

Delivering world-leading cancer services

Part two: expert opinions on the changes required to bridge the outcomes gap with comparable countries

A report by Incisive Health for Cancer Research UK

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Contents

Acknowledgements.....	3
Executive summary	4
Chapter 1: introduction.....	9
Chapter 2: future pressures.....	12
Chapter 3: changes required to deliver world-leading cancer services.....	16
Chapter 4: delivering better outcomes under increased pressure	20
Chapter 5: implications of change	27
Chapter 6: conclusion and recommendations	30
Glossary.....	33
Annex 1: methodology	35
Annex 2: workshop participants and summaries.....	37
References.....	79

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Executive summary

The Government has committed to “*lead the world in fighting cancer*”, and improving NHS cancer services for patients in England has been identified as a priority in the *Five Year Forward View*^{1, 2}. These are important and welcome commitments given that, despite improvements in some areas, cancer patient outcomes in England remain poorer than in other comparable countries³.

It is important to consider the changes required to deliver world-leading leading cancer services. To inform this discussion, Cancer Research UK commissioned Incisive Health to carry out a policy research project, which spanned two parts. Part one ‘*Funding world-leading cancer services: an analysis of recent changes in expenditure on cancer in England*’ reviewed recent trends in cancer expenditure and set the context of the falls in expenditure and relative lack of funding available for cancer services over the last five years.

This report summarises the outcomes of part two, which engaged with cancer experts to identify anticipated developments in services, funding pressures and opportunities to make further efficiencies. The focus of the report is on the changes required to improve cancer survival, although it is recognised that there are other aspects of a positive cancer outcome, including quality of life and patient experience.

Given the focus on survival, this report assesses the changes required on the diagnosis and treatment pathway. Services relating to prevention, living with and beyond cancer and end of life care are out of scope.

Two major explanations have been offered for the disparity in survival between England and comparable countries⁴:

- Later diagnosis, meaning that more people in England are diagnosed at a stage when cancer has already spread
- Poorer access to effective treatments, meaning that survival in England is lower, even when compared to people diagnosed at the same stage in other countries

Workshops were convened with experts on screening, early diagnosis, surgery and chemotherapy and cancer drugs. A separate process was undertaken for radiotherapy, drawing together evidence from existing documents and eliciting expert comment and feedback. Full details of the methodology used in developing this report are available in Annex 1. Reports of the workshops are included in Annex 2.

The findings presented in this report are based on the insight and experience of experts, supplemented by further evidence where available. Not all of the ideas presented in this report are

therefore supported by comprehensive evidence of effectiveness, but they are considered by experts to be appropriate courses of action or priorities for further research.

The context for NHS cancer services is challenging. Evidence from Part one of this project shows that spending on cancer services has fallen. For example, once expenditure has been adjusted for inflation, there has been a modest but significant fall in spending of 3.8% between 2009/10 and 2012/13. However, the cost of and demand for cancer services has increased and is expected to rise still further. This is driven by a range of factors such as increasing cancer incidence and survival rates, and increasing complexity of patient need and cancer treatment.

Changes required to deliver world-leading cancer services

Experts were optimistic that recent progress in improving cancer outcomes can be accelerated and that the gap with comparable countries can be bridged. These opinions are often supported by evidence from other sources, suggesting that improvements are achievable and affordable.

In relation to screening, trials looking into new screening techniques for lung and ovarian cancer, for example, are ongoing and it is difficult to predict which will prove to be effective. It is, however, prudent to plan on the basis that at least one major new screening programme would deliver significant benefits to the population over the next five years. It will also be important that efforts are made to optimise the impact of existing programmes, both through increasing participation and tailoring screening rounds to personal circumstances.

On early diagnosis, lowering the threshold for investigation as recommended in the NICE guidelines on investigation and referral will require redesigning diagnostic pathways and introducing new models of investigation in primary care, including through direct access to diagnostics.

There are significant quality and efficiency gains to be had from encouraging surgical teams to undertake higher volumes of procedures, with a greater focus on improving care before and after surgery to reduce the risk of complications and post-surgical recovery time. Where appropriate patients should also be offered alternatives to surgery, such as active surveillance.

More patients should also receive advanced radiotherapy techniques which are more targeted and reduce side effects. This will require the modernisation and replacement of equipment and the adoption of more efficient techniques that enable faster treatment.

Improvements in the efficacy and tolerability of cancer drugs can be expected to continue. Services should be more proactive in identifying signs of progression or suboptimal response to treatment so that medicines can be stopped and patients switched on to other evidence-based cancer drugs. It will be important that stronger links are established between specialist centres and local units so that more patients can receive treatment closer to their home. There will also need to be a renewed

focus on reducing side effects and reducing the need for emergency admissions, including through greater use of remote support.

In each area of the pathway investment will be required to deliver improvements, but there are also opportunities to make more effective use of existing resources whilst delivering quality improvements.

Delivering better outcomes under increased pressure

Although experts were asked to provide ideas for their particular part of the pathway, several common themes emerged.

Specialist national guidance to inform – but not dictate – the local delivery of services will be important, for example in relation to earlier diagnosis or the configuration of surgical services. Guidance should be supplemented and informed by applying the intelligence generated from consistent data collection to improve the quality, consistency and efficiency of services, for example in relation to optimising the use of cancer drugs and radiotherapy.

Technology can be used more effectively to deliver services, for example in relation to the provision of remote support for people receiving treatment. It should also be possible to improve the quality of treatment (and consistency of access to it) across the pathway, for example through the use of more targeted radiotherapy or more extensive surgery.

Treatment, services and information should be personalised. This will result in more person-centred care, but also treatment approaches which are tailored to the circumstances of the individual, for example through adjusting treatment protocols to take account of frailty or comorbidities.

There are many opportunities to make better use of workforce skills and capacity, including enabling different groups of healthcare professionals to play a more prominent role in the delivering of cancer care. For example, pharmacists could play a bigger role in encouraging earlier diagnosis and delivering treatment and support to people after they have received a diagnosis of cancer.

A range of cancer equipment will require replacing or updating in the coming years. There is a clear opportunity to achieve better value for money in the procurement of new technologies through a national approach to the planning and purchasing of equipment, combining purchasing decisions with the setting of national standards for their use and evaluation.

Services will need to be supported by funding flows which reflect the cost of delivering complex treatment and which reward and encourage improvements in quality, for example through ensuring that the use of new radiotherapy techniques or more complex surgery is fully reimbursed.

Experts recognised the funding pressures facing the NHS and understand that cancer services must continue to play their part in delivering more efficient care, building on the substantial efficiency gains of recent years. It will, however, be important to avoid inappropriate short-term savings, which could have long-term adverse consequences, such as delays in the rollout of effective new screening programmes or techniques; restrictions on cancer investigations and referrals; increased waiting times for treatment; delays in replacing or updating equipment; and reductions in access to clinical nurse specialists.

Implications of improvements

Making changes in diagnostic and treatment services, as well as the impact of increasing cancer incidence, will have implications for demand on various parts of the cancer pathway. Demand for diagnostic services is likely to increase through better screening, lower thresholds for referral from primary care, and increased awareness of cancer symptoms. While demand for some forms of treatment (particularly surgery) would increase, aggregate demand may reduce due to patients receiving earlier, less extensive treatment, with lower rates of recurrence reducing the need for follow-up treatment.

There are opportunities to make better use of existing workforce and equipment and the analysis presented in this report suggests that improvements in quality will, in themselves, help reduce some pressure on services. However, it is important to recognise that further investment will be required if the Government is to achieve its goal of world-leading cancer services and outcomes for patients. With half of the population set to be diagnosed with cancer during their lifetime, these improvements are something that the NHS must achieve if it is to retain its status as a world-leading health service^{5, 6}.

Recommendations

The ideas presented in this report, based on feedback from clinical experts, are intended to make a constructive contribution to the work of the independent Cancer Taskforce, as well as to help inform discussions about the prioritisation of investment in cancer services. We therefore provide the following recommendations:

1. Improving or even maintaining cancer outcomes in England will require additional expenditure. In setting out its ambitions for cancer services, the Government should make clear the additional level of investment available to the NHS
2. The Cancer Strategy should prioritise earlier diagnosis and improved access to and quality of treatment (thereby reducing the risk of, or delaying, recurrence). This has the potential to reduce demand for some services and improve outcomes

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3. Health Education England should undertake a review of the cancer workforce with a view to (a) optimising the existing available workforce, including encouraging non-specialists to assume greater roles in the delivery of cancer care; and (b) identifying shortages and developing strategies to fill them
 4. Harnessing the potential of digital technologies to improve cancer care should be a key theme for the Cancer Strategy. Digital technology offers the potential to improve the quality of support given to cancer patients across the pathway, as well as to maximise the positive impact of healthcare professionals' time
 5. Building on the principles of the Review of Operational Productivity in the NHS, the Cancer Strategy should set out how the NHS will approach the procurement of new cancer equipment. Investment in new cancer diagnostic and treatment equipment is likely to be a significant cost in the coming years. The NHS should utilise its bulk purchasing power to achieve better value. National planning and procurement should enable a sustainable approach to the roll out and evaluation of new technology
 6. The Royal Colleges and other professional experts should refine ways of working for multidisciplinary team meetings, to focus on discussing the most complex cases, whilst ensuring appropriate clinical oversight and review of all treatment decisions
 7. NICE, with support from NHS England, should lead a rapid review to update the Improving Outcomes Guidance to inform service NHS England service specifications and contracts for 2016/17
 8. The Cancer Strategy should include an assessment of the anticipated pressures on cancer services and set out the key actions that should be taken to manage these pressures so that all patients get the best care possible, building on the ideas set out in this report

Chapter 1: introduction

There is widespread commitment to delivering world-leading cancer services and outcomes in England. The Conservative Party's manifesto pledged that the new Government would⁷:

"Lead the world in fighting cancer...Improve survival rates and save thousands of lives through enhanced prevention, earlier detection and diagnosis, and better treatment and care."

