

Estimating the cost of growing the NHS cancer workforce in England by 2029

October 2020

Together we will beat cancer



Reference

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Cancer Research UK commissioned RAND Europe and the University of Cambridge, partners in the Cambridge Centre for Health Services Research, to carry out the research underpinning this report.

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Cancer Research UK

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<http://www.randeurope.org>

List of acronyms

AfC	Agenda for Change (NHS pay scales)
ALBs	Arm's-Length Bodies
CPD	Continuing Professional Development
DHSC	Department of Health and Social Care
ESR	Electronic Staff Record
FTE	Full-Time Equivalent
GDPR	General Data Protection Regulation (EU)
HEE	Health Education England
LTP	(NHS) Long Term Plan
MFF	Market Forces Factor
NHS	National Health Service
NQT	Newly Qualified Trainee

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Foreword

The UK public has always held doctors, nurses and health professionals in high regard – this is nothing new. What is new is what we saw during the height of the coronavirus (COVID-19) pandemic – millions of us uniting to show our appreciation for our NHS staff; week in, week out.

NHS staff do heroic things, but many would tell you that they are not themselves heroes. They are highly trained, highly skilled professionals, doing the job they are paid to do. Recruiting and training these professionals requires investment.

Even before the coronavirus pandemic began, NHS staff were working harder than ever to support a system that was too often running overwhelmed, with not enough capacity to meet the needs of all patients. In large part, this is due to a persistent failure from successive governments to properly invest in NHS staff.

When we stood on our doorsteps and balconies to clap for the NHS what we acknowledged, more than anything, was the immense pressure that NHS staff are under and our pride for the work they do. This pressure did not begin with COVID-19 and will not end after the pandemic – unless the Government takes significant action to provide adequate funding and prioritises the workforce in future NHS policy.

This has been all too apparent in cancer services. Early diagnosis is critical for good cancer outcomes. Growing pressure in diagnostic services due to staff shortages has led to a significant decline in performance against key cancer waiting times standards, and to staff delivering vital cancer treatments reporting that shortages are harming patient care.

Without action, this situation is only going to get worse. The number of people being diagnosed with cancer is growing all the time – by 2035, nearly 438,000 people are expected to be diagnosed with cancer in England every year, an increase of more than 40 per cent on 2015 levels, with 130,000 more cases projected. While the NHS Long Term Plan has set welcome

ambitions for cancer services, meeting these ambitions will increase demands on staff even further.

We do not yet know what the full impact of the COVID-19 pandemic will be on the NHS' need for staff in the future and its ability to recruit them – but it is likely that it will be significant and require Government action. The alarming figures recently seen on the backlog of people awaiting cancer tests or treatment will clearly impact on staff capacity to cope and may further shape the future landscape.

But what we do know – and what this report shows – is that, notwithstanding the impact of COVID-19, significant growth is needed almost across the board to equip the NHS workforce to diagnose and treat cancer patients in the future. This report makes clear that the Government must make significant, targeted investments now to make sure the NHS is ready for what lies ahead.

This important report sets out the investment needed in the recruitment and training of staff to support the delivery of excellent healthcare. Investing in the health care workforce is expensive, and too often Governments' have balked when faced with such a large cost. But less visible is the cost of not investing – staff shortages, lack of capacity and a reliance of temporary staffing options. Investing in staffing now is critical to delivering the high value health service we all want and need.



Anita Charlesworth
Director of Research and Economics
The Health Foundation

Executive summary

Over the last 50 years, the UK has made significant progress in improving survival outcomes for people diagnosed with cancer. In the 1970s, only 1 in 4 cancer patients would survive their disease for ten years or more. By 2010, this had risen to 2 in 4, and survival outcomes continue to improve.¹ There are several drivers for this, from the introduction of screening programmes and innovative treatments to ongoing improvements to health care pathways – all of which has been underpinned by the continued and tireless efforts of staff from across the NHS.

However, there is still much to be done. Cancer remains one of the leading causes of death in England. Every day around 1,000 people in England are diagnosed with cancer, and around 450 die from the disease.¹ Demand for cancer services is growing: more cases each year are diagnosed, and people are on average living for longer with cancer. An ageing and growing population means the cancer incidence continues to rise at an alarming rate, with many patients having increasingly complex needs. By 2035, the number of people estimated to be diagnosed with cancer in England is expected to reach over half a million per year, an increase of 40 per cent since 2015.² We also see lower survival in the UK than in comparable countries around the world, and significant variation in outcomes across the UK too.^{3,4}

Critical to addressing these challenges is our ability to diagnose cancer at an early stage. Patients diagnosed early, at stages 1 and 2, have the best chance of curative treatment and long-term survival.⁵ But in the UK, we currently diagnose just over half of patients at an early stage.⁶ The importance of this challenge is recognised by the UK Government and NHS England, in their commitment to diagnose 75 per cent of cancers at an early stage by 2028.⁷

But the diagnosis, treatment and support of people living with cancer relies on a range of skilled NHS staff conducting specialist tasks such as performing and reporting on diagnostic tests and providing different forms of treatment and support. Ensuring that the NHS has enough skilled staff, now and in the future, is therefore a vital part of fulfilling the ambitions of the LTP and improving outcomes for cancer patients.

Despite attempts to increase size of the cancer workforce, key cancer-related professions have remained under pressure, with vacant posts and staff shortages. Cancer Research UK found that nearly three in four staff surveyed in non-surgical oncology services see staff shortages as a barrier to providing excellent patient experience.⁸ Capacity constraints, particularly due to staff shortages in diagnostic services, are associated with poor performance against NHS waiting times standards.⁹ Even before the COVID-19 pandemic, the NHS had been reporting worsening performance against both the two-week wait for urgent suspected cancer referrals and the 62-day Cancer Waiting Times treatment standards.¹⁰

In June 2018, the government announced a long-term funding settlement for the NHS,¹¹ whereby NHS England's annual budget would rise by an extra £20.5 billion by 2023–24. No

announcement has been made beyond 2020–21 for other health bodies such as Health Education England (HEE), even though HEE is responsible for planning for and training the staff that will be required to deliver the government’s commitments.

Understanding mechanisms for workforce growth and their associated costs

In 2017 the NHS, led by NHS England and HEE, published a Cancer Workforce Plan for England.¹² This assessed the cancer workforce against the increasing demand for diagnostic capacity and for cancer care and raised particular concerns about whether the NHS had sufficient staff in seven key specialisms most closely related to cancer diagnosis and treatment: clinical and medical oncology, gastroenterology, histopathology, clinical radiology, diagnostic radiography, therapeutic radiography and specialist cancer nursing. In 2018 HEE set out that, to provide a world-class service for NHS cancer patients, the workforce in these seven priority professions would likely need to increase by 45 per cent by 2029.¹³

This study aimed to understand the increase in HEE’s future budget, beyond existing trends based on current levels of investment, required to recruit and train more staff to increase the NHS cancer workforce by 45 per cent by 2029 in England. These findings can inform the Government’s spending review by providing an estimate of the additional budget settlement required to promote workforce growth.

This report identifies several different ways of increasing staff numbers: by increasing training places, international recruitment and encouraging higher retention levels. It is important to note that the costs identified in this report do not represent the full cost to the health sector of increasing staffing in key professions, only those that HEE is responsible for. Many of the costs of international recruitment, for example, are borne by NHS Trusts, which are funded by the NHS England funding settlement.

Workforce and cost data have been identified for each of the priority professions in order to build a demographic stock-flow model, with workforce data based on number of staff in post rather than the number of funded positions – this means the modelling does not consider vacancies in funded posts. The model allows us to build up an idea of how many people we would expect to be in post in each profession each year, if current trends of entering and leaving that particular workforce continue. Using this model, we identified how many more people, over and above existing trends, HEE or other parts of the health system would need to recruit to meet an increase of 45 per cent in staffing by 2029. We tested the logic and validity of our findings by consulting a stakeholder advisory panel and holding a validation workshop to obtain feedback on the data and emerging messages.

Key findings

Aside from gastroenterology, all professions would need additional government investment to meet a growth of 45 per cent by 2029

Workforce numbers for six of the seven professions are already on an increasing trajectory, assuming a continuation of current trends. For one profession, gastroenterology, our model estimated that the workforce would increase by more than 45 per cent if its existing trajectory continues. Therefore, no *additional* measures to recruit and train staff would be required. For five of the other six professions, we estimated that the size of the workforce would increase to differing degrees over the period, but that there would be a need for additional intervention to achieve the needed growth rate of 45 per cent.

Table 1 sets out the estimated growth of each profession on the basis of current trends, and the estimated *additional* FTE required to achieve 45 per cent growth.

Table 1: Summary of the estimated growth of cancer specialists and additional number required to reach 45 per cent growth

Cancer profession	Estimated number of FTE staff in 2019	Expected growth by 2029 (based on current trends)		Estimated additional growth required to meet 45 per cent growth (above expected growth)		Total (expected and additional) increase in FTE staff needed to reach 45 per cent growth
		Percentage growth	Estimated FTE staff increase	Additional percentage growth	Additional FTE staff required	
Clinical and medical oncology	1,185	40%	477	5%	57	534
Gastroenterology	1,290	48%	623	0%	0	623
Histopathology	1,228	-2%	-27	47%	580	553
Clinical radiology	3,087	33%	1,004	12%	384	1,388
Diagnostic radiography	14,997	28%	4,158	17%	2,591	6,749
Therapeutic radiography	2,844	24%	672	21%	609	1,281
Specialist cancer nurses	4,135	28%	1,149	17%	710	1,859
Total	28,766	-	8,056	-	4,931	41,753

Source: RAND Europe modelling using NHS ESR data and other data.

The histopathology workforce is forecast to decline

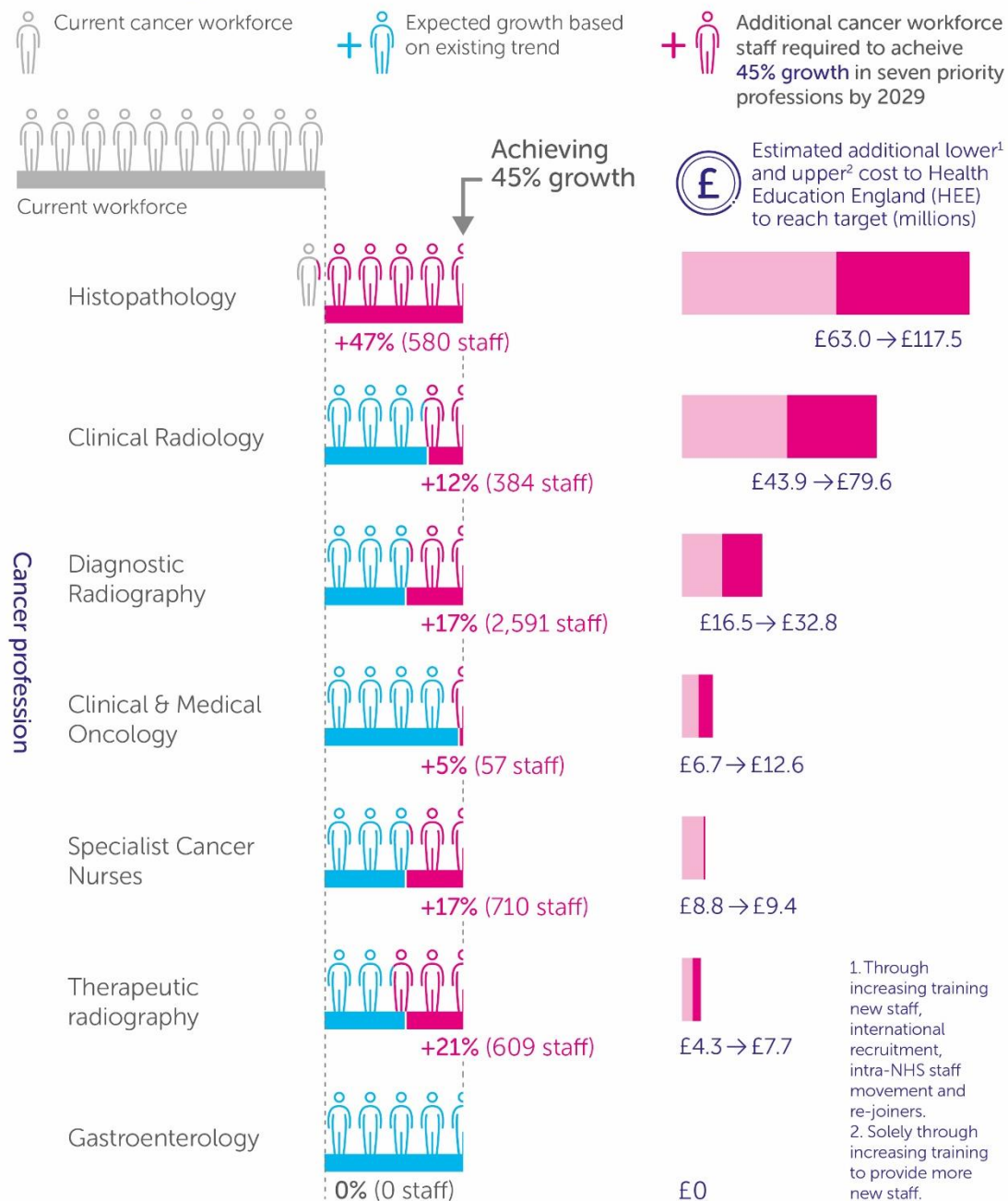
The results of the economic modelling show that achieving a growth of 45 per cent may be more difficult in some professions than others. For example, in clinical and medical oncology, if current trends continue this workforce would only need to grow by a further net addition of 57 staff to meet the 45 per cent growth scenario. However, in diagnostic radiography, an

estimated additional 2,591 staff would be needed in addition to the existing trend.

The modelling shows that, without any new intervention, the number of histopathologists is expected to reduce by 2 per cent by 2029. Therefore, to meet a 45 per cent growth, the profession would require 580 more staff at a potential maximum cost to HEE of £118 million.

Figure 1: Summary of the total additional number of cancer specialists required over ten years to 2029 and the total cost to HEE of different scenarios

Providing a world class cancer service



£ The total extra cost to HEE of growing the workforce beyond existing trends is estimated to be between £142 million and £260 million.

On the number of staff required, we recommend:

1. NHS England and Improvement should ensure that their next People Plan adequately reflects the NHS's ambitions for cancer care in England by clearly articulating details of how many staff will be needed to deliver quality services to a growing number of patients in the long-term.
2. NHS England and Improvement, working with HEE, should review how it can influence its pipeline of staff to the professions where they are most needed, with a particular focus on histopathology. The forecast of histopathology workforce numbers is particularly concerning, as this is the only profession with current trends suggesting a decline in staff numbers by 2029.

The total extra cost to HEE is estimated to be between £142 million and £260 million

Estimates for each profession explored three different scenarios that vary according to the extent to which the additional staff would be coming through specialist training or via other routes.

We estimate that the total additional cost to HEE to achieve a 45 per cent growth in the key cancer workforce professions would be between £142 - £260 million (Figure 1). (NB. The higher estimate of £260 million is approximately 6 per cent of HEE's spending for one year). The actual cost will depend on the route taken to increase the inflows over the next ten years to 2029. This funding would need to be front-loaded due to the time required to train staff. Of the total estimated cost to HEE, almost half would be required to train additional histopathologists due to the forecast decline in numbers in that specialism by 2029.

