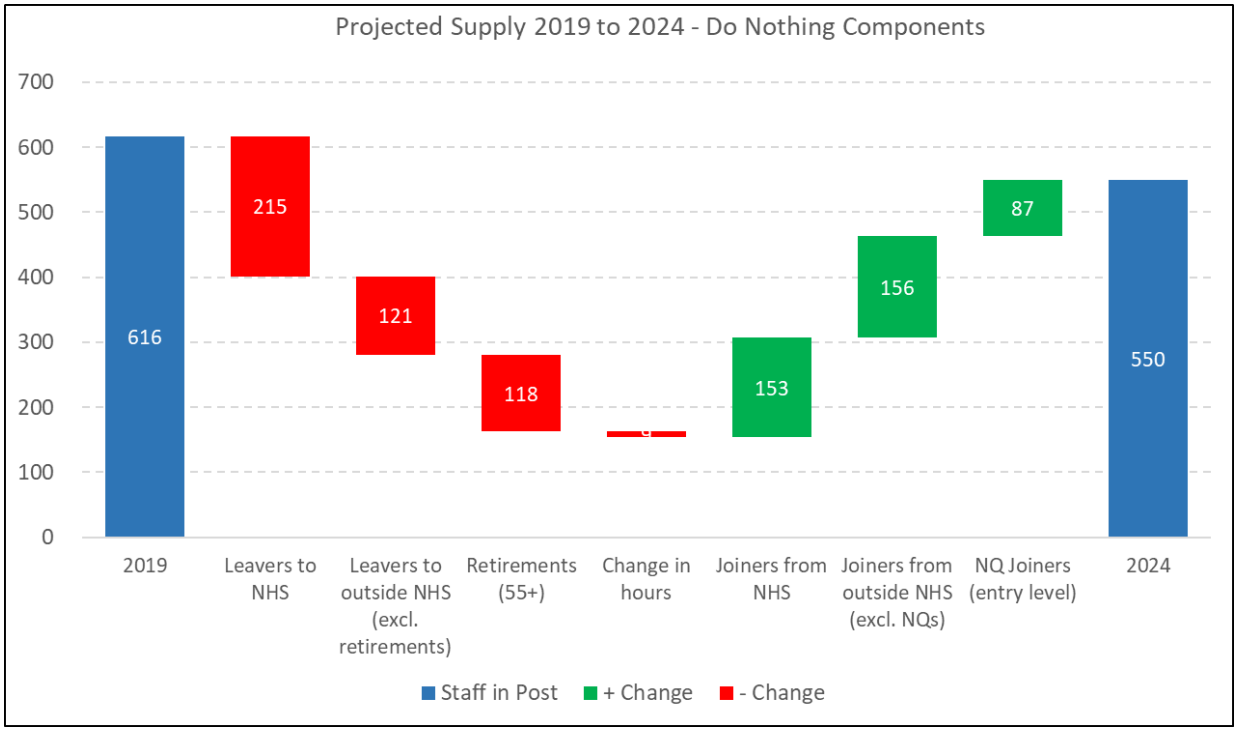
Source: NHS Electronic Staff Record

Figure G1: Leavers and joiners to the knowledge management workforce between 2014/15 and 2018/19 (1 April to 31 March) – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

Figure G2: Projected supply and workforce size for the knowledge management workforce, 2019/20 to 2023/24 – full-time equivalents (FTEs)



NQ = Newly Qualified
Source: Health Education England – Electronic Staff Record Flow Tool (HEFT)

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