This commitment was mirrored by many of the other political parties, with the Labour, Liberal Democrat and Green parties all committed to a similar goal in their 2015 manifestos^{8,9,10}. Importantly, NHS England identified improving cancer services as a key priority in its *Five Year Forward View*¹¹.

Improving cancer outcomes is likely to have expenditure implications that will need to be planned for and met. Although there have been significant improvements in cancer outcomes in England over the past fifteen years, evidence suggests that there is still some way to go before our outcomes can be described as 'world-leading.'

Analysis by the International Cancer Benchmarking Partnership suggests that poorer survival in England is primarily driven by later diagnosis and poorer access to effective treatment for some patients¹². Improvements will be required in all aspects of cancer services if we are to succeed in delivering world-leading cancer outcomes.

Now is the time to consider the changes that will be required to deliver this in England:

- NHS England and the other arms length health bodies have commissioned an independent cancer taskforce to develop a new cancer strategy to shape efforts to improve services over the next five years
- HM Treasury is due to conduct a spending review which is likely to determine the resources available to maintain and improve cancer services

To inform these processes, Cancer Research UK has commissioned Incisive Health to:

1. Evaluate recent changes in expenditure on NHS cancer services, establishing the context for future investment decisions (see *Part one: An analysis of the funding context for cancer services in England*)
2. Work with cancer experts in undertaking a horizon-scanning process to identify the key anticipated developments and cost-drivers in cancer services over the next five years

Part one of this project examines the funding context for cancer services in England in recent years¹³. This found that, between 2009/10 and 2012/13, overall expenditure on cancer services increased from £5.57 billion to £5.68 billion, amounting to an increase of 1.9%. This compares to overall increases in NHS programme budget expenditure of 8.4% in the same period¹⁴.

Despite the modest increase in expenditure on cancer, resources have not kept pace with increasing demand¹⁵:

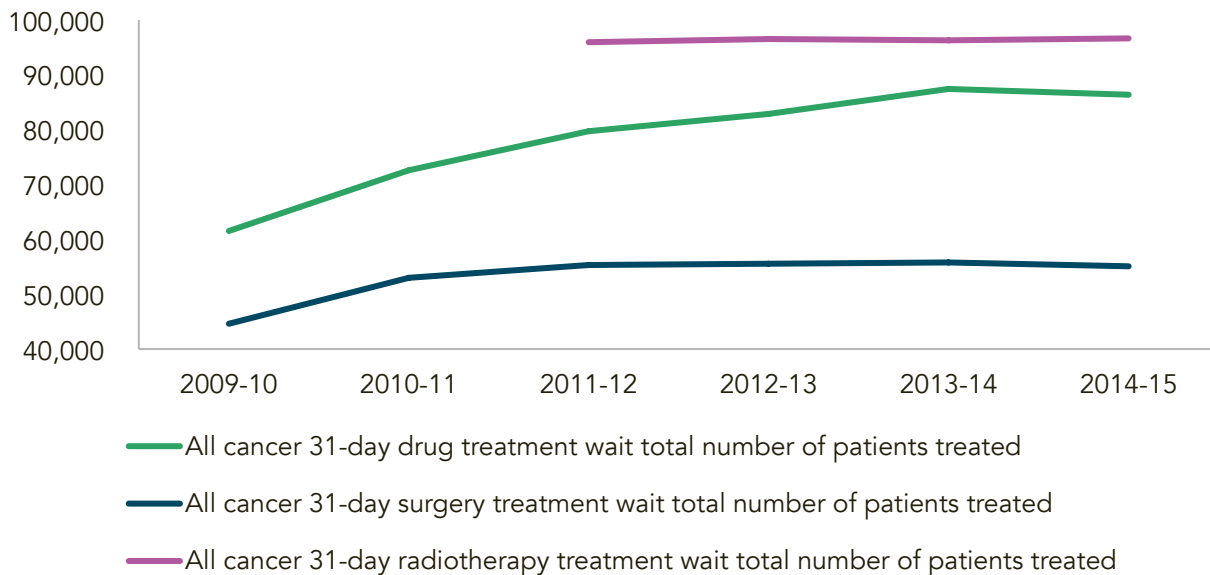
- Between 2009/10 and 2012/13 real terms expenditure on cancer services fell by £227.1 million – a reduction of 3.8%
- Funding per capita fell by somewhat more, declining by 5.7% since 2009/10. Had expenditure per capita been sustained at 2009/10 levels, then just under an additional £344 million would have been available across England in 2012/13
- Expenditure per newly diagnosed patient* fell by almost 10% in real terms, equivalent to over £2,000 per patient diagnosed in that year. Had spending per newly diagnosed patient remained the same as in 2009/10 in real terms, just over an additional £1.49 billion would have been available to cancer services over this period

The increased pressure on NHS cancer services in recent years can be seen in the levels of activity undertaken. For example, there have been substantial increases in the number of patients requiring surgery, radiotherapy and cancer drugs who are recorded in the cancer waiting times database for second or subsequent treatment¹⁶. Although the number of people requiring radiotherapy[†] appears to have remained broadly static in the years for which data are available, there has been an increase of just under 24% in those recorded as requiring surgery and 40% in those requiring cancer drug treatment between 2009/10 and 2014/15.

* Expenditure per newly diagnosed patient is calculated by dividing total cancer expenditure by the total number of cancer diagnoses in a given year. For more details, see Part one of the project

† Demand for radiotherapy may have been artificially constrained by shortages in capacity

Figure 1: second and subsequent treatment activity reported in the cancer waiting times database



This report sets out the key findings from Part two of the project. The findings are intended to make a constructive contribution to discussions on the steps necessary to deliver cancer services comparable with the best in the world, as well informing estimates of the likely cost implications of these steps. It is hoped that the issues presented in this report will inform detailed modelling of future expenditure requirements, ensuring that action to improve cancer services and outcomes is supported by appropriate expenditure commitments.

Chapter 2: future pressures

The pressures on cancer services can be expected to rise still further, driven by a variety of factors, including increasing:

- Incidence – increases in the number of people diagnosed with cancer are expected
- Complexity – as people live for longer, they are likely to develop multiple physical and mental morbidities which will result in cancer care becoming more complex to manage
- Survival – more people will survive for longer following a cancer diagnosis, requiring either active treatment or ongoing support

This chapter examines the impact that these trends will have on cancer services.

Incidence

Although the number of people diagnosed with cancer will grow, changes in cancer incidence will not be uniform. A study carried out in 2011 projected that the total number of cancers diagnosed each year in England will have increased by 45% between 2007 and 2030, from 297,885 to 431,955¹⁷.

These projected changes are driven by a combination of:

- The effect of the growing and ageing population
- Changes in the levels of risk for different cancers, irrespective of age (expressed as age-standardised rates, or ASR)

The impact of changes in the size and age of the population means that there will be an increase in the numbers of diagnoses of most cancers by 2030, as set out in the figures 2 & 3 below.

Figure 2: projected change in the annual number of cancer cases in women 2007-2030 by cancer

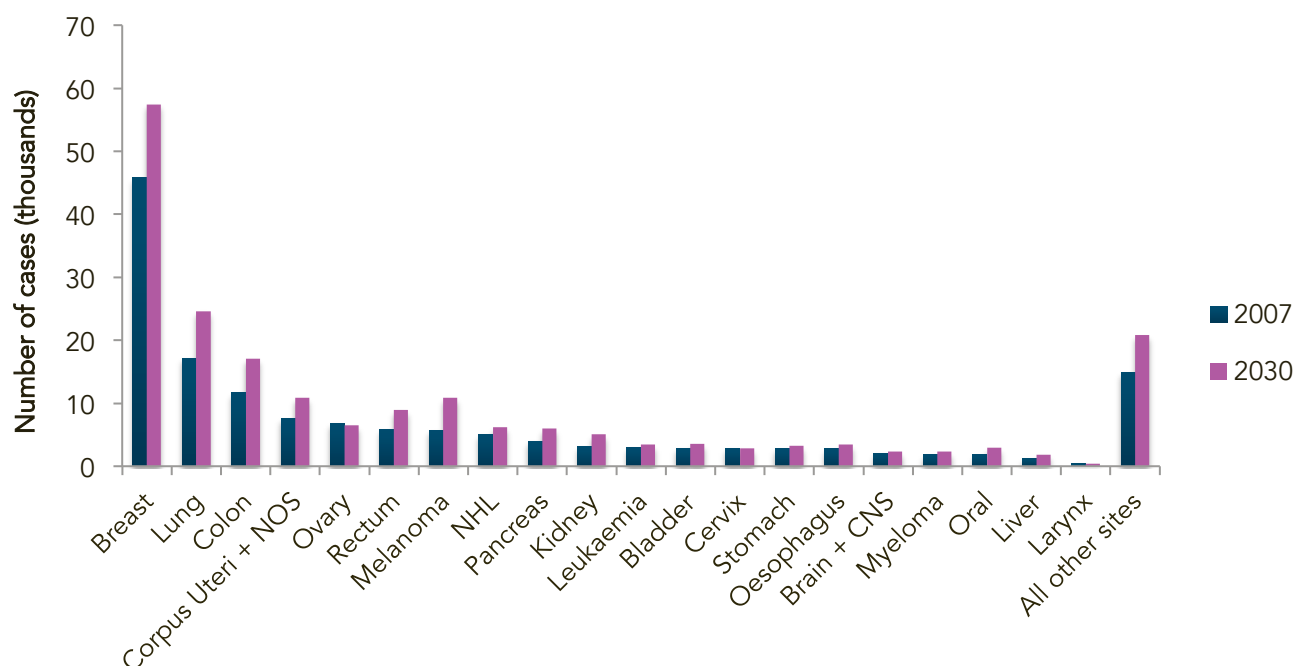
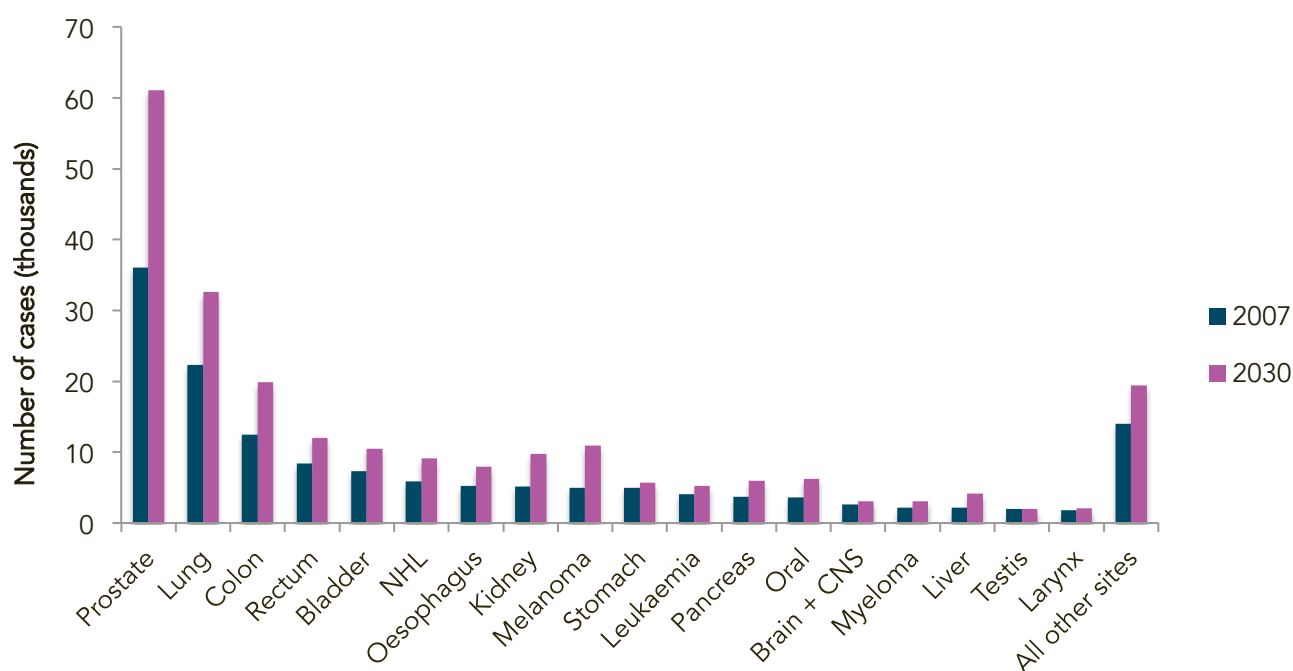