Since the analysis was completed, the NHS – led by NHS England, NHS Improvement and HEE – published an NHS People Plan for 2020/21, which takes some steps to increasing staff numbers in some of the key cancer professions. Whilst this is welcome, they do not address the long term needs outlined in this report.

On the cost of increasing the cancer workforce, we recommend that:

3. The UK Government should provide long-term additional funding to HEE, aligned to the NHS Long Term Plan, to secure a sufficient pipeline of future NHS cancer staff. Initial estimates suggest that, to achieve a 45% growth in the seven key cancer professions, *additional* funding for HEE will need to be at least £142 million but possibly as much as £260 million over the next three to five years. This should be taken into account in the next Comprehensive Spending Review.

There are some considerations about the feasibility of the modelled scenarios

Although the research modelled different cost scenarios, there may be some limitations in practice to their feasibility. Scenarios that include staff increases through a mixture of routes including international recruitment and encouraging rejoiners will be affected by external circumstances such as the COVID-19 pandemic and the UK's exit from the EU. Equally, scenarios that rely heavily on increasing the number of professionals trained may be limited by the

number of work placements available.

Two additional salient points are:

- The importance of extending foundation-level training, to provide sufficient doctors so that different parts of the NHS are not competing for the same limited pool of clinicians.
- The need to understand a nuanced picture of required future staffing, including the possibility of different roles and multidisciplinary working. For example, there may be a greater demand in future for some of these professions than for others.

On the scenarios for increasing the workforce we recommend that:

4. NHS England and Improvement, along with HEE, should assess the feasibility of the different scenarios for increasing inflows. This is particularly important in light of the likely restrictions arising from the COVID-19 pandemic and the UK's exit from the EU, which may reduce international recruitment.
5. Building on the NHS People Plan 2020/21, NHS England and Improvement, in collaboration with HEE, should ensure that consideration of likely future demand and planned future modelling of the workforce is translated into clear long-term ambitions for the growth of different cancer professions.
6. This research project identified several important areas for future research. NHS England and Improvement, the National Institute for Health Research and other funders should commission work to fill these research gaps, to inform its approach going forwards with a fuller understanding of the needs of the cancer workforce and the constraints to its growth.

Conclusion

This research is important in starting to understand the likely requirements for the NHS, and particularly for HEE, of increasing the number of staff in seven priority cancer professions by 2029. Whilst all seven professions will require continued investment to maintain current growth trends, this modelling indicates that this will not be enough and that *additional* investment will be required.

The modelling also contributes important information about which workforces will require the most significant interventions by HEE if they are to grow by 45 per cent, as well as an estimate of the associated specialist training costs of such interventions. In addition to HEE's important role in securing staffing, the report also explains that other parts of the health sector, particularly NHS trusts, also play a role.

While three different scenarios for increasing the workforce are set out, external factors such as the impact of COVID-19 will likely have significant implications for the NHS's ability to attract more staff through certain routes. This study will allow policymakers to consider the relative costs and feasibility of alternative options.

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Introduction

Background and rationale

Cancer Research UK commissioned RAND Europe to carry out a study to inform understanding of the future budget that Health Education England (HEE) would require to recruit and train more staff, if the NHS in England is to make sufficient progress on its key workforce requirements for cancer by 2029.

Cancer is one of the leading causes of death in the UK. Every day over 800 people in England are diagnosed with cancer, and nearly 400 die from the disease.¹⁴ Demand for cancer services is growing: more cases each year are diagnosed, and people are on average living for longer with cancer. An ageing and growing population is likely to mean that nearly 438,000 people per year are expected to be diagnosed with cancer in England by 2035, an increase of 40 per cent since 2015.¹⁵

The NHS in England has placed a strong emphasis on cancer: the NHS Cancer Transformation Programme has been created, and the NHS Long Term Plan (LTP) aims to improve early diagnosis of cancer as well as patient outcomes.¹⁶ The diagnosis, treatment and support of people living with cancer relies on a range of skilled NHS staff performing specialist tasks such as performing and reporting on diagnostic tests and providing different forms of treatment and support. Ensuring that there are sufficient skilled staff in place is therefore a vital part of improving cancer services and their outcomes for patients.

In 2017 the NHS published a Cancer Workforce Plan for England, led by NHS England and HEE.¹⁷ This assessed the cancer workforce against the increasing demand for diagnostic capacity and for cancer care, and raised concerns about whether the NHS had sufficient staff in seven key NHS specialisms that were most closely related to cancer diagnosis and treatment: clinical and medical oncology, gastroenterology, histopathology, clinical radiology, diagnostic radiography, therapeutic radiography and specialist cancer nursing. The plan contained actions to grow the cancer workforce by a total of 4,126 staff across six of the seven priority professions by 2021, a planned increase of 18.5 per cent.

Although the Cancer Workforce Plan focused on seven priority professions where there were particular concerns about capacity, there are a huge number of other health professionals who routinely deal with patients living with cancer, including allied health professionals, medical physicists, palliative care staff, surgeons, clinical endoscopists, advanced clinical practitioners and a wider range of support staff. It is also important to note that some of the seven professions, such as oncologists, work exclusively in cancer, whereas others, such as gastroenterologists and histopathologists, also care for patients with a range of other diseases, and not solely cancer. Nevertheless, in this report we focus on the seven professions identified as a priority by the 2017 Cancer Workforce Plan.

Cancer workforce under pressure and the impact on patients

Despite attempts to increase the cancer workforce, key cancer-related professions have remained under pressure. For example, the Society of Radiographers reported in its 2018 survey that almost one in ten diagnostic radiography posts were vacant, meaning services have been struggling to meet demand.¹⁸ Cancer Research UK found that nearly three in four staff surveyed in non-surgical oncology services see staff shortages as a barrier to providing efficient cancer treatments and excellent patient experience.¹⁹ One third of cancer patients believe that there were sometimes or rarely sufficient nurses on duty to care for them in hospital.²⁰ Capacity constraints, particularly due to staff shortages in diagnostic services and increased pressure on emergency services, are associated with poorer performance against NHS waiting times standards.²¹ Even prior to the COVID-19 pandemic, the NHS had been reporting worsening performance against both the two-week wait for urgent suspected cancer referrals and 62-day Cancer Waiting Times treatment standards.²² In September 2019, 77 per cent of patients were seen within the 62-day standard.²³

There is a large and increasing amount of evidence for a relationship between low staffing levels and adverse patient outcomes, including higher mortality rates.²⁴ For example, the Francis Report identified inadequate staffing levels as one of the key factors that led to poor quality care at Mid Staffordshire NHS Trust.²⁵ The *Review into the Quality of Care & Treatment provided by 14 Hospital Trusts in England*, led by Sir Bruce Keogh, similarly pointed to the impact of workforce issues on hospital mortality.²⁶ More specifically there is also evidence on staffing levels and patient outcomes for patients living with cancer.²⁷

Ambitions for the future cancer workforce

The emphasis in the NHS Cancer Transformation Programme on early diagnosis and treatment of cancer was renewed in the LTP, published in January 2019.²⁸ This plan outlined an ambition that by 2028 for every four patients diagnosed with cancer, three will be diagnosed at an early stage. It stated that currently only around half of patients with cancer are diagnosed while the disease is at an early stage. The LTP set out its aims to improve cancer outcomes by improving national screening programmes, giving people faster access to diagnostic tests, and investing in new technologies so that more patients can benefit from highly personalised treatments. Initiatives in the LTP should help to improve early diagnosis rates but will also require the NHS to diagnose and treat more people. However, it will be difficult to achieve these ambitions and improve cancer outcomes without significant increases in staff numbers.

In June 2019, the NHS published the Interim NHS People Plan,²⁹ which focused on the need to transform the workforce through new roles and multidisciplinary work, setting out immediate actions for 2019/2020. Then, in July 2020, the NHS published “We are the NHS: People Plan 2020/21 – action for us all”,³⁰ which set out some further steps to expand the cancer workforce. Commitments included training 450 reporting radiographers, providing training grants for 350 nurses to become cancer nurse specialists and chemotherapy nurses, and

training 400 clinical endoscopists, amongst others. It also set out short-term actions to improve workforce capacity by promoting international recruitment and encouraging former staff to return to practice.

Whilst these are positive steps, further detail is required that extend beyond the short-term. The NHS has said that more details on expanding the workforce in the longer term will be published after the next government spending review, scheduled to take place in Autumn 2020.

The role of HEE and NHS funding

Historically, HEE has played a significant role in workforce development, with responsibilities for providing system-wide leadership and oversight for workforce planning, education and training across England, working alongside system partners including other NHS arm's-length bodies (ALBs), NHS Providers and Royal Colleges. Despite governance changes in the health system, HEE remains responsible for workforce planning, education and training. As part of its strategic workforce planning relating to key cancer professions, HEE's internal modelling estimated in 2018 that to deliver world-class cancer services by 2029, the NHS in England would require an aggregate growth of 45 per cent in its cancer workforce.³¹

In June 2018, the government announced a long-term funding settlement for the NHS, whereby NHS England's annual budget would rise by an extra £20.5 billion by 2023–24.³² This funding increase allowed NHS England a longer planning horizon than most other central government bodies. However, no announcement was made for other health bodies including HEE, despite the latter's vital role in workforce planning and training. In September 2019³³ and March 2020,³⁴ the NHS budget was increased further, and similar increases were also announced for capital investment, public health and staff education and training. But unlike the core NHS funding increases, funding for these areas has not been determined beyond 2020/21.

This project therefore seeks to inform understanding of the increase in the future budget, beyond existing trends, that HEE would require to recruit and train more staff in order to increase the NHS cancer workforce by 45 per cent by 2029. It looks at the costs for three scenarios (see next section) for how such an increase in NHS staff might be achieved. Its findings will be useful in informing the next government spending review by outlining the budget settlement required to promote workforce growth. Although there are interlinkages between HEE and other national and local organisations with respect to workforce planning, training and recruitment, this project only seeks to identify the costs relating to HEE. Note, that the analysis in this report does not take into account commitments made to expand parts of the cancer workforce in the NHS People Plan 2020/21 as these commitments were announced after the analysis was conducted.

Research aims and objectives

The aim of this research was to identify how much additional funding Health Education England (HEE) would need in order to achieve three different growth scenarios in seven key cancer professions by 2029. These seven professions are:

- clinical and medical oncology
- gastroenterology
- histopathology
- clinical radiology
- diagnostic radiography
- therapeutic radiography
- specialist cancer nursing.

The seven professions were identified by HEE in its 2017 Cancer Workforce Plan as being of most significant concern at that time in terms of capacity.³⁵

The key research objectives for the study were to:

- Establish how many NHS staff in England currently work in each of the seven key cancer professions.
- Model how many additional staff would be required in each profession's workforce to achieve 45 per cent growth.
- Understand how much of its budget HEE currently spends on each of the seven cancer professions, including differing routes of entry to the professions such as domestic specialist training places or those rejoining the workforce.
- Estimate how much HEE would have to spend in order to increase the cancer workforce by 45 per cent in 2029 under three different scenarios.

We focused on three different scenarios that alter the inflows to each profession, through specialist training, international recruitment, intra-NHS transfers between professions³⁶ and rejoiners. The scenarios focus on inflows as these are of more direct relevance to HEE than retention programmes, which have been primarily led by NHS Improvement. The three scenarios modelled an increase in staff:

- 1) Solely through increasing training to provide more new staff.
- 2) Through increasing training of new staff and international recruitment only.
- 3) Through increasing training of new staff, international recruitment, intra-NHS staff movement and rejoiners.

Methods

This section provides a summary of the four main methods used in this research by the RAND Europe and University of Cambridge team. We provide fuller details of our methods in Section 1 of the supplementary information document,³⁷ available [online](#).

In summary, we identified the last available data on the seven key cancer workforces as well as HEE's associated budgeting and spending data. Alongside this we undertook expert consultation with key stakeholders to discuss any data identified up to that point and the existence of any additional data, and to validate the overarching assumptions in the economic modelling. We then collated the information gathered in these two stages and used it to develop a demographic stock-flow economic model, where inflows (e.g. through training) appreciate and outflows (e.g. through retirement) depreciate a given workforce stock over time. The purpose of the demographic stock-flow economic model was to project the stock of the workforce up to 2029. Finally, a workshop was undertaken with key stakeholders to validate the data input into the model, the assumptions made and the preliminary output. This was all undertaken with oversight from a small stakeholder advisory group throughout (see below).

Data collection

We collected data on workforce numbers and on the cost to HEE of growing the cancer workforce. In accordance with good ethics practice, any interviewees were fully informed about the study and had the opportunity to consent or to decline to take part. The research team collected and stored data for research activities securely and complied with EU General Data Protection Regulation (GDPR) requirements throughout the study.

Workforce data

We identified the latest available data on workforce numbers for each of the seven key professions. We were interested in both the current number of Full-Time Equivalent (FTE) staff in each profession (stock), as well as the number of FTE staff who join or leave the profession per year (inflows and outflows). The data on the latest number of NHS staff in each profession provided us with baseline stock of staff, which enabled us to establish the baseline for an economic model to estimate how expected trends in inflows and outflows would impact on the overall number by 2029. We identified the necessary data through two methods:

- Desk research using targeted searches to identify additional publicly available data that may be relevant for the economic model.
- Approaching key stakeholders to request relevant data. HEE was able to give us selected workforce data taken from the NHS Electronic Staff Record (ESR).³⁸ In addition, some data were available from other stakeholders such as census information carried out by Macmillan Cancer Support, the Royal College of Radiologists or by the Royal College of Pathologists.

We compared the different data sources to triangulate the data (see Section 2 in the [supplementary information pack](#)) and provide us with assurance on the likely accuracy of our data. We then used the data to populate a demographic stock-flow economic model.

Budgeting and spending data

As with the workforce data, we identified the necessary financial data through two methods:

- Desk research using targeted searches to identify additional publicly available data that may be relevant for the economic model.
- Approaching key stakeholders to request relevant data.

We identified the latest publicly available data on HEE's budget and spending data for each of the seven key professions. We used extensive desk research to identify as much data as possible on HEE's budgets and spending from published and grey literature. These data included HEE's published financial reports, business plans and board minutes, as well as wider online material about particular spending streams and information from other sources such as the Department of Health and Social Care (DHSC) and organisations training specialist students.

We applied the cost information gained from these methods to the demographic stock-flow economic model on workforce numbers. This approach allowed us to estimate how much additional investment HEE would require in three different scenarios to achieve a 45 per cent growth in the cancer workforce by 2029. The funding would need to be front-loaded in order to train sufficient specialist staff by 2029, as the average specialist training for each of the professions varies between three and five years. The model only includes the cost to HEE of specialist training, but not core and foundation training because these stages were outside the scope of the modelling.

The full details of the cost calculation are available in Section 1 of our [supplementary information pack](#). In summary, to estimate the training cost for each newly qualified specialist, we used the tariff prices for training set by DHSC and similar marginal costs of training each person. We adjusted our calculation to reflect the number of individual students who must be trained in order to reach the desired final FTEs of additional staff, factoring in drop-out rates and those working part-time.