Figure 3: projected change in the annual number of cancer cases in men 2007-2030 by cancer



Although these figures project changes to incidence by 2030, it will be important to begin planning for them now, particularly for those cancers where the most substantial change in demand will occur. The table below categorises different cancer types according to the projected percentage change in the number of diagnoses.

Table 1: projected change in the annual number of cancer cases in men and women 2007-2030, by cancer

Increase of > 60%	Increase of 40-60%	Increase of 20-40%	Increase of 0-20%	Decrease
Melanoma (104%)	Pancreas (55%)	Bladder (39%)	Stomach (14%)	Ovary (-4%)
Kidney (81%)	Colon (53%)	Myeloma (34%)	Larynx (13%)	
Liver (77%)	Rectum (47%)	Breast (26%)	Testis (2%)	
Oral (71%)	All cancers (45%)	Leukaemia (24%)	Cervix (0.1%)	
Prostate (69%)	Corpus Uteri + NOS (45%)			
All other sites (68%)	Lung (45%)			
Brain + CNS (66%)	Oesophagus (43%)			
	NHL (41%)			

Complexity

Over half of all cancer deaths in the UK already occur in people aged 75 and over and, by 2020, there will be two million people aged 65 and over alive following a diagnosis of cancer¹⁸.

More people are living with multiple health conditions as the population ages. This is as true for cancer patients as it is for the wider population. Treating cancer patients with multiple medical conditions can increase the complexity and costs associated with cancer care. For example, unlike for other age groups, inpatient admissions for the 75 and over age group continue to be higher than day case admissions¹⁹.

Evidence suggests that there is a particular disparity between the outcomes for older people with cancer in England and in other countries²⁰. Therefore improving the services available to older people will need to be an important focus if the goal of having world-leading cancer services in England is to be achieved.

Survival

Improvements in early diagnosis and the quality of, and access to, treatment mean that around half of all cancer patients are living for 10 years or more:

- Better early stage treatment means that more patients than ever are surviving cancer, but sometimes are living with ongoing effects from this treatment

- Better treatment for advanced cancer means that – for several cancers – there are now multiple treatment options where previously there were few or none. Examples of this include breast, prostate and some blood cancers, where patients will often receive multiple lines of radiotherapy or drug treatment, often over many years^{21, 22, 23}. Improvements in treatment for advanced cancer are also making more cancers operable²⁴. Thanks to research, further developments in treatment can be anticipated in the coming years, with relatively long term survival becoming a realistic prospect for more patients with advanced cancer

Increased survival is good news for patients; better treatment means that many more people are alive after cancer or are leading a good quality of life with incurable but manageable cancer for many years. However, increased survival is also placing more pressure on cancer services, including:

- Cancer survivors may develop a subsequent cancer
- The ongoing or late effects of cancer treatment may need to be managed by health and care services
- Multiple lines of treatment, often delivered over prolonged periods of time, place an increased demand on NHS capacity

Not only will there be more patients, often with greater degrees of medical complexity, but cancer services will need to support them for longer periods of time.

Chapter 3: changes required to deliver world-leading cancer services

Approaches to the diagnosis and treatment of cancer continue to evolve. From the perspective of cancer services in England, three types of change will be required in the coming five years if the goal of having world-leading cancer services is to be realised:

- Change to address shortcomings in cancer services, when compared with other countries
- Change to capitalise on developments in the understanding of cancer
- Change to cope with the increasing demand for cancer services

The experts we engaged with identified a range of actions that should be taken in the next five years, which are summarised in this chapter. Many of these suggested actions are already underpinned by good evidence. Others are based on professional opinion but will require careful testing and evaluation.

Cancer screening

Cancer screening services in England are considered to be of high quality by international standards, but experts anticipate that there will be further opportunities to increase early diagnosis for people before symptoms occur. In order to realise this opportunity, action over the next five years will be required to:

- Introduce new screening programmes – it is considered likely that at least one major new programme will be deemed to be effective, with trials due to report on lung and ovarian screening, as well as on different methods of breast, cervical and bowel screening. It would be helpful for a clear protocol and pathway to be developed to set out how new programmes should be piloted and then introduced into routine delivery
- Improve uptake – reversing the decline in participation in some existing programmes by applying new technologies and better data collection, as well as making better use of primary care professionals, to target at risk people
- Reassess the existing cervical screening programme – tailoring screening rounds to reflect the impact of HPV vaccination

Cost implications of changes to screening

Cost pressures are likely to include:

- The implementation of new screening programmes
- The use of new technology and equipment within existing programmes

Opportunities to contain expenditure include:

- More personalised approaches to screening, which may reduce the number of interventions per person
- Improved productivity as a result of new equipment and better use of staff

There are a range of approaches to workforce utilisation that could help deliver these changes, which are set out in the next chapter.

Early diagnosis of cancer

Delays in investigating symptoms are more than three times as long in England as they are in Australia²⁵. In order to achieve early diagnosis, people need to be aware of signs and symptoms and empowered to seek help from healthcare professionals. Delivering this will require:

- The 'normalisation' of cancer in communities, with cancer being discussed openly, families encouraging each other to seek help and healthcare professionals encouraging this both by making clear that they welcome people seeking help and by communicating that earlier diagnosis leads to better outcomes
- Making use of 'teachable moments' to reinforce messages about prevention and early diagnosis, such as after an investigation for suspected cancer, where cancer was not found
- Better use of technology to support diagnosis, for example through making online symptom checkers available to the public as well as healthcare professionals

Healthcare professionals will also need support and permission to investigate potential cancer and to refer promptly and appropriately, through:

- Lower thresholds of suspicion for investigation in primary care and referral as set out in the new NICE guidance, supported by better access to diagnostics and positive feedback on practice
- Greater time for investigation, with primary care professionals given the time and space to thoroughly investigate undifferentiated symptoms through models such as the use of non-specific symptom clinics with longer appointment times and access to a range of point of care diagnostics
- Increased focus on cancer early diagnosis in training, professional development and appraisals

Cancer surgery

Surgery cures more cancers than any other form of treatment and will remain the cornerstone of treatment for most forms of cancer. Experts believe that there are opportunities to make better use of surgical capacity and to achieve better outcomes.

Cost implications of changes to early diagnosis

Cost pressures are likely to include:

- Increased investigation and use of diagnostic tests
- Funding for sustained awareness programmes
- Increased demand on primary care time as a result of cancer issues

Opportunities to contain expenditure include:

- The bulk procurement of diagnostics
- Increased initial investigation in primary care potentially reducing referrals to specialist care
- Earlier diagnosis averting subsequent treatment costs for advanced cancer

Realising this opportunity will require:

- Greater centralisation where evidence shows benefit, with centres performing higher volumes of procedures in line with international practice
- A better balance between the number of specialist surgeons and general surgeons, with more needed of the latter
- Optimisation of surgical processes, including through the separation of emergency and elective surgery, the use of parallel theatres, greater stability in the composition of surgical teams and increasing the number of sessions in which specialist surgeons actually operate
- Enhanced focus on perioperative medicine, including through the use of 'prehabilitation' to minimise the risk of complications and to accelerate recovery times
- The planned procurement, roll out and evaluation of new technology, ensuring investments are made in a way which supports the best outcomes for patients and value for the taxpayer

Radiotherapy

More targeted radiotherapy, often used in combination with surgery and / or cancer drugs, will play a key role in cancer care in the coming years. In order to improve cancer outcomes, it will be necessary to:

- Increase the proportion of patients receiving advanced radiotherapy and reduce variations in access and usage
- Modernise and replace existing equipment, with an estimated 150 linear accelerators requiring replacement by 2016
- Make better use of existing capacity, including through the adoption of advanced techniques such as hypofractionation that reduce treatment times and greater automation to free up professional time
- Encourage multi-centre collaboration, enabling access to specialist advice, treatment planning and the testing of new techniques, alongside more local

Cost implications of changes to cancer surgery

Cost pressures are likely to include:

- Earlier diagnosis will mean that more patients need surgery
- Greater complexity in caseload due to comorbidities
- Increased role for expensive equipment (eg robots)
- Improved effectiveness of adjuvant chemotherapy meaning increased need for surgery

Opportunities to contain expenditure include:

- Greater use of active surveillance techniques for some cancers (eg prostate) reducing resection rates
- Increasing the number of sessions that specialist surgeons actually operate
- Centralised procurement of new equipment
- Improving perioperative medicine to reduce post-surgery bottlenecks

Cost implications of changes to radiotherapy

Cost pressures are likely to include:

- New equipment and software
- Training programmes in new techniques
- Increased usage of radiotherapy and access to more advanced forms of treatment

Opportunities to contain expenditure include:

- Centralised procurement of new, more efficient equipment
- Adoption of new and more efficient techniques
- Improved utilisation of capacity, through techniques such as hypofractionation

delivery of less complex treatments

- Invest in the workforce, both through ensuring existing professionals are trained in the latest techniques and through developing the capacity required to meet future demand

Chemotherapy and cancer drugs

Drugs are playing an increasing role in the management of cancer, both in the treatment of early stage disease and in the management of advanced cancer. There will be an increasing number of effective treatment options, further improving outcomes for patients but placing greater pressure on services. Managing this will require:

- Improved prevention, monitoring and management of treatment toxicity and serious side effects, including through enhanced remote support which makes use of digital technology and more effective triage of patients who present with complications
- Better links between specialist centres and local units, where much cancer drug treatment should increasingly take place under the oversight of clinical specialists. 'Hub and spoke' models should be supported by appropriate professional rotation to ensure that all staff have the appropriate development, oversight and support to maintain high standards of care
- Greater involvement for pharmacists in the preparation and delivery of treatment, as well as the management of side effects
- Support for appropriate prescribing in older people, ensuring they are able to benefit from treatment but that approaches are adjusted to take account of comorbidities and frailty
- More proactive monitoring for signs of progression, with 'stop and swap' approaches used where other evidence-based treatments are available which may deliver a better clinical benefit for the patient in question
- Appropriate funding and accreditation for the delivery of the molecular diagnostic tests required to inform access to precision medicine
- The development of remote monitoring and advice services, reducing the number of trips patients have to make to hospital, ensuring rapid access to help when it is needed and freeing up staff time
- Early access to palliative care services, which can in itself improve survival

Cost implications of changes to cancer drugs

Cost pressures are likely to include:

- Increasing number of tolerable and effective drug treatment options for patients
- Longer term use of drugs to treat people with advanced cancer
- Increased genomic sequencing of patients to tailor treatment

Opportunities to contain expenditure include:

- Better management of side effects, reducing the need for emergency care
- Opportunities for more proactive 'stop and swap' strategies in drug treatment
- Reduced use of ineffective treatment and avoidance of side effects

Chapter 4: delivering better outcomes under increased pressure

Clinical experts expect increased pressure on services at each part of the cancer pathway. Managing this pressure whilst seeking to maintain and improve cancer outcomes will require more than just additional investment, although this will be important. It is unlikely that there will be sufficient capacity (particularly, but not exclusively, in terms of appropriately trained and experienced professionals) to deliver an 'as usual' service, even if this was desirable in terms of outcomes.

Although there are aspects of cancer services which experts believe are world-leading – for example, some of England's screening programmes or the use of multidisciplinary teams – they were also clear that there is both a need and an opportunity to introduce changes to improve every stage of the pathway.

Many of the changes identified are specific to a particular part of the pathway. There are, however, a series of themes that emerge.

National specialist guidance, local delivery

Experts across the pathway highlighted the benefits that consistent national guidance, developed by specialists, can bring. Examples include:

- National screening programmes, which deliver economies and qualities of scale
- Guidance on the configuration of cancer services, which have improved access to multi disciplinary specialist expertise
- National commissioning for radiotherapy and chemotherapy, where standard national specifications appear to have reduced variations in the usage of treatments²⁶

Feedback suggests that national guidance should play an important role in implementing the changes that will be required to deliver world-leading cancer services. Some ideas on areas where new or updated guidance is required are set out in the boxes.

New guidance on the configuration of surgical cancer services

The *Improving Outcomes Guidance (IOG)* have played an important role in ensuring patients are seen by specialist services.

However, in some cases the Guidance is now more than 15 years old and predates important innovations, such as the use of surgical robots. Experts suggested that a rapid review of the IOGs should be undertaken to inform service specifications, contracts and investment decisions from 2016/17 onwards.

It is important that guidance keeps pace with developments in practice. It is notable that the Improving Outcomes Guidance are, for some cancers, more than 15 years old. Surgical experts identified a pressing need to update the guidance on the volumes of procedures that centres should undertake in order to be considered as having the appropriate level of specialism. Oncology experts highlighted that, with clinical practice changing rapidly, guidance can quickly become out of date. There is often a lag between changes in international guidance and their adoption in England-specific guidance. This could be addressed by simply adopting – rather than revising – credible international guidelines. For example, there is a case for adopting guidance by the American Society for Clinical Oncology (ASCO) or the European Society for Medical Oncology (ESMO) so as to avoid unnecessary duplication and delay.

Irrespective of the source, it will be important that national guidance does not impede local autonomy or creativity in how to deliver key standards. Examples of this could include:

- Early diagnosis, where standards on the speed of diagnosis and thresholds for investigation could be accompanied by greater local autonomy about how this is achieved[‡]
- The use of cancer drugs, where national decisions on what treatments should be provided and the kind of settings in which they should be delivered, should be accompanied by local work to tailor pathways to the needs and preferences of local populations

National standards on early diagnosis

Diagnosing patients before their cancer has spread is an important marker of quality.

As an alternative to traditional waiting time standards, NHS England should consider establishing standards for the time taken to diagnose people with cancer, leaving how this is achieved to local discretion.

This could incorporate NICE's guidance on the investigation, referral and diagnosis of cancer.

Applying intelligence to improve services

Guidance and services should be informed by and supplemented with evidence on quality outcomes taken from a range of sources, including:

- National datasets and clinical audits, identifying patterns in delivery and outliers, as well as suggesting appropriate benchmarks for performance
- Peer review, quality surveillance and audit, focusing on those services where patterns of practice vary from expected standards and guidance
- Patient feedback, both through the Cancer Patient Experience Survey (which provides important intelligence on all aspects of cancer services, not just experience) and involvement mechanisms, such as the co-design of pathways

[‡] NICE's updated guidance on the investigation and referral of suspected cancer will require NHS services to redesign pathways to reflect anticipated increases in investigation and referral for suspected cancer

Critically, it will be important to link datasets to enable analysis of cancer pathways in their entirety rather than simply discrete interventions within them. This will be important in planning future services and evaluating their effectiveness, as well as informing future research activity.

Improvements in the quality of intervention for all patients

Experts across the pathway identified opportunities to improve the quality of interventions used routinely in cancer services in England:

- Screening: it is reasonable to expect that the NHS will need to plan for the introduction of at least one new programme in the next five years and that new technologies will increase the efficiency and accuracy of existing screening programmes
- Early diagnosis: there is the potential for new tests – for example blood or breath tests – that have a good predictive value for cancer, helping to improve and speed up diagnosis
- Surgery: image guided surgery may offer the opportunity to reduce the risk of cancer returning whilst minimising side effects
- Radiotherapy: new, more targeted techniques that improve outcomes and reduce side-effects will mean that more patients are able to benefit from radiotherapy and will opt to receive it
- Chemotherapy: advances in functional imaging and diagnostics may help identify signs of progression earlier, enabling ineffective treatment to be changed or stopped

New surgical techniques

New technologies will help surgeons increase the effectiveness and reduce the side effects associated with surgery:

- Robotic surgery will become increasingly common
- Image-guided surgery will help surgeons better target tumours, removing them in a way which minimises damage to healthy tissue
- Intraoperative radiotherapy may enable the irradiation of tumours during an operation, reducing side effects

Capital investment in equipment and the redesign of operating theatres will be required. It will be important that all patients who could benefit are able to access improved surgical techniques

It will of course also be necessary to ensure that all people who need these services are able to access them.

Use of technology to deliver services more effectively

Experts also identified that developments in technology will also create opportunities to deliver services more effectively and efficiently:

- Screening: utilising mobile phone technology to deliver reminders and enable people to organise appointments in a way that is convenient for them, as well as delivering information on the benefits and risks of screening in a more accessible and engaging way

- Early diagnosis: there is the opportunity to support more informed discussions between patients and primary care professionals, utilising online information
- Treatment: increasing centralisation – which means that some patients may live further away from their lead treatment centre – can be balanced with greater use of remote consultations and enhanced involvement from primary care through better sharing of information

Automation of radiotherapy planning and delivery has the potential to provide efficiency savings, or at least offset the increased demands placed on staff by the increasing complexity of their roles²⁷.

Personalisation of services

Experts argued that, as research improves our understanding of cancer, it should also be possible to tailor services more to the needs of the individual. As well as resulting in a service that is more carefully tailored, this should help avert expenditure on interventions of limited value.