We also investigated the cost to HEE of the other types of inflow to the professions: international recruitment, intra-NHS moves and rejoiners. For most of the seven professions HEE does not routinely incur costs associated with these types of inflow, with much of the cost falling to the NHS Trust or organisation employing the individual. The exception was that HEE does have some costs associated with some nurses being recruited internationally or rejoining the NHS. We estimated the costs of nurses recruited through this method where we could; however, these routes are not specific to specialist cancer nurses.

Expert consultation

We undertook targeted semi-structured interviews with specialist representatives from seven organisations relevant to the seven cancer workforce professions within the scope of our review. All the stakeholders that we approached agreed to engage with us, including HEE and various Royal Colleges and Societies. We conducted the interviews by telephone and used our conversations to:

- Discuss the accuracy, robustness and reliability of the data we identified from public sources.
- Identify any further sources of data that would help to inform our economic modelling.
- Validate our proposed assumptions, such as retirement age, for the economic model and discuss adjustments where necessary.

Economic modelling

We developed a demographic stock-flow economic model, building on the stock-flow approach taken by the majority of health workforce planning models, for each of the seven targeted cancer professions.³⁹

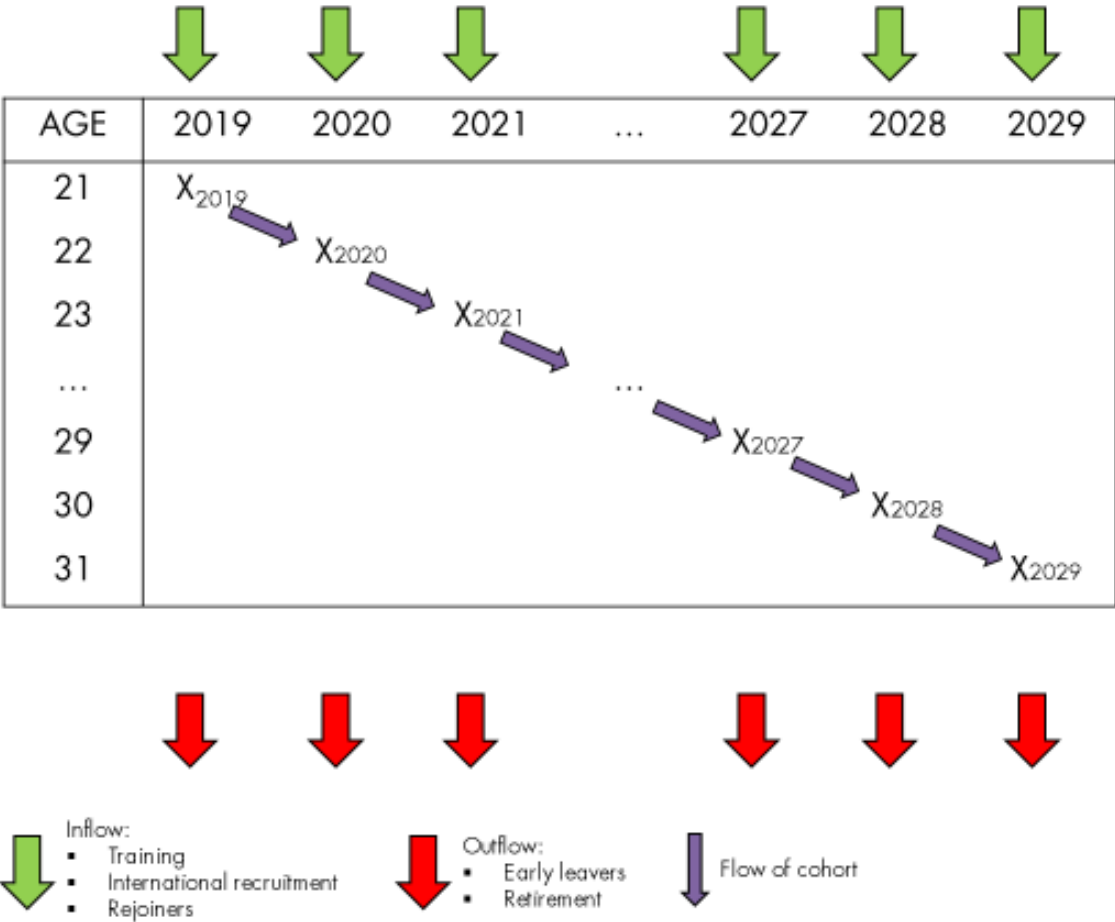
Rather than assuming that the number of FTE staff would remain constant from the baseline year to 2029 without additional investment, we have assumed that the 'status quo' baseline is a continuation each year of the average annual inflows and outflows observed over the most recent three years in each profession. We considered it more realistic to assume a similar growth than to model based on no 'status quo' growth given previous trends, but adopted an increase based on the flow numbers rather than percentage increases as this is more cautious. There are of course limitations in making any status quo growth assumptions, as particular initiatives to recruit more staff and particular circumstances (e.g. the UK's exit from the EU) may have a bearing on projections of future growth.

We considered it was better to use the most recent data for each of the two groups of professions (medical and non-medical) even though they do not cover exactly the same time period. For the medical workforces (clinical and medical oncology, gastroenterology, histopathology and clinical radiology) this was three years prior to 31 March 2018, and for the non-medical workforces (diagnostic radiography, therapeutic radiography and specialist cancer nursing) this was three years prior to 31 March 2019. [Figure](#) provides a more detailed visual representation of the demographic stock-flow model. Within the model each cohort of professionals (defined by age – in the example in [Figure](#) , cohort 'X' is people whose 21st birthday falls in 2019, 22nd birthday in 2020, and so on) is followed from the baseline year (the year with the latest available data) until 2029. A proportion of the cohort exits the workforce at an earlier point in their working life than retirement or due to retirement (outflows), while a proportion of the workforce joins the cohort through training, international recruitment and returning to practice (inflows).

We only include specialist training levels in our model. This is because the total time to train to be a specialist consultant is often about ten years, and thus a new trainee starting medical

training today may not qualify by 2029, the end date for this model. Instead we model based on the time it takes for a doctor to train from being newly qualified to a consultant, which is often approximately five or six years for a medical consultant, and sometimes less for some of the non-medically qualified professions covered in this study. The modelling also accounts for changes in the average number of FTE worked per individual (changes in FTE). Additionally, each cohort exits the model at the assumed latest age of retirement for each key cancer profession, given as 69 years.

Figure 2: Demographic stock-flow economic model



Source: RAND Europe.

The model uses a number of key assumptions. For example, we have assumed that all people over the age of 55 who leave the NHS ESR are retiring and so will not re-enter the workforce at a later date. Equally we model that all people entering the ESR from outside the NHS under the age of 30 are newly qualified staff. We set out all of the assumptions in more detail in Section 1 of the [supplementary information pack](#).

Starting from the growth estimated in the 'status quo' approach described above, we have modelled three different ways of achieving 45 per cent growth by 2029. In all three scenarios we do this by increasing the inflows as this is where HEE is more closely involved. The three scenarios are:

- The necessary additional workforce growth is achieved entirely through increasing newly qualified specialist staff (i.e. training).
- The necessary additional workforce growth is achieved through increasing training and international recruitment, in the same proportion relative to each other as was observed over the past three years.
- The necessary additional workforce growth is achieved through training, increasing international recruitment, intra-NHS moves and people rejoining the NHS, so that each element makes up the same proportion of inflows that were observed over the past three years.

The three scenarios focus on inflows to the cancer workforce (the green arrow in [Figure](#)) as the research was focused on HEE, whose work directly affects these. Outflows from the cancer workforce may be affected by staff retention programmes, which have been primarily led by NHS Improvement. Outflows are assumed to stay at the same rate as seen over the last three years, with retention programmes and other initiatives staying at the same relative level.

After modelling how many FTE of each key cancer profession a net increase of 45 per cent by 2029 would represent, and the means through which they flow into the workforce, we combined this information with the available data on the cost to HEE of training each of the seven types of cancer professionals. This allowed us to estimate how much HEE would have to spend on specialist training places to increase the stock of each cancer workforce in the three different growth scenarios by 2029.

Validation workshop

We invited a range of participants to a half-day workshop facilitated by the RAND Europe team. The purpose of the workshop was to sense check the emerging workforce and finance data, seek any additional data and to test whether the modelling assumptions were reasonable. A total of 13 individuals attended from governmental organisations, relevant Royal Colleges and Societies, and cancer charities, as well as research team members from RAND Europe and the University of Cambridge. Invitees who were not able to attend were asked instead to provide written comments on the information contained in the validation workshop pre-read material and on the notes of the discussion, and several did so. We used the validation workshop outputs and additional comments to refine and complete the workforce modelling and cost scenarios.

Project oversight

In addition to the work already described, we created a stakeholder group comprising Cancer Research UK, Macmillan Cancer Support, HEE, DHSC and NHS England and NHS Improvement. This group provided oversight of the project, as well as a readily accessible group with whom the research team could discuss queries as they arose to reach appropriate solutions. The stakeholder group contributed to an inception meeting and also validated our findings through participation in the wider validation workshop and through commenting on the factual accuracy of an early draft of this report.

Results

In this section we set out:

- Baseline workforce numbers as at 2019 in the seven cancer professions included in this research.
- An overview of HEE's spending and costs.
- Demographic stock-flow modelling of each of the seven professions, covering:
 - Clinical and medical oncology (combined)
 - Gastroenterology
 - Histopathology
 - Clinical radiology
 - Diagnostic radiography
 - Therapeutic radiography
 - Specialist cancer nursing.
- An overall compilation of the modelling results and costs for HEE.

Baseline workforce numbers in the seven cancer professions

Table 2 shows the baseline data identified for each of the seven professions and the year of that baseline. To promote consistency across the economic modelling of the seven professions we used NHS Electronic Staff Record (ESR) data in our model where possible, and we validated the reasonableness of the data through desk research and expert consultation. ESR data capture individual-level information on 99 per cent of NHS staff working in organisations that directly employ NHS staff in the Hospital and Community Health Services (HCHS) sector in England (as well as staff from ALBs, Clinical Commissioning Groups and some from the independent sector).⁴⁰ This means that the modelling used the number of staff, rather than the number of funded places for each profession. The ESR contains information on profession, employing organisation, contracted FTE and some demographic information. We received two separate workforce datasets from the ESR: one for the non-medical workforces (diagnostic radiographers, therapeutic radiographers and adult nurses); and the other for the four medically qualified professions (clinical radiologists, gastroenterologists, histopathologists and clinical and medical oncologists). For a detailed discussion of the ESR data, including its strengths and limitations, please refer to the [supplementary information pack](#).

Table 2: Baseline FTE numbers of NHS staff in each of the seven priority professions

Cancer-related profession	Year of baseline data	FTE of NHS staff in England
Clinical and medical oncology	2018	1,137
Gastroenterology	2018	1,222
Histopathology	2018	1,220
Clinical radiology	2018	2,965
Diagnostic radiography	2019	14,997
Therapeutic radiography	2019	2,844
Specialist cancer nursing (adult)	2017	3,851

Sources: RAND Europe analysis of NHS Electronic Staff Record (all professions except specialist cancer nursing) and Macmillan 2017 Cancer Workforce in England census (for specialist cancer nursing). Note: For all professions except specialist cancer nurses, these baseline data were recorded as at 31 March in the year listed. The baseline for specialist cancer nurses is taken from the Macmillan cancer workforce census which described the workforce on 9 October 2017.

Overview of HEE’s spending

HEE’s publicly available information includes annual data on spending on the future workforce, as well as projections. These data are broken down by region and by category: non-medical, undergraduate, postgraduate and other. However, they are not broken down by profession, so we were not able obtain data specific to the seven cancer professions in this way. Nevertheless HEE’s Annual Reports and Accounts provide an overview of HEE’s spending and trends (see [Table 3](#)).⁴¹

Table 3: Breakdown of HEE's spending, 2016–17 to 2018–19

Type of expenditure	2016–17 (£ m)	2017–18 (£ m)	2018–19 (£ m)
HEE staff costs	151	158	143
Education and training	4,527	4,404	4,023
Of which:			
Undergraduate medical and dental training	892	883	894
Postgraduate medical and dental training	1,846	1,868	1,896
Non-medical staff training ⁽¹⁾	1,788	1,654	1,233
Other operating expenditure	390	352	404
TOTAL	5,069	4,914	4,570

Source: Health Education England Annual Report and Accounts 2017–18 and 2018–19.

Note (1): HEE support for students commencing nursing programmes ceased in September 2017. The reduction in HEE expenditure in this area between 2017–18 and 2018–19 can be seen under the 'non-medical' heading.

This table shows that HEE's budget decreased slightly overall between 2016–17 and 2018–19. The decrease can be explained by the loss of HEE support for students commencing nursing programmes via a nursing bursary in September 2017. In other lines of future medical workforce spending, there have been modest increases of approximately 1 per cent to the postgraduate medical training budgets each year.

Newly qualified training tariffs

The DHSC publishes tariffs each year for the amount to be paid by HEE to training providers for education and training placements for specialist training. A Market Forces Factor (MFF) is then applied to these tariff payments. The MFF is a multiplier for the basic tariff payment which varies based on geographical location.⁴² This approach allows funding to take into account an estimate of unavoidable cost differences between healthcare providers. The latest guidance for the 2019–20 tariff shows:

- A non-medical placement costing £3,270 + MFF
- A medical undergraduate placement costing £33,286 + MFF
- A medical postgraduate costing £11,418 + MFF
- A study leave budget of £734 per student and a contribution to basic salary costs.⁴³

We then adjusted these costs to allow for drop-out rates and people who work part-time (i.e. the need to train more than one person to achieve one FTE). The above information is sufficient to model the cost of increasing the workforce for each of the seven professions by training of new staff (see next section for detailed results).

HEE costs of other inflows to cancer professions

We found that attracting rejoiners, recruiting from overseas or improving retention rates seldom incurs a cost to HEE. This is because these costs fall to others within the health sector, often to the NHS Trust who is or will be employing the professional in question. For example, in international recruitment, the National Audit Office reported in 2020 that the estimated average cost to recruit a nurse from overseas is £12,000,⁴⁴ but it is NHS providers who are responsible for the recruitment, with HEE providing support for the overseas recruitment strategy and planning through its regional teams.

However, for nursing, we found some costs are met by HEE. For rejoiners, HEE pays about £2,600 per rejoiner, although many of the nurses recruited through this scheme will not be specialist cancer nurses. This comprises:

- a £500 stipendiary (one-off payment)
- a £1000 recruitment fee per rejoiner
- a £1,100 contribution to placement costs.

HEE also contributes to international recruitment of nurses who join under the Global Learners Programme, by paying the fixed central administrative and educational costs. However, we were unable to obtain a figure for these costs, and the unit costs of recruitment are borne by the recruiting trust. This year HEE also planned to launch a partnership with other organisations to bring overseas clinical radiologists to the UK, but we do not know the cost to HEE of this programme.

Demographic stock-flow modelling by workforce to 2029, including cost estimates

The results of the economic modelling are presented in the sections below, for each of the seven professions in turn. These data show what the growth of the workforce might be, if projected forward from trends in the three previous years using the demographic stock-flow economic model – i.e. no change other than the continuation of existing trends. The existing trend was identified using the average of three years' of data for each inflow and outflow. The growth of the workforce is compared to the reference year 2019, highlighted by the vertical line in the figures and green cells in the tables. All costs are expressed in 2019/20 prices and assume that the real cost of training per trainee does not change over time.

Economic modelling by profession

Clinical and medical oncology

Context

Clinical oncologists use radiotherapy and systemic therapies, such as chemotherapy, to treat and manage patients with cancer.⁴⁵ Medical oncologists diagnose, assess, treat and manage patients with cancer, and conduct research that has practical applications.⁴⁶ Clinical and medical oncology are complementary disciplines, with some overlap in their respective roles.⁴⁷ Issues with occupational coding mean it is not possible to distinguish between clinical and medical oncologists in the ESR data, meaning they are modelled simultaneously.⁴⁸

Once medical students have completed their two-year foundation training and a further two years of core medical training, they can specialise in clinical oncology, which usually takes a further five years,⁴⁹ or more for part-time students. Specialising in medical oncology takes a minimum of four years⁵⁰; however, most trainee medical oncologists will also undertake some form of applicable research alongside their training and therefore take longer than the minimum four years.⁵¹ Our modelling begins at specialty trainee level 3 (ST3), where both specialty training routes begin.⁵² The first round fill rate for clinical oncologists was 100 per cent in 2019.⁵³ The latest data we have on fill rates for medical oncologists is from 2016, when 82 per cent of places were filled in round 1.⁵⁴

Historic workforce stock and flows

On 31 March 2018 there were 1,137 FTE consultant clinical and medical oncologists working in the NHS in England. Over the three years prior, the following average **annual** FTE flows are observed:

- Inflows:
 - Newly qualified from specialist training: 61 (53 per cent of inflows)
 - Intra-NHS⁵⁵: 19 (16 per cent of inflows)
 - Rejoiners and international recruitment: 36 (31 per cent of inflows)
- Outflows:
 - Early leaver: -42 (70 per cent of outflows)
 - Retirement: -18 (30 per cent of outflows)

Overall, there is an average annual total of 116 FTE inflows to the workforce and -60 FTE outflows from the workforce, with a net average annual inflow of 56 FTE.

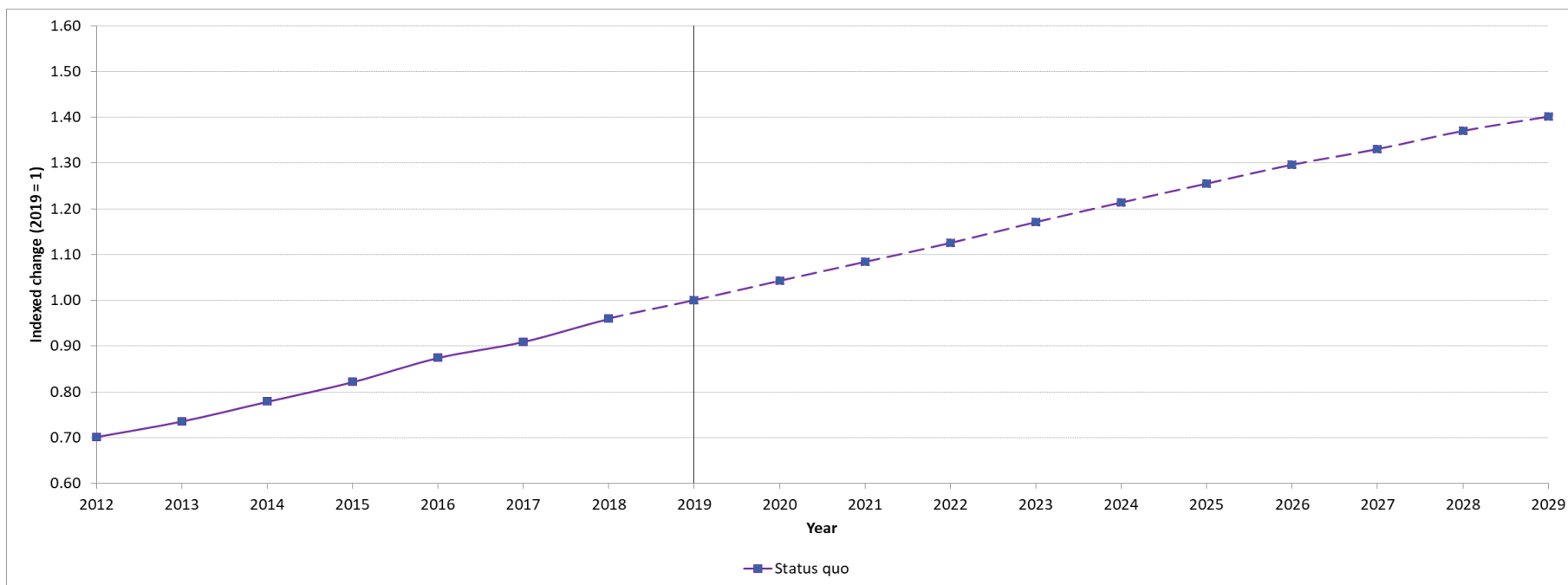
The validation workshop highlighted the following key points:

- Many countries internationally do not have an equivalent clinical oncologist role, meaning that international recruitment is not a major inflow for the profession.⁵⁶ This suggests that most of the international recruitment for this profession is related to medical oncology.
- Approximately 5 per cent of the workforce are locums.
- For clinical and medical oncology, the number of rejoiners is relatively low.

Projected status quo change

[Figure 3](#) shows the projected status quo growth of clinical and medical oncologists from 2018 to 2029 (dashed line), assuming a continuation of inflow and outflow trends over the past three years (i.e. in the results achieved from HEE's current activity level) and applying those 'flow' trends to the known 'stock', including age and FTE characteristics, of the current population of oncologists at that time. This approach is not the same as a simple linear extrapolation of increases since the model builds in stock characteristics such as, for example, if a high proportion of the population are nearing retirement. Using 2019 as the reference year, the demographic stock-flow economic model projects a 40 per cent increase in FTE, a growth of 477 FTE from 1,185 in 2019 to 1,662 in 2029, as outlined in [Table 4](#). This is in line with the historic growth in the workforce, as shown by the solid line in [Figure 3](#).

Figure 3: Historic and projected status quo changes in the clinical and medical oncology workforce, indexed to 2019



Source: RAND Europe. Note: For the medically qualified workforces (clinical radiologists, gastroenterologists, histopathologists and clinical and medical oncologists), values up to and including 2018 are historic (solid line) and values from 2019 onwards are outputs of the modelling (dashed line). This reflects the latest available data at the time of modelling.

Table 4: Historic and status quo changes in the clinical and medical oncology workforce

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total FTE	832	872	923	974	1037	1078	1137	1185	1236	1284	1334	1388	1439	1488	1537	1577	1625	1662
Indexed change	0.70	0.74	0.78	0.82	0.87	0.91	0.96	1.00	1.04	1.08	1.13	1.17	1.21	1.26	1.30	1.33	1.37	1.40

Source: RAND Europe. Note: Indexed change from reference year.

Scenario growth and costing

We calculate that to achieve 45 per cent growth in the clinical and medical oncology workforce by 2029, an additional 57 FTE are required, as the status quo increase is projected to be already at 40 per cent.

Table 5 outlines the required FTE increase to achieve the 45 per cent growth target in each of the three scenarios. The required inflow and cost to HEE of each scenario is as follows:

- Scenario 1: an additional 57 Newly Qualified Trainee (NQT) FTEs are required to achieve the necessary growth. An NQT is a doctor who has just completed specialist training. As clinical and medical oncologists work at an average of 0.92 FTE per individual,⁵⁷ and assuming an average training drop-out rate of 10 per cent, this means an additional 68 individuals need to be trained by 2029, at a total additional cost of £12.6m to HEE over the ten years.
- Scenario 2: an additional 36 NQT and 21 rejoiner and international FTE are required. Applying the average FTE per individual of 0.92, and assuming an average training drop-out rate of 10 per cent, this means an additional 43 individuals need to be trained, at an NQT cost to HEE of £8.0m over the ten years.
- Scenario 3: an additional 30 NQT, 9 intra-NHS and 18 rejoiner and international FTE are required. Applying the average FTE per individual of 0.92, and assuming an average training drop-out rate of 10 per cent, this means an additional 36 individuals need to be trained, at an NQT cost to HEE of £6.7m over the ten years.

As stated in the methods section above, since HEE pays costs associated with specialist training we can estimate the cost to HEE of training each additional person by using the standard tariff rates set by DHSC and then adjusted for other factors such as the market forces factor, the average FTE worked per individual, and the need to train more people than positions required to allow for drop-out rates.

Scenarios 2 and 3 include other entry routes which create costs elsewhere in the health system. Such costs tend mainly to fall to the Trust or NHS body employing the individual as Continuing Professional Development (CPD) and international recruitment costs are their responsibility. Our understanding is that no costs arise to HEE from these entry routes, so this does not affect the total estimated cost to HEE. However, when interpreting the overall costs of different scenarios, it must be remembered that this represents the cost to HEE only, not the total cost to the health sector.

Table 5: Scenario growth of the clinical and medical oncology workforce

Scenario	Total required FTE increase (numbers)			Total estimated cost to HEE
	Newly qualified (specialist) training (NQT)	Intra-NHS	Rejoiners and international recruitment	
Scenario 1	57	-	-	£12,638,325
Scenario 2	36	-	21	£7,991,882
Scenario 3	30	9	18	£6,690,878

Source: RAND Europe.

Gastroenterology

Context

Gastroenterologists investigate, diagnose, treat and work to prevent all gastrointestinal (intestines and stomach) and hepatological (biliary tree, gallbladder, liver and pancreas) diseases.⁵⁸ Once medical students have completed their two-year foundation training and a further two years of core medical training they can specialise in gastroenterology, which begins at specialty trainee level 3 (ST3) and takes at least five years to complete.⁵⁹ Our modelling begins at this level. Specialist gastroenterology training places have a fill rate of 100 per cent nationally.⁶⁰

Historic workforce stock and flows

On 31 March 2018 there were 1,222 FTE consultant gastroenterologists working in the NHS in England. Over the three years prior, the following average **annual** FTE flows are observed:

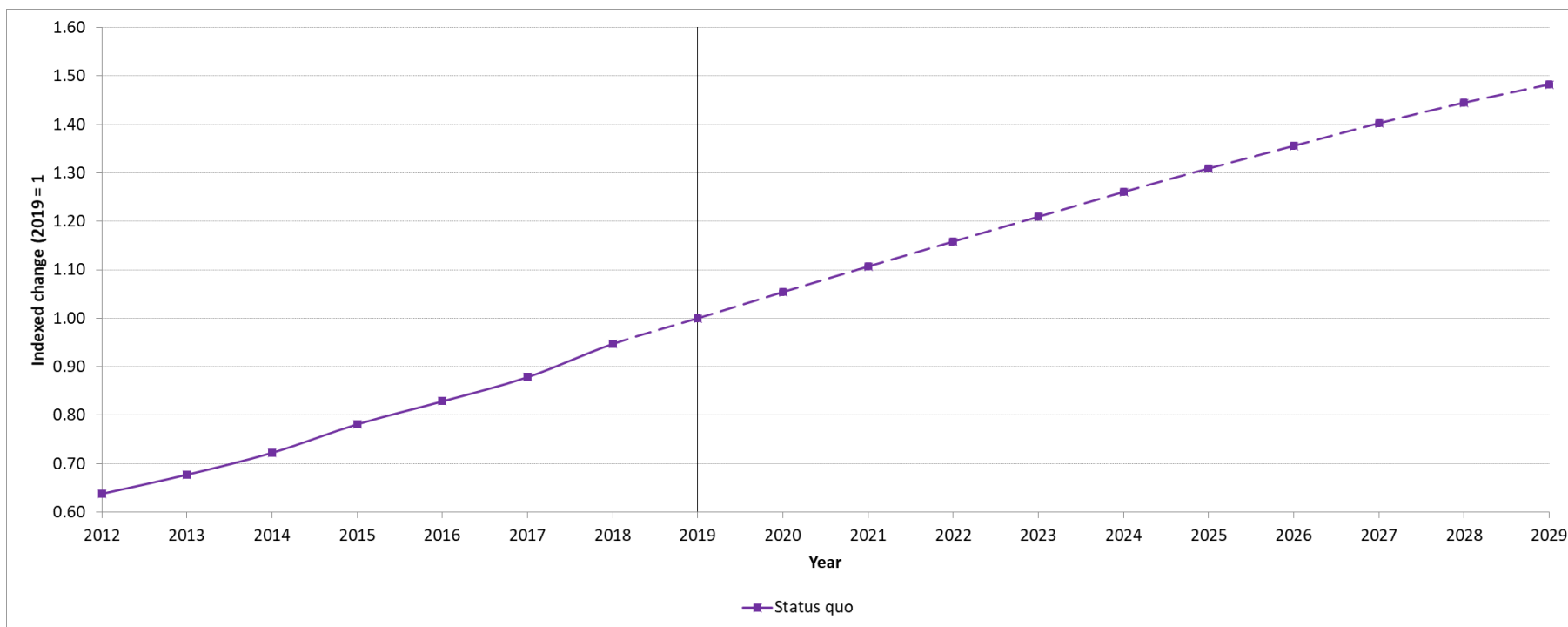
- Inflows:
 - Newly qualified from specialist training: 72 (66 per cent of inflows)
 - Intra-NHS: 5 (4 per cent of inflows)
 - Rejoiners and international recruitment: 32 (29 per cent of inflows)
- Outflows:
 - Early leaver: -24 (61 per cent of outflows)
 - Retirement: -15 (39 per cent of outflows)

Overall, there is an average annual total of 109 FTE inflows to the workforce and -39 FTE outflows from the workforce, with a net average annual inflow of 70 FTE.

Projected status quo increase

Figure 2 shows the projected status quo growth of gastroenterologists from 2018 to 2029 (dashed line), assuming a continuation of inflow and outflow trends over the past three years (i.e. without any change by HEE in its current activity level). Using 2019 as the reference year, the demographic stock-flow economic model projects a 48 per cent increase in FTE, a growth of 623 FTE from 1,290 in 2019 to 1,913 in 2029, as outlined in Table 6. This is in line with the historic growth in the workforce, as shown by the solid line in Figure 2 .

Figure 2 : Historic and status quo changes in the gastroenterology workforce, indexed to 2019



Source: RAND Europe. Note: For the medically qualified workforces (clinical radiologists, gastroenterologists, histopathologists and clinical and medical oncologists), values up to and including 2018 are historic (solid line) and values from 2019 onwards are outputs of the modelling (dashed line). This reflects the latest available data at the time of modelling.

Table 6: Historic and status quo changes in the gastroenterology workforce

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total FTE	823	874	932	1008	1069	1133	1222	1290	1359	1428	1494	1560	1626	1689	1748	1809	1863	1913
Indexed change	0.64	0.68	0.72	0.78	0.83	0.88	0.95	1.00	1.05	1.11	1.16	1.21	1.26	1.31	1.36	1.40	1.44	1.48

Source: RAND Europe. Note: Indexed change from reference year.

Scenario growth and costing

The status quo increase of the gastroenterology workforce is 48 per cent from 2019 to 2029, which is greater than the 45 per cent growth scenario target, meaning that growth scenarios were not undertaken for this workforce, although of course to achieve status quo growth, HEE will still need to invest money in continuing its training of this workforce.