Examples of the potential for more personalised approaches include:

- Screening – adjusting age intervals and methods to better reflect personal circumstance (for example, in relation to HPV vaccination status), or through better targeted information and engagement with different communities
- Multidisciplinary team meetings – refocusing team meetings on patients with complex needs could ensure specialist attention is devoted to those patients who most need it, streamlining decisions on straightforward treatment approaches in the process. This proposal reflects the ideas presented in previous work on surgery²⁸
- Radiotherapy – personalised treatment protocols can be designed using imaging and tumour tracking, enabling treatment to be adjusted in real time
- Cancer drugs – treatment approaches can be adjusted to reflect issues such as comorbidities or frailty and, increasingly, it will be possible to use treatments targeted at the specific characteristics of a person's cancer

Digital cancer care

The digital delivery of support has the potential to improve quality across the pathway, including through:

- Online symptom checkers for early diagnosis
- Interactive decision-support aids to inform treatment decisions
- Remote monitoring of side effects
- Home consultations with specialists
- The delivery of treatment reminders to improve concordance
- Information that is tailored to a person's needs and circumstances

Maximising the impact of multidisciplinary team meetings

As the demands on cancer services increase, it will not be the best use of resources for all patients to be considered at multidisciplinary team meetings. Instead, team leaders could agree straightforward treatment approaches, freeing up time for patients with more complex needs where treatment approaches require multidisciplinary input.

The impact on caseload of this change will vary according to cancer type. For some common cancers, experts estimated that in up to 80% of cases treatment could be agreed outside the meeting.

The quality of decision-making could be assessed through the peer review of outliers.

Making better use of workforce skills and capacity

Experts across the pathway expressed concern that there is insufficient workforce capacity to meet future demands using existing models of working. There are, however, opportunities to work differently across the pathway:

- Screening: nurses can play a greater role in leading endoscopy services. As demand for cytologists decreases, personnel could be retrained in the analysis of polyps
- Early diagnosis: different members of the primary care workforce could assume urgent referral responsibilities. Earlier diagnosis will create additional demands on imaging services, but it should be possible to train other professionals to read scans (see box)
- Surgery: increasing demand for surgery should not necessitate an increase in the number of trained cancer surgeons, but it will require a redistribution of existing trained personnel. Cancer specialists should be expected to spend a greater proportion of their time operating on complex cases. There is currently an oversupply of specialist registrars. There is a need to encourage more surgeons to undertake generalist or diagnostic roles
- Radiotherapy: it was suggested that therapeutic radiographers are well placed to coordinate the adoption of new imaging technology, due to their involvement in every stage of the radiotherapy pathway
- Cancer drugs: chemotherapy nurses are under increasing pressure and are being diverted away from patient contact and engagement where they add particular value. There is a need to train other staff to help support the delivery of cancer drugs
- Multidisciplinary team working: refocusing team meetings on complex cases will help to tailor treatment approaches to individual patients, but should also help optimise workforce capacity by ensuring that skilled professionals focus on the patients where they can have the biggest impact

The early diagnosis workforce

A range of different professional groups should play a role in different aspects of early diagnosis. For example:

- Urgent referral rights could be given to dentists or opticians who suspect head or neck cancer, reducing demands on GPs
- Healthcare scientists and technicians could be trained to read CT scans, becoming 'diagnosticians'

Making greater use of pharmacists

A surplus of pharmacists is predicted in coming years. Experts identified that pharmacists could play a greater role across the pathway:

- Providing information on screening and potentially distributing screening kits
- Encouraging people with signs and symptoms (for example a persistent cough) to seek help and potentially referring them directly
- Managing patients' medications, including advising on potential interactions between cancer drugs and those for other conditions
- Administering cancer drugs, particularly in community settings

A common theme was the potential of pharmacists to assume a greater role in the delivery of cancer services across the pathway (see box).

A number of clinical experts emphasised the effectiveness of previous national training programmes and suggested that this model should be adopted in future. In particular, training was identified as an important mechanism in ensuring that the workforce is kept up to date with new techniques, building on the previous laparoscopic surgery-training programme.

There may also be ways of freeing up the time of skilled professionals, maximising their focus on patients. As well as enabling the delivery of support closer to home, experts highlighted that technology can play an important role in this respect. They also suggested that new roles can help maximise the time of professionals who are in short supply. The enhanced use of physician associates and medical administrators should be tested.

Even with new models of working and the better utilisation of the existing workforce, there will be shortages in key personnel at each stage of the pathway that do need to be addressed, as set out in the box.

Achieving best value from the procurement of new interventions

Changes in technology will require the procurement of new equipment and supplies. This is particularly the case for surgical equipment, radiotherapy and imaging equipment and the technology required to perform some molecular diagnostics.

This, combined with the need to replace existing equipment, will necessitate significant capital expenditure. Experts suggested that the piecemeal procurement of equipment in the past has not worked well:

- Failing to deliver the efficiencies associated with bulk procurement
- Resulting in the inconsistent roll out of new techniques, with overconcentration in some geographies and under provision in others
- Hindering efforts to evaluate impact or ensure appropriate volumes

Shortages in personnel

The increasing pressure on cancer services is likely to require additional investment in:

- General practitioners
- Radiologists
- Endoscopists
- Radiographers
- Medical physicists
- Pathologists
- Nurses
- Oncologists

Cancer equipment fund

A cancer equipment fund should be established to provide for the procurement of new technologies.

As well as achieving economies of scale, access to the fund could be linked to the evaluation of new interventions and centres achieving the volumes required to deliver appropriate quality and efficiency.

In relation to cancer drugs, NHS England and NICE are leading work to improve the way in which cancer drugs are assessed for use in the NHS and made available in a timely manner. This issue is outside the scope of this project, but – if the benefits of improvements in treatments are to be realised – it will be important to develop a process which better reflects the clinical benefits that new treatments can bring, handles the uncertainties inherent in the evidence for any new treatment and delivers better value for money for the taxpayer.

Ensuring that funding flows support high quality care

It will also be important that funding flows to NHS cancer services reflect the full costs of delivering high quality care and support further improvements. Experts reported that there were examples – particularly but not exclusively relating to surgery and radiotherapy – where the cost of delivering complex treatment was not matched by the funding received. In the past it has been possible to effectively subsidise very complex surgery with the margin made on more straightforward procedures. However, reductions in payments for routine treatment mean that this is now not usually possible. In radiotherapy, uptake of hypofractionated radiotherapy has been hindered by payment mechanisms that have rewarded longer durations of treatment, even when these may not be in the best interest of patients.

Avoiding inappropriate short term savings

Experts across the pathway stressed that, although cancer services are under pressure, it will be important to avoid the temptation to seek short term savings which will have longer term consequences for the quality of services, the cancer outcomes achieved and consequent costs for the NHS.

The table below sets out some examples of inappropriate short term savings across the pathway, which – if implemented – could have negative longer-term consequences.

Table 2: examples of inappropriate short term savings

Screening	Early diagnosis	Surgery	Radiotherapy	Cancer drugs
Delays in rollout of effective screening programmes	Restrictions on investigations and referrals	Increased waiting times	Delays in updating equipment	Reductions in specialist nursing support

Chapter 5: implications of change

Improvements in one part of the cancer pathway can have significant implications for demands on other parts of the pathway. As set out in Chapter 1, late diagnosis and poorer access to effective treatment have been identified as reasons for the disparity in cancer survival between England and other countries²⁹. Experts who contributed to this project also highlighted these issues repeatedly.

Although the causes of late diagnosis and poorer like-for-like treatment outcomes are complex, experts are optimistic that they can be addressed; there is nothing inherent in the population or in the NHS which means that poorer cancer outcomes are inevitable.

Experts believe that the ideas set out in this report will help to close the outcomes gap, both through reducing late diagnosis and improving the effectiveness of treatment, and ensuring universal access to it. This chapter explores some of the implications for health services of achieving progress on both these issues.

Tackling late diagnosis

Late diagnosis is associated with poorer cancer survival. Studies suggest that countries where primary healthcare professionals are more willing to proactively investigate cancer signs and symptoms early achieve better outcomes³⁰.

Previous work by Incisive Health for Cancer Research UK has suggested that, as well as improving outcomes for patients, reducing late diagnosis can avert significant treatment costs³¹.

Earlier diagnosis should also reduce the demand for treatment for advanced cancer, but can be expected to increase demand for earlier stage cancer treatment, such as surgery. Using the cost calculator developed to inform the *Saving lives, averting costs* report it is possible to model the impact in demand for different treatments which would be created by all Clinical Commissioning Group (CCGs) in England achieving the level of early diagnosis of the best³².

The model suggests that earlier diagnosis can be expected to lead to an aggregate decrease in treatment activity, although an increase in treatments for early stage cancer will be required. For example, for lung cancer there would be:

Saving lives, averting costs

If all CCGs were able to achieve the level of early diagnosis of the best in England:

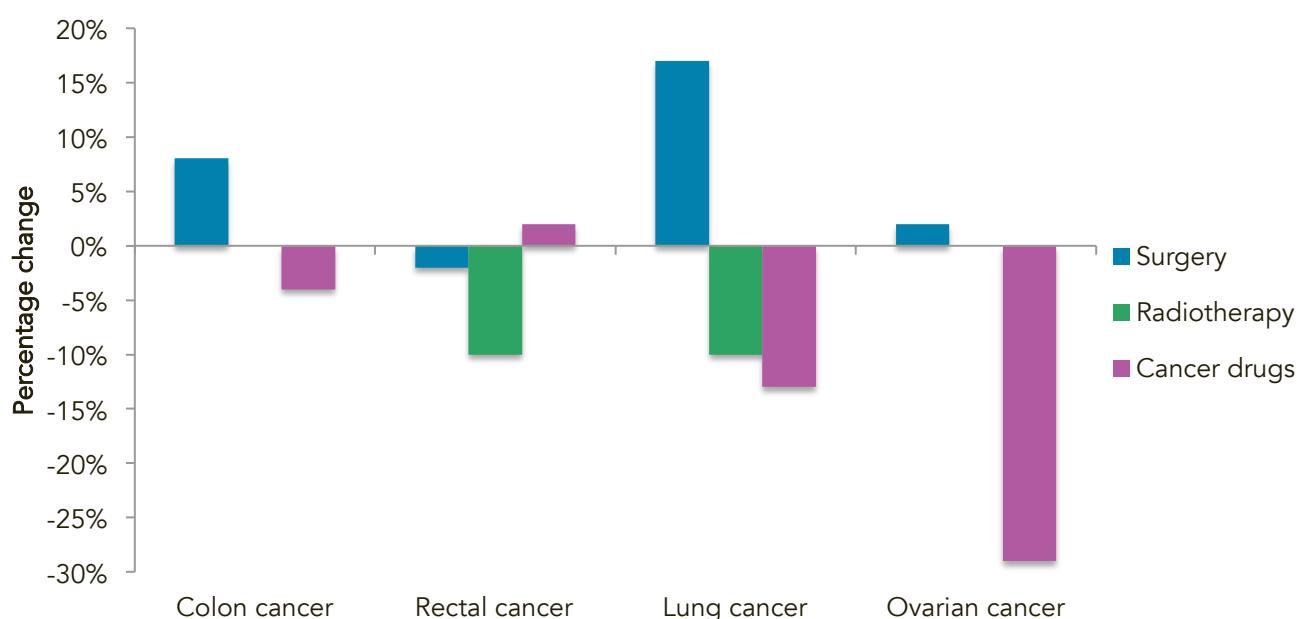
- For colon cancer, savings of over £24 million could be realised (benefitting over 4,500 patients)
- For rectal cancer, savings of nearly £10 million could be realised (benefitting over 1,700 patients)
- For ovarian cancer, savings of over £16 million could be realised (benefitting over 1,400 patients)
- For lung cancer, over 3,400 patients would benefit. Due to the higher level of recurrence that occurs in lung cancer, achieving this level of earlier diagnosis would incur a cost of £6.4 million

- An increase of 17% in surgical activity
- A decrease of 10% in radiotherapy
- A decrease of 13% in the use of cancer drugs

It should be noted that, although surgery is primarily associated with early stage cancer and cancer drugs with advanced disease, there is in fact a good deal of surgical activity in patients with advanced cancer (for example, liver resections for colon cancer) and a good deal of cancer drug usage in early stage patients (for example, adjuvant chemotherapy). Radiotherapy is also used in curative and palliative settings.

The figure below sets out the anticipated changes in treatment activity for colon, lung, ovarian and rectal cancers.

Figure 4: change in the proportion of cancer patients receiving different treatments if all CCGs achieved the 'England best' level of early diagnosis, as set out in *Saving lives, averting costs*



Improving the effectiveness of treatment

Tackling late diagnosis will only improve survival if it is accompanied by access to effective treatment. Evidence suggests that, even when stage of disease is adjusted for, treatment outcomes in England may be poorer than in some other countries. This is probably as a result variations in access to the most effective treatments, or of 'under treatment' (the use of less intensive treatment), which does not reduce the risk of cancer recurrence or spread as much as it could do. Improving the

overall effectiveness of treatment is therefore an important component of improving cancer outcomes and bridging the gap with other countries.

If fewer patients suffer a relapse or recurrence of their cancer following treatment for early stage cancer, then survival will be higher. Therefore an increase in the rate of survival for patients diagnosed with early stage cancer can be a good proxy for the effectiveness of an early stage treatment, as the rate of recurrence will have reduced.

Using the cost calculator developed for *Saving lives, averting costs*, it is possible to estimate the impact that improvements in survival may have on demand for different types of treatment. The table below sets out the projected changes in activity associated with a 10% improvement in five year survival for patients diagnosed with Stage 1 and 2 disease (early stage cancer).

Table 3: reduction in Stage 4 cancer treatment associated with a 10% improvement in five year survival for patients diagnosed at Stage 1 and 2 for colon, lung, ovarian and rectal cancer

	Surgery	Radiotherapy	Cancer drugs
Reduction in number of interventions for colon cancer [§]	188	-	304
Reduction in number of interventions for lung cancer	80	515	587
Reduction in number of interventions for ovarian cancer	146	-	218
Reduction in number of interventions for rectal cancer	112	49	39

The projections in the table above are based on the number of diagnoses and the stage distribution of these diagnoses in 2012. Any change in incidence or the stage at which patients are diagnosed would impact upon these numbers. Larger survival gains for patients diagnosed with early stage cancer could be expected to yield larger reductions in treatment activity.

[§] As five year survival for Stage 1 colon cancer is 97%, this has not been adjusted. Stage 2 five year survival has been increased by 10% as per the other cancers

Chapter 6: conclusion and recommendations

The Government has set a clear ambition that England should have “*world-leading*” cancer services by 2020. Given the gap that exists in cancer survival between England and comparable countries, achieving this ambition will require significant improvements across the cancer pathway. NHS cancer services will need to deliver these changes in a challenging context of increasing demand. Services must also do so against a backdrop of reductions in expenditure on cancer in recent years.

Nonetheless, there are grounds for optimism. Cancer outcomes have improved still further in recent years and, in some areas, the survival gap with other countries has begun to close. Experts believe that the gap can be bridged and have identified a range of changes across the pathway that they consider will be necessary to achieve this.

The changes discussed in this report will require investment and it is important that this expenditure is planned carefully and delivered in a coordinated manner, maximising its impact. Experts also identified a range of ways in which the pressure on expenditure can be constrained, but not removed.

It will be important that the NHS in England seeks to control expenditure in a way which improves quality rather than focusing on short term cuts which will lead to longer term harm. Experts are clear that these opportunities exist; it will be important that the Cancer Strategy sets out how they will be realised.

The ideas presented in this report are intended to make a constructive contribution to the work of the Cancer Taskforce, as well as to help inform discussions about future expenditure plans for cancer services.

Recommendations

In order to ensure that NHS cancer services are in a position to implement the changes identified as necessary by the experts who contributed to this project, we make the following recommendations:

1. Improving or even maintaining cancer outcomes in England will require additional expenditure. In setting out its ambitions for cancer services, the Government should make clear the additional level of investment available to the NHS
2. The Cancer Strategy should prioritise earlier diagnosis and improved access to and quality of treatment (thereby reducing the risk of, or delaying, recurrence). This has the potential to reduce demand for some services and improve outcomes

-
3. Health Education England should undertake a review of the cancer workforce with a view to (a) optimising the existing available workforce, including encouraging non-specialists to assume greater roles in the delivery of cancer care; and (b) identifying shortages and developing strategies to fill them
 4. Harnessing the potential of digital technologies to improve cancer care should be a key theme for the Cancer Strategy. Digital technology offers the potential to improve the quality of support given to cancer patients across the pathway, as well as to maximise the positive impact of healthcare professionals' time
 5. Building on the principles of the Review of Operational Productivity in the NHS the Cancer Strategy should set out how the NHS will approach the procurement of new cancer equipment. Investment in new cancer diagnostic and treatment equipment is likely to be a significant cost in the coming years. The NHS should utilise its bulk purchasing power to achieve better value. National planning and procurement should enable a sustainable approach to the roll out and evaluation of new technology
 6. The Royal Colleges and other professional experts should refine ways of working for multidisciplinary team meetings, to focus on discussing the most complex cases, whilst ensuring appropriate clinical oversight and review of all treatment decisions
 7. NICE, with support from NHS England, should lead a rapid review to update the Improving Outcomes Guidance to inform service NHS England service specifications and contracts for 2016/17
 8. The Cancer Strategy should include an assessment of the anticipated pressures on cancer services and set out the key actions that should be taken to manage these pressures so that all patients get the best care possible, building on the ideas set out in this report

Glossary

- **Access to treatment** – whether patients are able to gain access to particular types of treatment
- **Active surveillance** – a way of proactively monitoring early stage cancer rather than treating it straight away. It is particularly used in prostate cancer
- **Active treatment** – interventions given with a view to managing a person's cancer, thereby extending their life and improving its quality
- **Advanced cancer** – a primary cancer that is unlikely to be cured or a cancer that has spread from its initial site to other parts of the body
- **Age Standardised Rate** – the incidence of cancer adjusted for changes in the age structure of the population. Useful for assessing changes in risk
- **Centralisation** – the process of bringing together similar services into specialist hubs
- **Commissioning** – the process by which services are planned, organised and contracted
- **Demographic trends** – changes in the age, gender and socioeconomic structure of the population
- **Early diagnosis** – diagnosis of cancer before it has spread to other parts of the body
- **Effectiveness of treatment** – the extent to which a treatment achieves its intended goals (often reducing the risk of recurrence or improving survival). Appropriate access to treatment is an important part of effectiveness
- **Expenditure per newly diagnosed patient** – amount of money spent per person who has been diagnosed with cancer within the past 12 months
- **Hypofractionation** – delivering the same dose of radiotherapy over a shorter time period
- **Incidence** – the number of new cases of cancer diagnosed in an identified population within a specified time period
- **Late diagnosis** – diagnosis of cancer after it has spread to other parts of the body

- **Multidisciplinary team** – a group of professionals with different areas of expertise who work together to deliver treatment and care to a patient
- **Per capita** – measurement per head of population
- **Precision medicine** – treatment that is targeted to an individual's genetic or biological characteristics
- **Procurement** – the process used by the public sector to purchase goods and services
- **Radiotherapy** – the use of high-energy rays, usually x-rays and similar rays, to treat disease by destroying cancer cells in the area that's treated
- **Real terms** – the change in a financial number after correcting for the effect of inflation
- **Palliative care** – support to reduce the impact of a disease and / or treatment, often given alongside and after active treatment
- **Perioperative medicine** – the medical care of patients from the time of contemplation of surgery through the operative period to full recovery, but excluding the operation or procedure itself
- **Screening** – the process of testing a defined population of people who do not have symptoms of a disease with a view to diagnosing a condition at an earlier stage
- **Side effects** – negative consequences associated with any treatment, which can be short term or long lasting
- **Spending Review** – the process for allocating budgets to different government departments by HM Treasury
- **Stage** – terminology used to describe the size of a cancer and how far it has spread
- **Surgery** – the removal of a tumour and surrounding tissue during an operation
- **Survival** – the percentage of people still alive after a specified amount of time (often 1, 5 or 10 years) subsequent to a diagnosis of cancer at a specific time (e.g. 2010-11)