Histopathology

Context

Histopathologists are responsible for diagnosing and studying disease in tissues and organs through the examination of samples of tissue.⁶¹ Histopathologists determine the cause of death by undertaking autopsies and are integral to the management of patients with cancer, through the staging and grading of tumours.⁶² There are important areas of growth in histopathology – one is the increasing use of digital pathology, which includes the acquisition, management, sharing and interpretation of pathology information in a digital format. Artificial intelligence (AI) also plays an increasing role, carrying out repetitive tasks and sifting through data to find common features and to make conclusions based on statistical probability although it is anticipated to augment the role of a histopathologist rather than replace it. Both of these changes may affect the size and nature of the histopathologist workforce in the longer term

Training in histopathology is separated into four stages and takes at least five years to complete when in training full time.⁶³ In the validation workshop we heard that there may often be seven years between starting and completing training. Training for histopathology is a run-through course⁶⁴ which begins as speciality trainee level 1 (ST1).⁶⁵ In 2019 there was a training place fill rate of 100 per cent in the first round of recruitment for that year; however, in 2018 this was only 47 per cent in the first round.⁶⁶

Historic workforce stock and flows

On 31 March 2018 there were 1,220 FTE histopathologists working in the NHS in England.

Over the three years prior, the following average **annual** FTE flows are observed:

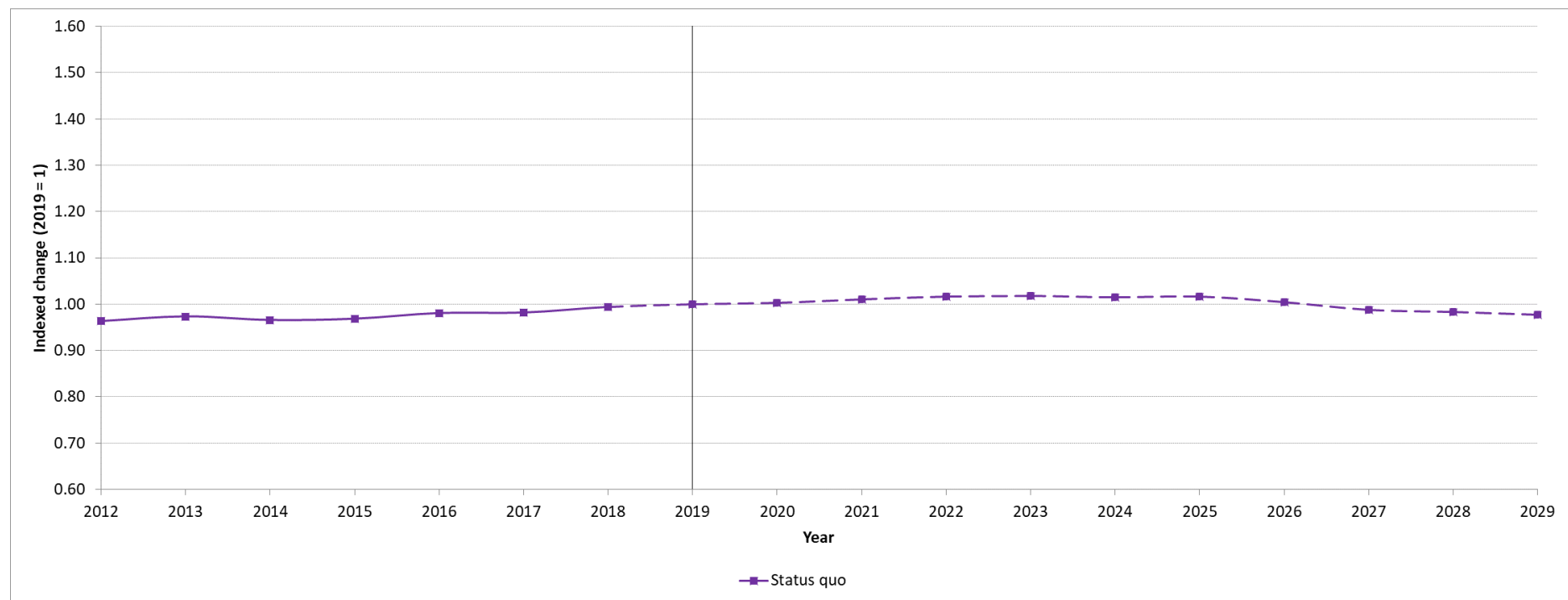
- Inflows:
 - Newly qualified training: 46 (54 per cent of inflows)
 - Intra-NHS: 9 (11 per cent of inflows)
 - Rejoiners and international recruitment: 31 (36 per cent of inflows)
- Outflows:
 - Early leaver: -34 (49 per cent of outflows)
 - Retirement: -35 (51 per cent of outflows)

Overall, there is an average annual total of 86 FTE inflows to the workforce and -69 FTE outflows from the workforce, with a net average annual inflow of 17 FTE.

Projected status quo change in workforce

Figure 3 shows the projected status quo growth of histopathologists from 2018 to 2029 (dashed line), assuming a continuation of inflow and outflow trends over the past three years (i.e. in the results achieved from HEE's current activity level) and applying those 'flow' trends to the known 'stock', including age and FTE characteristics of histopathologists. Using 2019 as the reference year, the demographic stock-flow economic model projects a 2 per cent decrease in FTE, a decline of 27 FTE from 1,228 in 2019 to 1,201 in 2029, as outlined in Table 7. This is initially in line with the historic growth in the workforce, as shown by the solid line in Figure 3, until 2026 when the stock of the workforce begins to consistently decline as a result of an ageing workforce and outflows becoming greater than inflows.

Figure 3: Historic and status quo changes in the histopathology workforce, indexed to 2019



Source: RAND Europe. NOTE: For the medically qualified workforces (clinical radiologists, gastroenterologists, histopathologists and clinical and medical oncologists), values up to and including 2018 are historic (solid line) and values from 2019 onwards are outputs of the modelling (dashed line). This reflects the latest available data at the time of modelling.

Table 7: Historic and status quo changes in the histopathology workforce

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total FTE	1182	1195	1185	1189	1204	1205	1220	1228	1232	1241	1247	1249	1245	1248	1233	1213	1207	1201
Indexed change	0.96	0.97	0.97	0.97	0.98	0.98	0.99	1.00	1.00	1.01	1.02	1.02	1.01	1.02	1.00	0.99	0.98	0.98

Source: RAND Europe. Note: Indexed change from reference year.

Scenario growth and costing

To achieve 45 per cent growth in the histopathology workforce by 2029 an additional 580 FTE are required, as the status quo change projects a 2 per cent decrease in the size of the workforce.

Table 8 outlines the required FTE increase to achieve the 45 per cent growth target in each of the three scenarios. The required inflows and cost of each scenario to HEE is as follows:

- Scenario 1: an additional 580 NQT FTEs are required to achieve the necessary growth. Histopathology-specific data on average FTE could not be identified, however NHS consultants work at an overall average of 0.94 FTE per individual in 2018 (the year the baseline data corresponds to), which was used as a proxy for histopathologists.⁶⁷ Assuming a 10 per cent training drop-out rate, this means an additional 677 individuals need to be trained by 2029, at a total additional cost of £117.5m to HEE over the ten years.
- Scenario 2: an additional 349 NQT and 231 rejoiner and international FTE are required. Applying the average FTE per individual of 0.94, and assuming an average training drop-out rate of 10 per cent, this means an additional 407 individuals need to be trained, at an NQT cost to HEE of £70.6m over the ten years.
- Scenario 3: an additional 310 NQT, 63 intra-NHS and 206 rejoiner and international FTE are required. Applying the average FTE per individual of 0.94, and assuming an average training drop-out rate of 10 per cent, this means an additional 363 individuals need to be trained, at an NQT cost to HEE of £63m over the ten years.

As stated in the methods section above, since HEE pays costs associated with specialist training we can estimate the cost to HEE of training each additional person by using the standard tariff rates set by DHSC and then adjusted for other factors such as the market forces factor, the average FTE worked per individual, and the need to train more people than positions required to allow for drop-out rates.

Scenarios 2 and 3 include other entry routes which create costs elsewhere in the health system. Such costs tend mainly to fall to the Trust or NHS body employing the individual as CPD and international recruitment costs are their responsibility. Our understanding is that no costs arise to HEE from these entry routes so this does not affect the total estimated cost to HEE. However, when interpreting the overall costs of different scenarios, it must be remembered that this represents the cost to HEE only, not to the total cost to the health sector.

Table 8: Scenario growth of the histopathology workforce

Scenario	Total FTE increase			Total cost to HEE
	Newly qualified (specialist) training (NQT)	Intra-NHS	Rejoiners and international recruitment	
Scenario 1	580	-	-	£117,453,896
Scenario 2	349	-	231	£70,611,131
Scenario 3	310	63	207	£62,977,495

Source: RAND Europe.

Clinical radiology

Context

Clinical radiologists use images to diagnose, treat and manage medical conditions and diseases. Clinical radiologists work closely with radiographers and collaborate with a wide range of other health professionals. They are responsible for reporting most imaging procedures used in diagnosing medical conditions and will perform many interventional procedures, such as minimally invasive surgery.⁶⁸

Training in clinical radiology takes around five years to complete when in full-time training and, like histopathology, is a run through course which begins at ST1.⁶⁹ Our modelling begins at this stage. When trainees studying part-time are included, training can take about six years to complete. In 2019 there was a training place fill rate of over 99 per cent in the first round of recruitment for that year, and in 2018 this was 100 per cent.⁷⁰ The final fill rate has been 100 per cent for several years.

There is currently a Global Radiologists Programme for clinical radiologists, offered by a partnership of four organisations, including HEE and the Royal College of Radiologists. The purpose is to attract and recruit experienced clinical radiologists from other countries to come and work for three years in a suitable NHS trust in England on an earn, learn, return basis. We do not have further information on the numbers recruited through this scheme or the costs to HEE of taking part.⁷¹

Historic workforce stock and flows

On 31 March 2018 there were 2,965 FTE consultant clinical radiologists working in the NHS in England. Over the three years prior, the following average **annual** FTE flows are observed:

- Inflows:
 - Newly qualified from specialist training: 133 (54 per cent of inflows)
 - Intra-NHS: 2 (1 per cent of inflows)
 - Rejoiners and international recruitment: 112 (45 per cent of inflows)
- Outflows:
 - Early leaver: -57 (53 per cent of outflows)
 - Retirement: -51 (47 per cent of outflows)

Overall, there is an average annual total of 247 FTE inflows to the workforce and -108 FTE outflows from the workforce, with a net average annual inflow of 139 FTE. Just under half (45 per cent) of inflows come from those rejoining the workforce or entering through international recruitment, of which a considerable number come from South Africa, India and Pakistan.⁷²

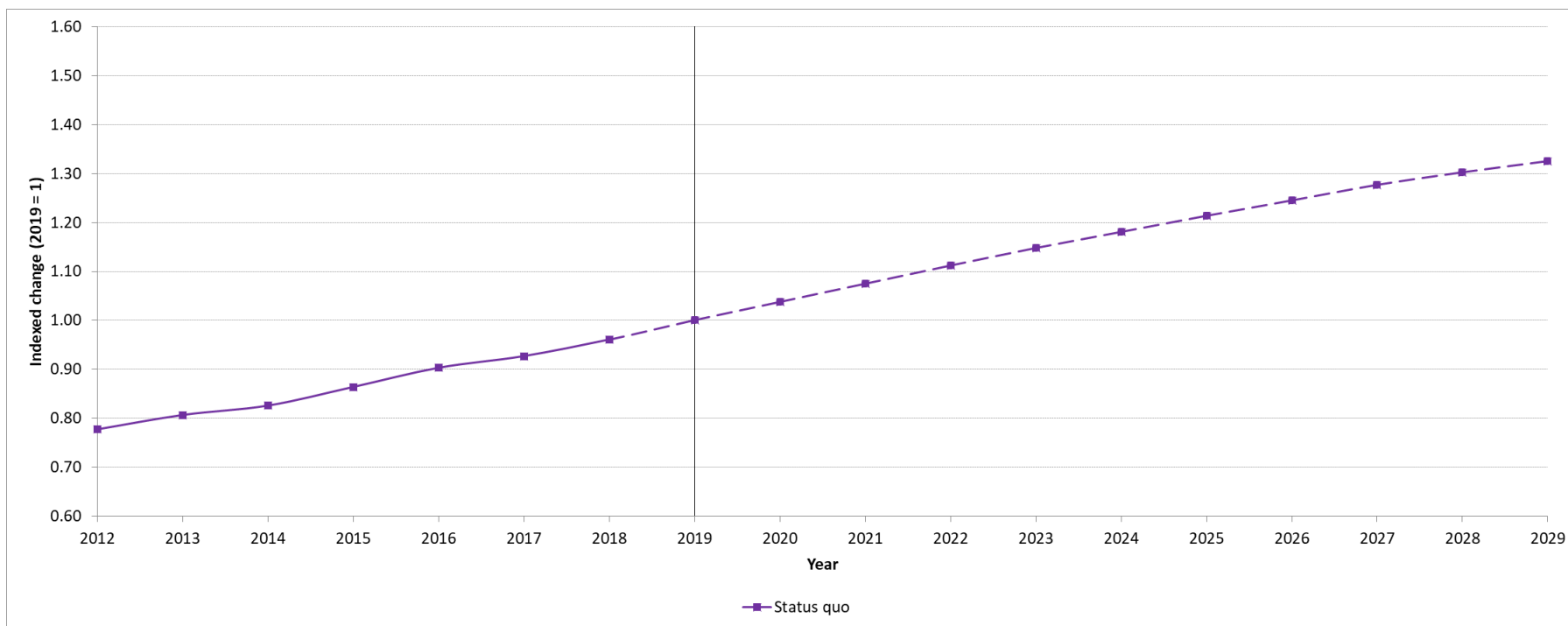
Insights from the validation workshop

- For clinical radiology, approximately 6 per cent of the workforce are locums.
- For radiologists, recruiting abroad is common compared with some of the other professions in this study.
- The number of rejoiners is relatively low for clinical radiologists.

Projected status quo change

Figure 4 shows the projected status quo growth of clinical radiologists from 2018 to 2029 (dashed line), assuming a continuation of inflow and outflow trends over the past three years (i.e. in the results achieved from HEE's current activity level) and applying those 'flow' trends to the known 'stock' of clinical radiologists, including age and FTE characteristics. Using 2019 as the reference year, the demographic stock-flow economic model projects a 33 per cent increase in FTE, a growth of 1,004 FTE from 3,087 in 2019 to 4,091 in 2029, as outlined in Table 9. This is in line with the historic growth in the workforce, as shown by the solid line in Figure 4.

Figure 4: Historic and status quo changes in the clinical radiology workforce, indexed to 2019



Source: RAND Europe. NOTE: For the medically qualified workforces (clinical radiologists, gastroenterologists, histopathologists and clinical and medical oncologists), values up to and including 2018 are historic (solid line) and values from 2019 onwards are outputs of the modelling (dashed line). This reflects the latest available data at the time of modelling.

Table 9: Historic and status quo changes in the clinical radiology workforce

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total FTE	2398	2489	2548	2666	2787	2860	2965	3087	3205	3319	3433	3543	3644	3747	3842	3940	4019	4091
Indexed change	0.78	0.81	0.83	0.86	0.90	0.93	0.96	1.00	1.04	1.08	1.11	1.15	1.18	1.21	1.24	1.28	1.30	1.33

Source: RAND Europe. Note: Indexed change from reference year.

Scenario growth and costing

We calculate that to achieve 45 per cent growth in the clinical radiology workforce by 2029 an additional 384 FTE are required, as the status quo increase is projected to be a 33 per cent increase in the size of the workforce. [Table 10](#) outlines the required FTE increase to achieve the 45 per cent growth target in each of the three scenarios. The required inflow and NQT cost of each scenario is as follows:

- Scenario 1: an additional 384 newly qualified trainee (NQT) FTEs are required to achieve the necessary growth. As clinical radiologists work at an average of 0.92 FTE per individual,⁷³ and assuming an average training drop-out rate of 10 per cent, this means an additional 459 individuals need to be trained by 2029, at a total additional cost of £79.6m to HEE over the ten years.
- Scenario 2: an additional 208 NQT and 176 rejoiner and international FTE are required. Applying the average FTE per individual of 0.92, and assuming an average training drop-out rate of 10 per cent, this means an additional 249 individuals need to be trained, at an NQT cost to HEE of £43.2m over the ten years.
- Scenario 3: an additional 207 NQT, 3 intra-NHS and 174 rejoiner and international FTE are required. Applying the average FTE per individual of 0.92, and assuming an average training drop-out rate of 10 per cent, this means an additional 247 individuals need to be trained, at an NQT cost to HEE of £42.9m over the ten years.

Table 10: Scenario growth of the clinical radiology workforce

Scenario	Total FTE increase			Total known cost to HEE
	Newly qualified (specialist) training	Intra-NHS	Rejoiners and international recruitment	
Scenario 1	384	-	-	£79,632,700
Scenario 2	208	-	176	£43,199,439
Scenario 3	207	3	174	£42,852,455

Source: RAND Europe. Note: Total known cost to HEE does not include any financial contribution made by HEE to the Global Radiologists Programme as we do not have any information on this.

As stated in the methods section of the report, since HEE pays costs associated with specialist training, we can estimate the cost to HEE of training each additional person by using the standard tariff rates set by DHSC and then adjusted for other factors such as the market forces factor, the average FTE worked per individual, and the need to train more people than positions required to allow for drop-out rates.

Scenarios 2 and 3 include other entry routes which create costs elsewhere in the health system. Such costs tend mainly to fall to the Trust or NHS body employing the individual as CPD and international recruitment costs are their responsibility. We believe in this case there may also be some additional cost to HEE of participating in the Global Radiologists Programme but we do not have this information. When interpreting the overall costs of different scenarios, it must be remembered that the cost stated above represents the cost to HEE of specialist training only, not to the total cost to the health sector.

Diagnostic Radiography

Context

Diagnostic radiographers use the latest technology in clinical imaging to screen, diagnose and undertake ongoing surveillance of patients, such as cancer patients after treatment.⁷⁴ They use a range of imaging technology and techniques such as x-ray, fluoroscopy and ultrasound.⁷⁵

Traditionally, training in diagnostic radiography is provided in a three-year full-time undergraduate degree, which can also be completed part-time in around six years.⁷⁶ Those with a relevant undergraduate degree can undertake a postgraduate programme in diagnostic radiography, although it can be hard for individuals to acquire funding for such courses and, as a result, not many newly qualified trainees take this route.⁷⁷

Historic workforce stock and flows

On 31 March 2019 there were 14,997 FTE diagnostic radiographers working in the NHS in England. Over the three years prior, the following average **annual** FTE flows are observed:

- Inflows:
 - Newly qualified training: 880 (50 per cent of inflows)
 - Intra-NHS: 318 (18 per cent of inflows)
 - Rejoiners: 375 (21 per cent of inflows)
 - International recruitment: 181 (10 per cent of inflows)
- Outflows:
 - Early leaver: -919 (82 per cent of outflows)
 - Retirement: -208 (18 per cent of outflows)

Overall, there is an average annual total of 1,754 FTE inflows to the workforce and -1,127 FTE outflows from the workforce, with a net average annual inflow of 627 FTE.

Other relevant information

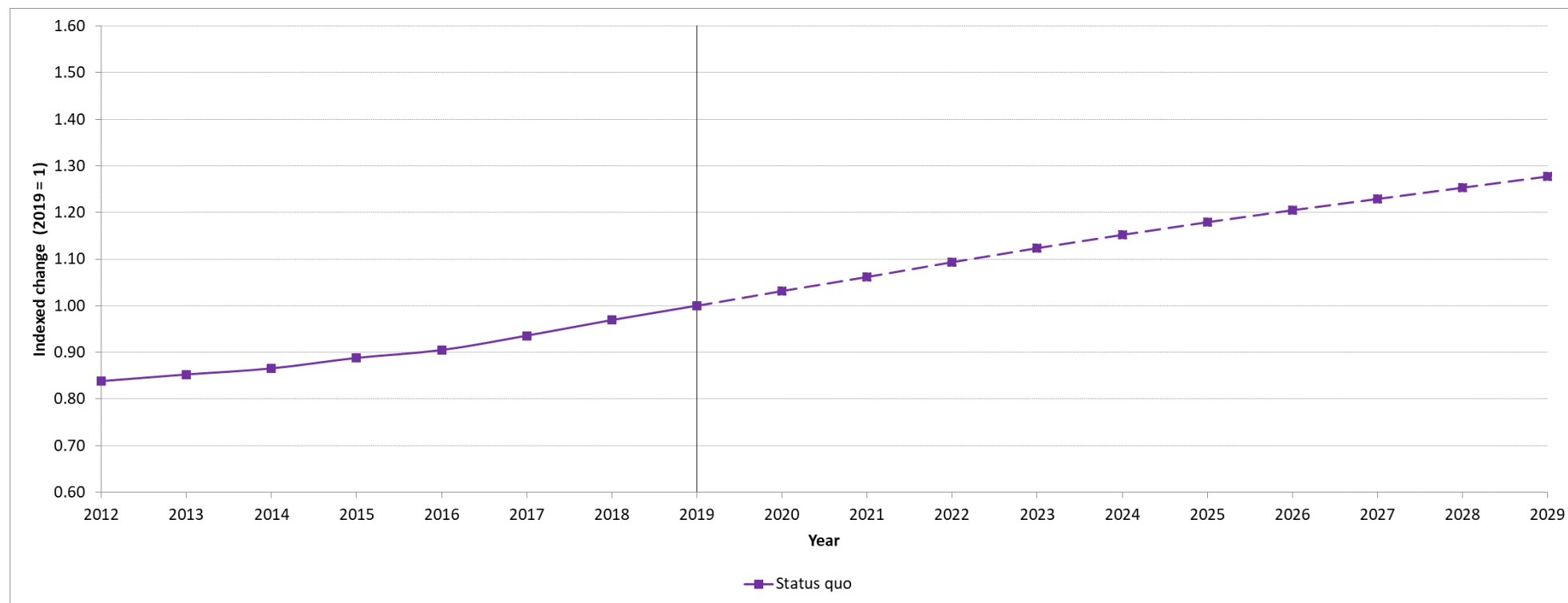
The Interim NHS People Plan, published in June 2019,⁷⁸ stated that over the following five years, more clinical degree-level apprenticeships would be introduced, including for therapeutic and diagnostic radiographers. Furthermore, in July 2020, the NHS published the NHS People Plan 2020/2021,⁷⁹ which made a commitment to training 450 reporting radiographers.

We were not able to build these commitments into our model for diagnostic radiographers because the data were not available at the time of conducting the modelling.

Projected status quo change

[Figure 5](#) shows the projected status quo increase in diagnostic radiographers from 2019 to 2029 (dashed line), assuming a continuation of inflow and outflow trends over the past three years (i.e. in the results achieved from HEE's current activity level) and applying those 'flow' trends to the known 'stock' of diagnostic radiographers. Using 2019 as the reference year, the demographic stock-flow economic model projects a 28 per cent increase in FTE, a growth of 4,158 FTE from 14,997 in 2019 to 19,155 in 2029, as outlined in [Table 11](#). This is in line with the historic growth in the workforce, as shown by the solid line in [Figure 5](#).

Figure 5: Historic and status quo changes in the diagnostic radiography workforce, indexed to 2019



Source: RAND Europe. Note: For diagnostic radiographers and therapeutic radiographers, values up to and including 2019 are historic (solid line) on the graph, and values from 2020 onwards are estimates from the modelling (dashed line).

Table 11: Historic and status quo changes in the diagnostic radiography workforce

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total FTE	12570	12783	12979	13317	13570	14032	14535	14997	15463	15930	16393	16843	17276	17682	18064	18436	18801	19155
Indexed change	0.84	0.85	0.87	0.89	0.90	0.94	0.97	1.00	1.03	1.06	1.09	1.12	1.15	1.18	1.20	1.23	1.25	1.28

Source: RAND Europe. Note: Indexed change from reference year.

Scenario growth and costing

We estimate that to achieve 45 per cent growth in the diagnostic radiography workforce by 2029 an additional 2591 FTE are required, as the status quo projects a 28 per cent increase in the size of the workforce. [Table 12](#) outlines the required FTE increase to achieve the 45 per cent growth target in each of the three scenarios. The required inflow cost to HEE of each scenario is as follows:

- Scenario 1: an additional 2,591 NQT FTEs are required to achieve the necessary growth. Diagnostic radiography-specific data on average FTE could not be identified, however therapeutic radiographers work on average 0.92 FTE per individual, which was used as a proxy for diagnostic radiographers.⁸⁰ Assuming an average drop-out rate of 10 per cent, this means an additional 3,103 individuals need to be trained by 2029, at a total additional cost of £32.8m to HEE over the ten years.
- Scenario 2: an additional 2,149 NQT and 442 international recruitment FTE are required. Applying the average FTE per individual of 0.92, and assuming an average drop-out rate of 10 per cent, this means an additional 2,574 individuals need to be trained, at an NQT cost to HEE of £27.2m over the ten years.
- Scenario 3: an additional 1,300 NQT, 470 intra-NHS, 554 rejoiner and 267 international FTE are required. Applying the average FTE per individual of 0.92, and assuming an average drop-out rate of 10 per cent, this means an additional 1,557 individuals need to be trained, at an NQT cost to HEE of £16.5m over the ten years.

Table 12: Scenario growth of the diagnostic radiography workforce

Scenario	Total FTE increase				Total known cost to HEE
	Newly qualified (specialist) training	Intra-NHS	Rejoiner	International recruitment	
Scenario 1	2591	-	-	-	£32,822,089
Scenario 2	2149	-	-	442	£27,226,574
Scenario 3	1300	470	554	267	£16,469,221

Source: RAND Europe.

As stated in the methods section of the report, since HEE pays costs associated with specialist training, we can estimate the cost to HEE of training each additional person by using the standard tariff rates set by DHSC and then adjusted for other factors such as the market forces factor, the average FTE worked per individual, and the need to train more people than positions required to allow for drop-out rates.

Scenarios 2 and 3 include other entry routes which create costs elsewhere in the health system. Such costs tend mainly to fall to the Trust or NHS body employing the individual as CPD and international recruitment costs are their responsibility. Our understanding is that no costs arise to HEE from these entry routes, so this does not affect the total estimated cost to HEE. However, when interpreting the overall costs of different scenarios, it must be remembered that this represents the cost to HEE only, not to the total cost to the health sector.

Therapeutic Radiography

Context

Therapeutic radiographers deliver radiotherapy treatments, such as x-rays and other ionising radiation, to treat patients with medical conditions, largely cancer and tumours.⁸¹ They care for patients along the whole care pathway, from referral to post-treatment follow up, working within multidisciplinary teams.⁸²

Similarly to diagnostic radiography, training in therapeutic radiography is traditionally provided in a three-year full-time undergraduate degree, which can also be completed part-time in around six years.⁸³ Those with a relevant undergraduate degree can undertake a postgraduate programme in therapeutic radiography, although it can be hard for individuals to acquire funding for such courses and, as a result, not many newly qualified trainees take this route.⁸⁴ Furthermore, some training spaces have recently been left unfilled, largely because student bursaries have recently been removed for therapeutic radiography.⁸⁵

Historic workforce stock and flows

On 31 March 2019 there were 2,844 FTE therapeutic radiographers working in the NHS in England. Over the three years prior, the following average **annual** FTE flows are observed:

- Inflows:
 - Newly qualified training: 219 (56 per cent of inflows)
 - Intra-NHS: 111 (28 per cent of inflows)
 - Rejoiners: 49 (13 per cent of inflows)
 - International recruitment: 11 (3 per cent of inflows)
- Outflows:
 - Early leaver: -260 (90 per cent of outflows)
 - Retirement: -30 (10 per cent of outflows)

Overall, there is an average annual total of 390 FTE inflows to the workforce and -290 FTE outflows from the workforce, with a net average annual inflow of 100 FTE.

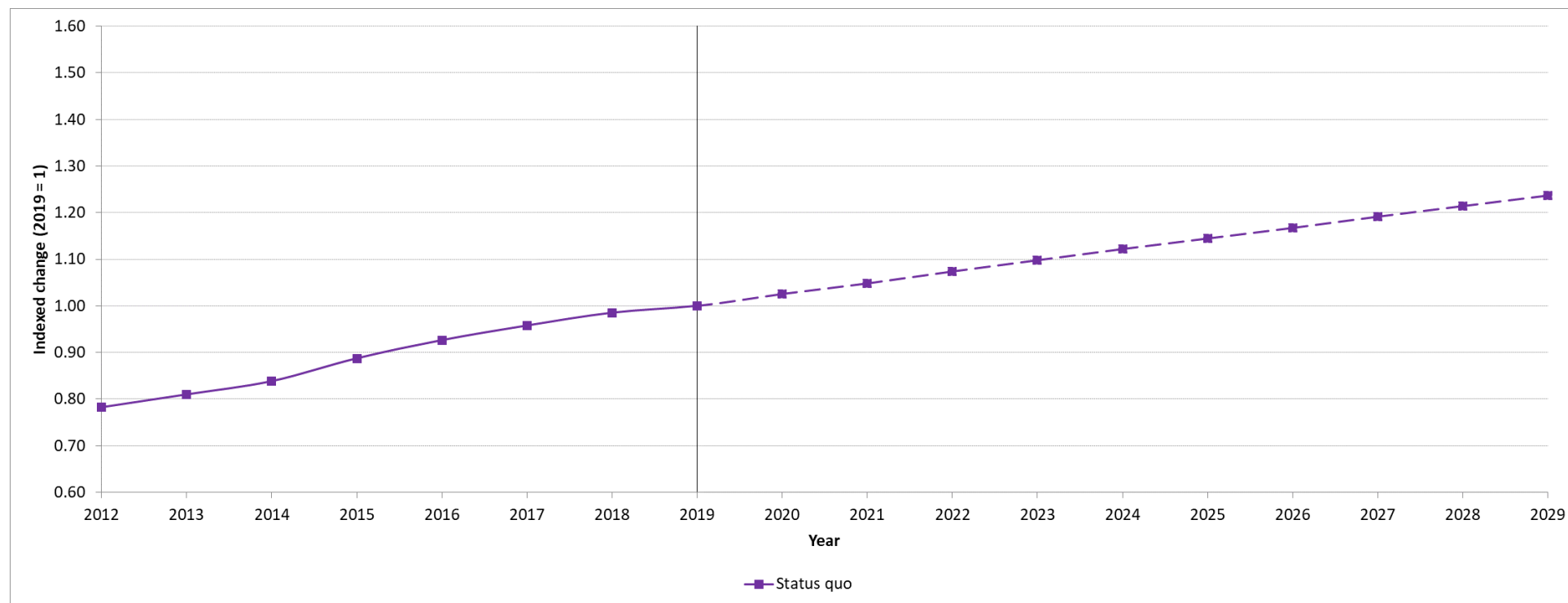
Other relevant information

The Interim NHS People Plan, published in June 2019,⁸⁶ stated that over the following five years, more clinical degree-level apprenticeships would be introduced, including for therapeutic and diagnostic radiographers. It also said that in 2019–20, there would be a focus on increasing applications to undergraduate education, particularly in professions such as therapeutic radiography where there is a shortage. Furthermore, the NHS People Plan 2020/2021,⁸⁷ published in July 2020, also reinforced the commitments to addressing workforce shortages within radiography. We were not able to build these plans into our model for therapeutic radiographers because the data were not available at the time the analysis was conducted.