Annex 1: methodology

The nature of cancer research means that it is difficult to predict which developments in services will prove to be effective, or indeed how much they will cost. It is, however, possible to project in broad terms the changes that will be needed if England is to bridge the outcomes gap with other countries:

- There is good evidence to support projections of changes in the demand for cancer services
- There are aspects of cancer services where we know that improvements are required to bridge the existing survival gap with other countries and it is therefore reasonable to assume that change should be a priority
- There are proven interventions where further change is required to improve access to services, as well as their quality and consistency, for example in relation to radiotherapy or molecular diagnostics
- There are developments in research and technology which can reasonably be expected, even if it is not possible to predict the specific technologies that will prove to be effective

It is important to note that there are many different dimensions to cancer outcomes, including the number of people who will develop cancer; the number of people who will die as a result of the disease; the quality of life of those living with it; and their experience of treatment and care. This study primarily focuses on the investment decisions required to improve survival, although it is considered that the improvements in the quality of services set out in this report will help improve all aspects of cancer outcomes.

Issues considered

To assess the factors that will impact upon the costs associated with delivering world-leading cancer services and outcomes by 2020, this project has sought to address the following questions:

- What are the demographic trends that will impact upon the cost of cancer services?
- What are the anticipated trends in the delivery of cancer services which the NHS in England will need to adapt to?
- What will be the cost drivers associated with cancer and what opportunities will exist to constrain expenditure without damaging quality?
- What are the opportunities to deliver efficiencies as well as improvements in quality?
- What are the opportunities to shift duties to other parts of the healthcare workforce that may be associated with lower costs and/or greater availability?
- What are the interdependencies between different aspects of cancer care and what areas should be prioritised to improve cancer survival?

Analytical process

In order to address these questions:

- A rapid review of evidence on anticipated costs was undertaken, including assessing existing estimates of the costs and benefits of service changes where they exist
- A series of expert workshops were convened on different aspects of the cancer pathway to consider current gaps in English services compared to countries with better outcomes, the steps that should be taken to address these gaps, and the likely cost drivers and opportunities to ease the funding pressures which may present themselves over the coming five years. A list of the workshop participants is included in Annex 2
- The findings from these workshops were summarised and shared with a wider group of experts for comment. The reports from the workshops are included in Annex 2
- A separate process was undertaken for radiotherapy, whereby a summary of the key issues identified in other meetings was prepared and commented on by radiotherapy experts
- The findings from these workshops were collated and critically reviewed to identify common themes and interdependencies

Issues out of scope

The project considered changes on the cancer pathway, but does not address the issue of prevention, living with and beyond cancer, and end of life care.

It has sought to assess the anticipated changes in cancer services over the next five years that need to be planned for and funded. Given the inherent difficulty in predicting which interventions will be proven to be effective, or indeed what their costs will be, this project has not sought to identify the particular interventions or technologies that will be introduced, nor to estimate their cost, but instead has set out the trends that can be expected, including – in broad terms – where new technologies can be expected to play a role.

A workforce with appropriate skills and capacity will be required to deliver world-leading cancer care. Issues such as NHS pay – an important determinant of health service costs – are beyond the scope of this project.

There has been a good deal of debate about the costs associated with new cancer medicines and other technologies. These costs are subject to a number of variables which are outside the scope of this project, including:

- The outcomes of clinical trials which may be some distance from reporting
- Pricing approaches adopted by manufacturers
- Changes to NHS pricing, reimbursement and procurement policy

Annex 2: workshop participants and summaries

The issues and views summarised in the workshop summaries do not necessarily represent the views of individual participants. All participants attended in a personal capacity.

Screening

Attendees

Professor Wendy Atkin
Mr Tim Elliott
Professor John Field

Dr Anne Mackie
Professor Sue Moss
Dr Peter Sasieni

Discussion

National system

The national system of determining access to screening programmes has important benefits in terms of equity, quality assurance and efficiency. It should be maintained. However, local delivery that is tailored to the needs of the population should be encouraged so as to increase participation.

Changes in the scope of screening programmes

Approving and implementing new programmes

The UK National Screening Committee (UK NSC) advises Ministers and the NHS in all four countries about all aspects of screening policy and supports implementation. Using research evidence, pilot programmes and economic evaluation, it assesses the evidence for screening programmes against a set of internationally recognised criteria.

Implementing new screening programmes involves a range of complex considerations, including:

- Gathering evidence which shows the balance of benefit and harm to otherwise 'healthy' populations
- Appraising the potential for translating the effects seen in a research setting into an ordinary NHS service setting
- Considering the cost and capacity implications of new programmes
- Ensuring that screening is delivered to an appropriate standard of quality and safety

Running pilot projects is key to ensuring that the implications of introducing a new screening programme into the NHS are thoroughly understood before recommending its implementation.

The process for assessing and introducing screening programmes can be lengthy and is often poorly understood. It would be helpful for the UK NSC to consider publishing a clear protocol for the pilot and introduction of new programmes, including:

- Setting out which organisation has responsibility for which decision
- Clarifying the timelines and key decision points
- Establishing timescales for making decisions on the funding of programmes which have been recommended for implementation

This protocol is especially important in the new health and care system where it is sometimes unclear which organisation has responsibility for different aspects of the roll out. In the current economic climate, financial implications and who makes decisions on financing pilots and new programmes should also be clear.

Anticipated developments in screening programmes

It is not possible or desirable to pre-empt decisions by the UK NSC on individual screening programmes. However, in general terms, it is anticipated that over the next two to five years:

- At least one new screening programme for a common cancer will be deemed to be effective, subject to results of research trials
- Further developments will occur in cancers for which screening programmes already exist

Below is a summary of anticipated developments for different cancers:

- Bowel cancer screening:
 - Bowel scope screening will be fully rolled out across the country
 - Use of the Faecal Immunochemical Test (FIT) in place of a guaiac based test will be rolled out
 - It is unlikely that virtual colonoscopy will be deemed to be a valid primary screening test by 2020
- Breast cancer screening:
 - The age extension trial will continue for at least two further screening rounds, and may be extended to women aged 74 – 76 as recommended by the All Party Parliamentary Group on Breast Cancer
 - A decision will be required on the use of 3D breast screening (tomosynthesis), subject to results of ongoing trials
- Cervical cancer screening:
 - Based on the success of a pilot study, primary Human Papillomavirus (HPV) screening is likely to be rolled out across England, possibly from 2017, allowing the safe lengthening of the screening intervals

- The first major cohort of HPV vaccinated women will be eligible for screening from 2020, proving an opportunity to explore more personalised screening, with intervals and methods (such as self-sampling) adjusted for personal circumstances
- Lung cancer:
 - A decision will have been made to pilot lung cancer CT screening for high-risk groups (smokers and ex-smokers) based on the ongoing UK CT screening trial (UKLS) and the pooling of data with the Dutch screening trial (NELSON) by 2017
- Ovarian cancer:
 - The results from the recent sample in the UK Collaborative Trial of Ovarian Cancer Screening (UKCTOCS) found that a new testing method appears to be able to correctly identify more than eight out of 10 women (86 per cent) with ovarian cancer, twice as many when compared with existing techniques. Although this is encouraging, there has been no concrete proof that using the test will save lives
 - Following the full results of the trial, expected towards the end of 2015, a decision will need to be made to pilot ovarian cancer screening, with possible early roll-out if successful
- Prostate cancer:
 - There will be research reporting throughout the next five years that will constantly update the benefit/harm ratio for Prostate Specific Antigen (PSA) screening, although the extent to which active surveillance is accepted as a primary management option and evidence for screening high-risk groups may become available
 - The ProtecT trial will have reported on the optimum treatment for prostate cancer, along with the control trial looking at prostate cancer screening
 - Trials of the use of the PSA test in combination with other tests (such as PCA3 and prostate volume) will be underway

As the population ages and life expectancy grows, there will be a case to reconsider the upper age limits for all screening programmes based on evidence.

There is the potential for risk-based models, which would enable the selection of high-risk individuals, ie for lung cancer, as well as adjustments in the spacing of screening, to be applied to all screening programmes. However, such models are contingent on the availability of appropriate data (see below).

Changes in the technologies used in screening programmes

There are a number of opportunities to improve screening through the use of the technology.

Advances in IT and IT systems

The consistent collection of primary care data would be extremely beneficial, enabling the identification of high-risk people. A challenge is that lifestyle data (for example on smoking) are not currently accurate enough to support the development of risk-based models for screening.

Scandinavian countries are an exemplar in this area and further investigation into what mechanisms they put in place and how this could inform future advances in England should take place.

Medical technology

In terms of medical technology advances, there are three key advances that are expected to progress in the next five years:

- New generation CT scanners for lung cancer have the potential to make imaging more effective and the scans more straight-forward to interpret, increasing the certainty in identifying cancers
- Standing technology could increase the convenience, tolerability and productivity of imaging services
- Computerised reading of scans could increase the accuracy of diagnoses and reduce workforce capacity implications

Changes in participation in screening programmes

Although still higher than in many comparable countries, participation in screening programmes in England is beginning to reduce and it is anticipated that – without action – it will further decline. There are, however, a range of actions which could be taken to address this.

Appropriate information

It is important to ensure that all those invited to screening programmes have the information required, which outlines the major benefits for participating, but also the information on potential harms, prior to making an informed choice. Therefore all information should be easy-to-understand, engaging and balanced. Information should also be developed at different levels for different groups in society.