Projected status quo growth

[Figure 6](#) shows the projected status quo growth of therapeutic radiographers from 2019 to 2029 (dashed line), assuming a continuation of inflow and outflow trends over the past three years (i.e. in the results achieved from HEE’s current activity level) and applying those ‘flow’ trends to the known ‘stock’ of therapeutic radiographers. Using 2019 as the reference year, the demographic stock-flow economic model projects a 24 per cent increase in FTE, a growth of 672 FTE from 2,844 in 2019 to 3,516 in 2029, as outlined in [Table 13](#). This is in line with the historic growth in the workforce, as shown by the solid line in [Figure 6](#).

Figure 6: Historic and status quo changes in the therapeutic radiography workforce, indexed to 2019



Source: RAND Europe. Note: For diagnostic radiographers and therapeutic radiographers, values up to and including 2019 are historic (solid line) on the graph, and values from 2020 onwards are estimates from the modelling (dashed line).

Table 13: Historic and status quo changes in the therapeutic radiography workforce

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total FTE	2225	2303	2385	2524	2634	2724	2802	2844	2915	2983	3054	3123	3190	3255	3320	3387	3454	3516
Indexed change	0.78	0.81	0.84	0.89	0.93	0.96	0.99	1.00	1.02	1.05	1.07	1.10	1.12	1.14	1.17	1.19	1.21	1.24

Source: RAND Europe. Note: Indexed change from reference year.

Scenarios and costing

We estimate that to achieve 45 per cent growth in the therapeutic radiography workforce by 2029 an additional 609 FTE are required, as the status quo projects a 24 per cent increase in the size of the workforce. [Table 14](#) outlines the required FTE increase to achieve the 45 per cent growth target in each of the three scenarios. The required inflow and cost to HEE is as follows:

- Scenario 1: an additional 609 NQT FTEs are required to achieve the necessary growth. As therapeutic radiographers work on average 0.92 FTE per individual,⁸⁸ and assuming an average drop-out rate of 10 per cent, this means an additional 729 individuals need to be trained by 2029, at a total additional cost of £7.7m to HEE over the ten years.
- Scenario 2: an additional 578 NQT and 30 international recruitment FTE are required. Applying the average FTE per individual of 0.92, and assuming an average drop-out rate of 10 per cent, this means an additional 693 individuals need to be trained, at an NQT cost to HEE of £7.3m over the ten years.
- Scenario 3: an additional 341 NQT, 173 intra-NHS, 77 rejoiner and 18 international FTE are required. Applying the average FTE per individual of 0.92, and assuming an average drop-out rate of 10 per cent, this means an additional 409 individuals need to be trained, at an NQT cost to HEE of £4.3m over the ten years .

Table 14: Scenario growth of the therapeutic radiography workforce

Scenario	Total FTE increase				Total cost to HEE
	Newly qualified (specialist) training	Intra-NHS	Rejoiners	International recruitment	
Scenario 1	609	-	-	-	£7,711,023
Scenario 3	578	-	-	31	£7,330,231
Scenario 2	341	173	77	18	£4,326,212

Source: RAND Europe.

As stated in the methods section of the report, since HEE pays costs associated with specialist training, we can estimate the cost to HEE of training each additional person by using the standard tariff rates set by DHSC and then adjusted for other factors such as the market forces factor, the average FTE worked per individual, and the need to train more people than positions required to allow for drop-out rates.

Scenarios 2 and 3 include other entry routes which create costs elsewhere in the health system. Such costs tend mainly to fall to the Trust or NHS body employing the individual as CPD and international recruitment costs are their responsibility. Our understanding is that no costs arise to HEE from these entry routes, so this does not affect the total estimated cost to HEE. However, when interpreting the overall costs of different scenarios, it must be remembered that this represents the cost to HEE only, not to the total cost to the health sector.

Specialist cancer nursing

Context

Cancer nurses play a critical part in the delivery of cancer services across the pathway, ensuring personalised care and support for people living with and beyond cancer. The HEE workforce plan focused on specialist cancer nurses who have high levels of specialised technical skills as a priority profession. However, nursing for cancer patients is much wider than these specialist nurses – nurses support people with a wide variety of health conditions in both the community and acute settings.

However, the way in which nurses are currently recorded by the NHS means we cannot identify the wider cancer nursing workforce, so instead this analysis focuses on just the specialist cancer nurses who were included in the Macmillan Cancer Workforce in England census.⁸⁹ This includes nurses on Agenda for Change Bands 5 to 9 who spend more than half of their time directly supporting adults living with cancer and have a documented training record declaring them to be specialists in cancer care. It includes secondary and tertiary care in both hospitals and the community.

Individuals cannot become a specialist cancer nurse directly from newly qualified training routes as experience is required as an adult nurse before specialisation in cancer is possible. This means that inflows largely come from individuals in the wider nursing pool who undertake ad hoc training to become a specialist cancer nurse.⁹⁰ Generally, specialist cancer nurses require at least five years' post-registration clinical experience, including two in cancer or a similar area, as well as a specialist qualification in cancer, palliative care or similar. As a result, all individuals under 30 years of age entering the workforce from outside the NHS (i.e. a private organisation) are classed as inflows from continued professional development, rather than newly qualified training.

Historic workforce stock and flows

On 9 October 2017 there were 3,851 FTE specialist cancer nurses working in England. Data on

the flows of specialist cancer nurses were not available, meaning that data on inflows and outflows of Agenda for Change⁹¹ Band 6, Band 7 and Band 8a nurses (which cover 99 per cent of specialist cancer nurses) were used as a proxy for flows into and out of the specialist cancer nurse workforce. This assumption is the best available but there are likely to be important differences. For example, 9 per cent of specialist cancer nurses working in 2017 were from outside the EU and a further 5 per cent were from the EU excluding the UK,⁹² which may not be the same proportion as general nursing. Over the three years leading up to 2019, the following average **annual** FTE flows are observed:

- Inflows:
 - Joining the NHS: 5 (1 per cent of inflows)
 - Intra-NHS: 713 (91 per cent of inflows)
 - Rejoiners: 56 (8 per cent of inflows)
 - International recruitment: 7 (1 per cent of inflows)
- Outflows:
 - Early leaver: -544 (88 per cent of outflows)
 - Retirement: -73 (12 per cent of outflows)

Overall, there is an average annual total of 781 FTE inflows to the workforce and -617 FTE outflows from the workforce, with a net average annual inflow of 101 FTE.

Other relevant information

- The proportion of specialist cancer nurses aged 50 or over has increased from 33 per cent in 2014 to 37 per cent in 2017, which could result in a peak of retirements in the next ten years
- Brexit may have had an impact and the loss of bursaries has reduced the numbers of nurses in training.
- There has also been a rapid increase of specialist cancer nurses between 2014 and 2017, in part caused by the establishment of acute oncology services. Some of these were funded by Macmillan and this growth is unlikely to be replicated.
- There is a Global Learners Programme which supports nurses who wish to migrate to the UK to work in the NHS. It includes an online educational package to support nurses in meeting the regulatory requirements to register in the UK. Currently, HEE runs a programme team and bears the fixed central administrative costs. However, these figures can not be included in our costings as we do not know the average amounts. The unit costs of recruitment via the Global Learner Programme are borne by NHS Trusts. This programme is aimed at all nurses; not just specialist cancer nurses.
- Very few specialist cancer nurses are recruited internationally because specialist cancer nursing is not well-developed in other parts of the world.
- HEE also has a rejoining scheme for nurses. For each nurse, it pays approximately £2,500 in course fees, contribution to placement costs and stipendiary. However, the COVID-

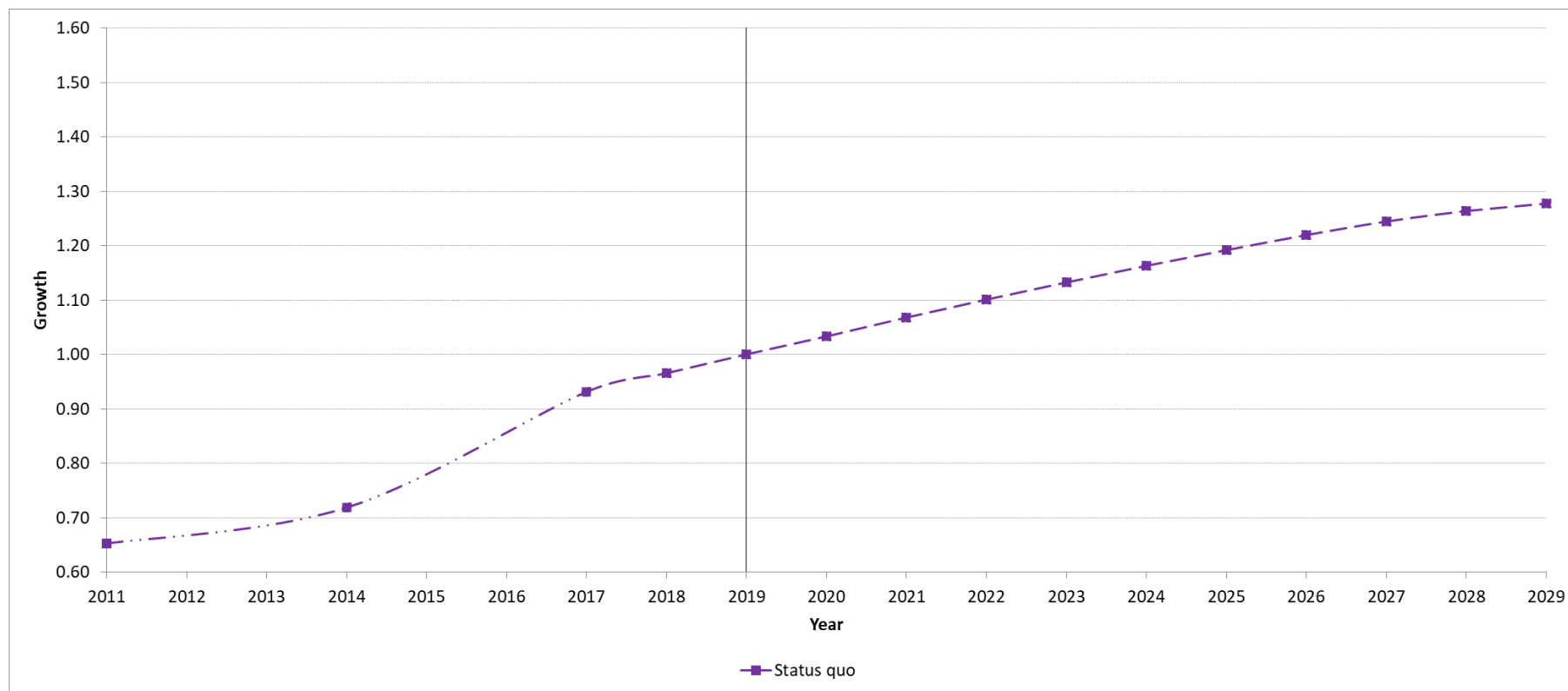
19 response may have severely limited the pool of possible rejoiners over the medium term.

- Subsequent to conducting this analysis, the NHS published the NHS People Plan 2020/2021,⁹³ which set out commitments to offer training grants for specialist cancer nurses.

Projected status quo change

Figure 7 shows the projected status quo growth of specialist cancer nurses from 2017 to 2029 (dashed line), assuming a continuation of inflow and outflow trends over the past three years (i.e. in the results achieved from HEE's current activity level). Using 2019 as the reference year, the demographic stock-flow economic model projects a 28 per cent increase in FTE, a growth of 1,149 FTE from 4,135 in 2019 to 5,284 in 2029, as outlined in Table 15. This represents a decrease in the growth rate of the workforce compared to historic trends, as shown by the dotted and dashed line in Figure 7. This is perhaps unsurprising given the rapid increase in specialist cancer nurses when setting up acute oncology teams after 2014. However, the historic trend line is dotted and dashed, rather than solid, because different methodologies were applied when undertaking the census in 2011,⁹⁴ 2014⁹⁵ and 2017. This means differences in the stock of specialist cancer nurses over time may be a genuine increase in the size of the workforce, or a result of the different methodologies applied in the censuses over time, or a combination of the two – which is most likely. However, for the purposes of calculating the historic growth rate from 2011 to 2017 we have assumed that all of the differences in the stock of specialist cancer nurses over time are a result of genuine increases in the size of the workforce.

Figure 7: Historic and status quo changes in the specialist cancer nursing workforce



Source: RAND Europe.

Table 15: Historic and status quo changes in the specialist cancer nursing workforce

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total FTE	2702	-	-	2974	-	-	3851	3993	4135	4274	4413	4550	4684	4811	4930	5043	5147	5223	5284
Indexed change	0.65	-	-	0.72	-	-	0.93	0.97	1.00	1.03	1.07	1.10	1.13	1.16	1.19	1.22	1.25	1.26	1.28

Source: RAND Europe. Note: Indexed change in **reference year**; - = data not available.

Scenario growth and costing

There is no single qualification that enables an individual to become a specialist cancer nurse, with nurses entering the workforce through CPD rather than NQT, and no national information is available on the cost of the ad hoc training that adult nurses undertake to become a specialist in caring for patients with cancer.⁹⁶ As a result we used the necessary training to become an adult nurse as a proxy for training to become a specialist cancer nurse. This was both for staff joining the NHS and transferring within the NHS. Training to become an adult nurse is traditionally a three-year full-time undergraduate degree.⁹⁷ However, it is a big assumption that cancer nurses will behave in the same way in terms of inflows and outflows as the remainder of nurses.

To achieve 45 per cent growth in the specialist cancer nurse workforce by 2029 an additional 710 FTE are required, as the status quo projects a 28 per cent increase in the size of the workforce. [Table 16](#) outlines the required FTE increase to achieve the 45 per cent growth target in each of the three scenarios. The required inflow and NQT cost of each scenario is as follows:

- Scenario 1: an additional 710 CPD FTEs are required to achieve the necessary growth. As specialist cancer nurses work on average 0.88 FTE per individual,⁹⁸ and assuming an average drop-out rate of 10 per cent, this means an additional 892 individuals need to be trained by 2029, at a total additional cost of £9.4m to HEE over the ten years.
- Scenario 2: an additional 703 nurses transferring intra-NHS or joining the NHS and 7 international recruitment FTE are required. Applying the average FTE per individual of 0.88, and assuming an average drop-out rate of 10 per cent, this means an additional 887 individuals need to be trained, at an NQT cost to HEE of £9.3m over the ten years.
- Scenario 3: an additional 651 intra-NHS, 53 rejoiner and 6 international FTE are required. Applying the average FTE per individual of 0.88, and assuming an average drop-out rate of 10 per cent, this means an additional 822 individuals need to be trained, at a CPD cost to HEE of £865,000 over the ten years, plus 53 rejoiners at a cost of £2,500 per rejoiner = £132,500.

Table 16: Scenario growth of the specialist cancer nursing workforce

Scenario	Total FTE increase			Total known cost to HEE
	Joining the NHS / Intra NHS	Rejoiners	International recruitment	
Scenario 1	710	-	-	£9,435,161
Scenario 2	703	-	7	£9,342,138
Scenario 3	651	53	6	£8,783,612

As stated above we can estimate the cost to HEE of training each additional person using the proxy of basic three-year training. In addition, for Scenario 3, we can estimate HEE's share of the cost for a rejoiner. However, much of the cost of the rejoiner is still met by the trust, so this estimation only represents the cost to HEE only, not the total cost to the health sector.

Summary of results

Workforce numbers for six of the seven professions were already on an increasing trajectory, assuming a continuation of current trends (Table 17). For one profession, gastroenterology, our model estimated that the workforce would meet a 45 per cent growth in the number of staff if it continued its existing trajectory, meaning that no additional measures to recruit and train more staff beyond a continuation of the same growth trend would be required. For five of the other six professions, we estimated that the size of the workforce would increase to differing degrees over the period in question, but that there would be a need for additional intervention to achieve a growth rate of 45 per cent. For the histopathology workforce, the modelling shows that without any new intervention, the number of histopathologists would actually be forecast to reduce by 2 per cent by 2029. Therefore, to meet a growth of 45 per cent, the profession would require 580 more staff at a potential maximum cost to HEE of £118 million.

Table 17: Summary of the estimated growth of cancer specialists and additional number required to reach 45 per cent growth

Cancer profession	Estimated number of FTE staff in 2019	Expected growth by 2029 (based on current trends)		Estimated additional growth required to meet 45 per cent growth (above expected growth)		Total (expected and additional) increase in FTE staff needed to reach 45 per cent growth
		Percentage growth	Estimated FTE staff increase	Additional percentage growth	Additional FTE staff required	
Clinical and medical oncology	1,185	40%	477	5%	57	534
Gastroenterology	1,290	48%	623	0%	0	623
Histopathology	1,228	-2%	-27	47%	580	553
Clinical radiology	3,087	33%	1,004	12%	384	1,388
Diagnostic radiography	14,997	28%	4,158	17%	2,591	6,749
Therapeutic radiography	2,844	24%	672	21%	609	1,281
Specialist cancer nurses	4,135	28%	1,149	17%	710	1,859
Total	28,766	-	8,056	-	4,931	41,753

Source: RAND Europe modelling using NHS ESR data and other data.

Our model estimated the *additional* cost to HEE consequent on meeting the 45 per cent growth target across all seven professions, beyond what we would expect to see if current growth trends continue. We provided estimates for a range of scenarios that vary according to the extent to which the additional staff would be coming through specialist training. We therefore

estimated the total extra cost to HEE of increasing all workforces as being between £142.2 million and £259.7 million, depending on the route taken to increase the inflows over the ten years to 2029.

We wanted to understand the extent to which our model was sensitive to our assumptions about inflows being inaccurate. We therefore applied deterministic sensitivity analysis at the 10 per cent range to the results of our modelling to identify the extent to which the additional funding required is sensitive to the changes in the inflows and outflows to each of the cancer professions. We looked at how many more (or less) FTE staff would be required through training if the other assumptions changed. This enabled us to see which are the most important inflow and outflows. For most of the workforces, the model was most sensitive to changes in the early leaver assumption, as this represents a large proportion of the outflows from the profession. Clinical and medical oncology and clinical radiology appear to be the most sensitive to almost all of the inflows and outflows, whereas the histopathology model is not sensitive to any of the assumptions. The full results of the sensitivity analysis are provided in section 4 of the [supplementary information pack](#).

Discussion

This study firstly aimed to assess how many more staff would be required in seven key cancer professions in order to achieve a 45 per cent growth in those workforces by 2029. Secondly, it aimed to estimate the additional funding, above and beyond that which would be expected if current trends continue, that HEE would require if it were to meet those increases. Our research used the best available NHS data to estimate the baseline stock position and then build a demographic stock-flow economic model that projected the ‘status quo’ workforce growth out to 2029 for each of the seven key cancer professions, assuming the previous three-year average inflows and outflows remained constant (i.e. the results achieved from HEE’s current activity level). The model then estimated how many more staff in each profession would be required to achieve an overall growth of 45 per cent by 2029. Finally, it estimated the training cost to HEE of that increase using available data. We found that if all of the additional growth in the cancer workforce was through training, then the total cost over ten years would amount to about 6 per cent of HEE’s annual budget.

The study’s methodological approach – that there would be a ‘status quo’ change in each workforce even without additional HEE intervention – is similar to that used in many economic models. As we did not identify any specific one-off workforce initiatives that might mean the data we collected is not representative, and as there are many specialist trainees already in training, it is reasonable to assume that trends from the past three years may continue to be valid for flows into and out of the workforce in the near future. The relationship between HEE’s budget and that planned growth is less clear. Our analysis of HEE’s accounts for the past three years indicates an overall decline in its budget (largely because student nurses are no longer entitled to bursaries). However, even looking at post-graduate medical and dental courses only, HEE’s spending has only increased by approximately 1 per cent in cash terms from one year to the next (see [Table 2](#)). This is a modest change alongside the increases in staffing that we have already seen in each of our professions (bar histopathology). The small increase in spending may indicate that increasing staff numbers in each workforce may not be closely dependent on large HEE budget increases, although time lags between training costs and the subsequent inflow of qualified staff are also an important caveat when considering the link between the HEE’s spending and the number of trained staff.

The results of our economic modelling show that the target of 45 per cent growth is more stretching in some professions than others. This may be in terms of the health sector’s ability to scale up its activity, or about the financial cost of increasing staffing. As [Figure 3](#) shows, if current trends continue in clinical and medical oncology, that profession’s numbers would increase by 40 per cent by 2029 without additional intervention; the workforce only needs to grow by an additional 57 staff to meet the 45 per cent growth scenario. However, the cost per professional trained is high. In diagnostic radiography, however, the modelling estimated the need for an additional 2,591 staff to meet a 45 per cent increase, although the cost of training

each person is significantly less than for a clinical or medical oncologist. As might be expected, we noted that the costs of training per person are substantially less for those workforces that are not medical doctors (radiographers and nurses), even though the numbers required are larger. The costs presented only include specialist training rather than foundation-level training, because students starting their medical training in 2020 may not be consultants by 2029.

There are also some issues regarding the feasibility of different scenarios modelled in this study. For some professions, particularly clinical oncology, there is often no international equivalent role and therefore international recruitment is difficult. External circumstances such as the UK's exit from the EU and the COVID-19 pandemic will further affect the feasibility of recruiting internationally. Equally, scenarios that rely heavily on increasing the number of professionals trained may find constraints in the number of work placement places to be a limiting factor. Relying heavily on increased training would also create a need to front-load recruitment of any additional staff towards the start of the ten-year period, due to the time taken to complete specialist training. Therefore, this will also require a front-loaded budget for HEE.

The model looks at the cost of specialist training but increases in all of the cancer professions highlighted in this study may mean that several different professions seeking staff are all searching primarily in the same pool of foundation-qualified doctors. It will be important to understand the extent to which there is any tension between different professions using the same pool of foundation-level qualified doctors to attract specialty recruits, or whether the NHS is able to increase its number of foundation and core training places, to accommodate such increases. If it cannot, then any increase to doctors specialising in cancer may be at the expense of other parts of the NHS. For this reason, it will be important for HEE to understand how many undergraduate medical placements will be required and the potential impact in other NHS sectors.

The true picture of required future staffing is likely to be more nuanced than a simple 45 per cent increase across all seven professions. For example, there may be a greater demand in future for some of these professions than for others. Histopathology is a profession of particular concern, given the almost static size of its workforce under the status quo assumptions, unlike the other six professions. Histopathology is likely to remain a crucial cancer workforce, given that it provides the definitive diagnostic for most cancers. Technological advances and new, more flexible, job roles can also be expected to affect the growth scenarios, such as the increasing use of non-medical staff or even artificial intelligence to report on some of the imaging tests undertaken, a role historically carried out solely by radiologists.⁹⁹

Study strengths and limitations

We are not aware of other previous studies that have attempted to estimate the associated costs to HEE of increases to the seven cancer professions identified in the 2017 Cancer

Workforce Plan as being priorities for growth. Such estimates are important as HEE has a pivotal role in ensuring an adequate future workforce for the NHS, but it is yet to receive a long-term funding commitment. This study will therefore hopefully assist the government and HM Treasury in understanding the implications for funding of workforce increases in a vital area. Other key strengths of the work are:

- The study is based on the most complete source of NHS workforce data.
- The study builds forward from historic growth trends rather than modelling scenario increases from a static baseline, which would be less realistic.
- We have used a collaborative approach throughout and engaged many relevant stakeholders to test and validate data sources and assumptions. There has been a good deal of consensus over the results of this work.

There are, however, some limitations and caveats with the economic modelling. We give a summary of these here, and describe them in more detail in the Section 3 of the [supplementary information pack](#).

- The ESR workforce data we have used has some minor flaws. In particular, it does not give us complete information about the inflows and outflows of staff, the coding of staff to particular professions is not always 100 per cent accurate, and it cannot give us detailed data on specialist cancer nurses.
- The model assumes that previous growth rates will continue, but in reality a wide range of factors may influence this. For example, it would be reasonable to assume that there is a finite pool from which international staff and rejoiners will come, and therefore the health sector may find it increasingly difficult to recruit from these fields once they have picked the 'low-hanging fruit'.
- There are significant costs in increasing the seven workforces that do not fall to HEE, so the cost information described cannot be used in itself to make comparisons between the total costs of different scenarios for increasing the workforce. In modelling different cost scenarios for achieving a 45 per cent growth, we do not consider the contribution or costs of other parts of the NHS.
- We did not look at the changing nature and productivity of the different workforces; for example, advances in imaging technology may allow the same number of staff to meet the needs of more patients.
- We could not fully consider the feasibility of the modelled scenarios for increasing the workforces. There may be particular limitations to the feasibility of different scenarios, not least that the current COVID-19 pandemic and the UK's exit from the EU may impact the recruitment of international nurses and doctors to the NHS.

Conclusion

Although there are several caveats and limitations associated with our analysis (see above), this research aims to understand the requirements for the NHS, and particularly for HEE, of increasing the seven priority cancer workforces by 45 per cent by 2029. The modelling identifies the workforces that will likely require the most significant additional interventions by HEE if they are to grow by 45 per cent and offers an estimate of the associated specialist training costs of such interventions. In addition to HEE's important role in securing staffing, the report also explains that other parts of the health sector, particularly NHS trusts, also play a role. While three different scenarios for increasing the workforce have been set out, external factors such as the impact of COVID-19 and the UK leaving the EU will likely have significant implications for the NHS's ability to attract more staff through some routes and this study will allow policymakers to think about the relative costs and feasibility of alternative options. It should also be noted that the analysis does not take into account commitments made to expand parts of the cancer workforce in the NHS People Plan 2020/21 as these commitments were announced after the analysis was conducted.

Future Research

Some of the limitations and uncertainties described above might be addressed through future research studies. In our view, the most important of these are:

- Considering the growth in the cancer workforce in the context of updated forecasts of increasing demand. Understanding both modelled demand and capacity will allow a clearer understanding of what investment may be needed in order to maintain or improve the quality and timeliness of cancer services in line with the NHS's ambitions. Modelling future demand would need to take into account of not only the changing UK population demographics, cancer incidence, survival and the needs of people living with cancer, but also the likely impact of NHS policies to improve early diagnosis, and to improve treatment personalisation.
- Linked to the question of future demand, it would be useful to explore the implications of new ways of working for the mix of skills and professions required to diagnose, treat and support people living with cancer. The research reported here assumed that the same percentage increase will be required for all seven cancer professions by 2029, but it might be possible to refine this approach by looking at where the biggest capacity constraints and delays are in a cancer patient's journey, as this would inform understanding of how to prioritise workforce growth among the different specialisms.
- The present research focused on the implications and costs for HEE, in line with the research brief. Future research might map the responsibilities for workforce training, recruitment, retention and deployment, and use these to obtain fuller costings across all organisations of the different options of increasing the size of key cancer professions by 45 per cent by 2029. Although this report focuses primarily on inflows, it would also be important to consider the possible role of staff retention in increasing numbers given

the large proportion of staff who leave the workforce pre-retirement.

- Collecting more granular data on how international staff are recruited to the NHS, including greater understanding of the numbers attracted through recruitment programmes versus those who join the NHS individually due to family or other circumstances. The impact of the UK's exit from the EU and the COVID-19 pandemic may also significantly affect the number and nationality of staff recruited from overseas. It would also be useful to understand the barriers to joining the NHS and to assess the cost of recruiting an international doctor to specialist posts, including any hidden costs such as greater turnover of international staff. This might give a better view of the extent to which the status quo assumptions for international staff are likely to be feasible in practice.
- Seeking better information about the impact of increased workforce capacity on patient experience and outcomes. This might include modelling how more staff affect a patient's flow through the system or their waiting time for cancer care, assessing geographical variation in services provided, and even comparing England to international data on the link between staffing and outcomes for cancer diagnosis, treatment and support.

Policy recommendations

The research team makes the following recommendations for health bodies if they are to secure sufficient staff to meet the ambitions of earlier diagnosis and improved outcomes as set out in the NHS Long Term Plan:

1. The government must provide long-term funding, aligned to the NHS Long Term Plan, to secure a sufficient pipeline of future NHS cancer staff. Initial estimates suggest that, to achieve a 45 per cent growth in the seven key cancer professions, this will need to be at least £142 million but closer to £260 million over the next three to five years. This should be taken into account in the next Comprehensive Spending Review.
2. NHS England and Improvement should ensure that their next People Plan adequately reflects the NHS's ambitions for cancer by clearly articulating how many staff will be needed to deliver quality services to a growing number of patients in the long term.
3. NHS England and Improvement, working with HEE, should review how it can influence its pipeline of staff to the professions where they are most needed, with a particular focus on histopathology. The forecast histopathologist numbers are concerning, as this is the only profession with current trends suggesting a decline in the number of staff by 2029.
4. Building on the NHS People Plan 2020/21, NHS England and Improvement, in collaboration with HEE, should ensure that consideration of likely future demand and planned future modelling of the workforce is translated into clear long-term ambitions for the growth of different cancer professions.
5. This research project identified a number of important areas for future research. NHS England and Improvement, the National Institute for Health Research and other funders should commission work to fill these research gaps, to inform its approach going forwards with a fuller understanding of the needs of the cancer workforce and the constraints to its growth.
6. NHS England and Improvement, along with HEE, should assess the feasibility of the different scenarios for increasing inflows. This is particularly important in the light of the likely restrictions arising from the COVID-19 pandemic, which may make international recruitment more difficult.

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