However, there is a case for making a clearer offer in relation to screening, alongside the information required to enable informed consent. For example, if the information provided prior to screening is too complex it may discourage attendance. Behavioural insights, or “nudge” methodologies, may be useful when developing appropriate information.

Digital engagement

Utilising mobile phones for screening invitations, appointments or text reminders and use of screening apps has the potential to enhance participation.

Mobile phones could be used in the administration of self-sampling techniques to verify whether certain people are suitable for screening (eg to check whether they are in the right age group or haven’t already had the test). This would be easier than using the NHS number, which many

members of the public do not have as readily available. The mobile phone numbers would need to be linked to NHS numbers to ensure that all records are kept up to date.

Consideration should also be given to the role of social media in improving screening uptake, particularly amongst certain groups.

Appointments

The convenience (or otherwise) of screening services can be an important factor in participation. Digital technology offers the opportunity to introduce more flexible appointments.

Local tailoring

Engaging disadvantaged groups is often a challenge with regards to participation. Encouraging the local tailoring of activities would help to engage more effectively with members of the public in their area. This could take the form of redesigning invitation letters and information leaflets to engage with local people or mechanisms to overcome language barriers. It is also important to note that if materials are tailored, changes should be based on solid evidence and that all the key information required for participants to make an informed choice regarding participation is retained.

Role of GPs / pharmacists

Primary care physicians, such as GPs and pharmacists, could also play a greater role in encouraging participation in screening. For example, including endorsement from local GPs on invitation letters, or sending the letters on headed paper from local GPs, may encourage more people to participate. Previous research has found that approximately 10% more people are likely to participate in bowel cancer screening if they are sent a letter of endorsement signed by their GP³³.

Community pharmacy is considered to be an untapped resource in relation to screening. Opportunities should be considered for people to pick up kits or to receive information about screening in their local pharmacy. There are, however, logistical information implications to this given the importance of maintaining accurate information records about screening participation.

Workforce and capacity

Screening programmes can have significant workforce implications and therefore there is a need to plan for future new screening programmes to enable training. There are, however, some opportunities to make better use of existing capacity.

Capacity planning

A key consideration for the implementation of any screening programme is the infrastructure required to ensure that it is implemented safely and to a high standard. Planning for capacity requirements should take place well in advance of the implementation stage of the process to ensure programmes can be implemented safely and to avoid unnecessary stress on the system.

Skills shift

There are opportunities to encourage different groups of professionals to help deliver screening. Examples include:

- Nurse-led services, particularly nurse endoscopists
- Encouraging professionals involved in screening services where demand may decline (such as cervical cytology) to diversify into different programmes (such as the analysis of polyps or DNA testing in HPV primary screening)
- Training radiographers or potentially health scientists to read CT scans, becoming 'diagnosticians' who would work closely with consultant radiologists

In order for this to be achieved the following would be necessary:

- Agreement from professional groups, such as the Royal Colleges
- Appropriate infrastructure to be put in place
- Accredited training courses developed – for example by Skills for Health, Health Education England or professional groups
- The continuation of strict quality assurance in all screening programmes

Other factors

Population-based trials

Given the nature of screening, population-based trials are often required for new interventions and the management of these is complex. There is a risk that increasingly complex and demanding rules relating to consent will deter future generations of researchers from screening trials.

Guidelines for implementation

It would be very helpful to develop consensus guidelines on developing and implementing screening research, including developing and issuing a good practice approach to ethics and consent issues. Cancer Research UK may also wish to raise this issue with the Accelerated Access Review.

Over diagnosis / over treatment

Over diagnosis and over treatment as a result of screening is rightly a key concern. It would be helpful to develop a common definition and approach to measuring this in screening programmes.

Monitoring pre-disease

As our understanding of cancer develops and diagnostic technology improves, it will be increasingly possible to identify patients with signs of pre-cancer (or increased risk of cancer) but where no clinical intervention will be necessary, or indeed, possible. Although this is beyond the scope of population-based screening programmes, approaches will be required to support people through

enhanced surveillance and counselling. In particular, people with an elevated family risk of cancer will require support.

Early diagnosis

Attendees

Ms Celia Ingham Clark
Dr Pawan Randev
Professor Greg Rubin

Ms Julia Ozdilli
Dr Richard Roope

Discussion

Public behaviour

For cancer to be diagnosed early, the public need to be:

- Aware of the signs and symptoms of cancer
- Empowered to seek help in a timely manner

'Hard-to-reach' groups

The Be Clear on Cancer campaigns have been effective in increasing awareness of cancer symptoms. However some demographic groups in society may be harder to reach than others and different groups will respond to messages in different ways. Targeting and tailoring support will be necessary to ensure that cancer is diagnosed early in all groups in society.

For some groups, it will also be important to ensure that people are aware of what services are available and understand how to access them. There are groups that do not understand the structures of the NHS and that primary care is the first port of call. Others may be deterred by the difficulty in accessing their general practice by telephone to book appointments. Therefore, there is a role for navigators to help those who have a suspected cancer through their appointments and treatments. Overcoming language barriers and helping to explain the process may increase the use of services that support early diagnosis.

'Normalisation' of cancer

Even when awareness of cancer signs and symptoms exists, people may be inhibited from seeking help by stigma or fear. In order to address this, it will be necessary to normalise discussions about cancer, but also to demonstrate that, if diagnosed early, cancer can be effectively treated.

Addressing misperceptions about the impact and toxicity of treatment will also be important, particularly amongst older people whose attitudes towards cancer and its treatment may have been formed decades ago.

Healthcare professionals also have a role to play in normalising cancer – talking about signs and symptoms, its impact and how well local services are performing.

Role of family

Evidence suggests that people are often unwilling to ‘bother’ their GP with symptoms they consider to be minor – for example a cough that they have had for three weeks. There may be a role for family members to encourage relatives to visit their GP. For example, more could be done to support younger relatives in encouraging people with signs and symptoms to seek appropriate help.

Health literacy

Health literacy can be a barrier to communication with healthcare professionals regarding cancer symptoms and diagnosis; if people cannot articulate signs and symptoms, it can be difficult for GPs to identify them. There should be more education on key health issues, such as cancer symptoms, for example in schools or through TV series that are widely viewed by the public. People should be aware from a young age that the early diagnosis of cancer can help to increase survival.

Professional practice

Primary care professionals play a key role in the identification and treatment of cancers. The below summarises some barriers and advances for the future that are required to improve early diagnosis.

Variation in nature of GP practices

There are a number of different types of GP practices. For example:

- Multi-partner GP practices
- Practices with GP trainers who are up-to-date with processes and procedures
- Practices with high numbers of locum GPs
- Single-handed practices

It is important to recognise this variation in designing support for general practice in relation to cancer. The development of GP federations, multi-specialty community providers and primary and acute care systems provide opportunities to accelerate learning and ensure access to greater cancer expertise. Such organisations should designate a cancer lead or champion to lead on service and practice improvement.

Referral for investigation

Lowering the threshold of suspicion for investigation, as encouraged in the recent changes to the NICE guideline, will be important in encouraging earlier diagnosis. GPs should be empowered to carry out the ‘right’ tests for their patients, rather than ensuring that every test they request finds cancer. In order for this to be effective, GPs should receive the results to the tests they request promptly, including any necessary interpretation of the result and the Practice needs a mechanism for all test results to be seen and acted on in an appropriate and timely fashion by the requesting

clinician. Resource constraints have shifted from pressure to reduce the number of diagnostics and tests requested, to constraints on GP time and capacity.

Key to empowering GPs to request diagnostic tests and investigations is appropriate feedback mechanisms. This feedback will be important for GPs to understand whether they are appropriately requesting tests and investigations as well as helping to change the current culture regarding referrals. Feedback should be moderated at an individual and practice level and could be included in the practice profiles. There should be no repercussions for ordering tests if they were right for the patients, whether cancer is diagnosed or not.

Education

The GP appraisal and revalidation process should be updated to encourage clinicians to study a wide variety of topics from the curriculum, including specific issues such as cancer, and areas where there are the greatest needs, rather than carrying out CPD in the topics that are of most interest. For example, the Royal College of Anaesthetists, whose curriculum for CPD covers the breadth of the specialty, requests that every consultant anaesthetist carries out a spread of CPD that covers the whole curriculum every five years.

It is understood that work in GP CPD training is being undertaken in Denmark. Further investigation is required to identify any key learnings that could be applied in England.

The nurse revalidation process, which is currently being reviewed, should also explicitly include cancer.

Workforce and equipment

There are a number of concerns regarding capacity and the workforce required to improve the early diagnosis of cancer. In particular, there will be greater demand for:

- GPs
- Radiologists
- Endoscopists
- Pathologists
- Radiographers
- Ultrasonographers

An increase in early diagnosis of cancer, including through routes such as screening and increased referral of symptomatic patients (as is currently the case for colorectal cancer), will increase demand and pressure on early stage treatment services.

Role of nurses and pharmacists

There is an opportunity to appropriately increase the role of GP nurse practitioners and pharmacists, taking into account their specific skills and expertise, to relieve pressure on GPs. This would not be in terms of diagnosing cancer symptoms, this should continue to a role provided by GPs, but in terms of carrying out some of the activities that would be appropriate given their expertise, to free up GP time. Further suggestions are outlined below.

The introduction of practice cancer nurses – similar to diabetes nurses – would help enable more patients to be managed in primary care. These nurses would be provided with expert training and knowledge of cancer and provide support to patients, guidance on managing treatment and care and advice on referrals to other professionals.

Where possible, non-branded and local or community pharmacists should also be utilised more effectively to engage with hard-to-reach groups, as they tend to have a continuity of interaction with patients. Some services could also be offered by pharmacists, for example questionnaires about lung cancer and care for chronic conditions, to free up GP time. A primary care commissioning report, due to be published shortly, is looking at capacity and the increased utility of pharmacists.

There is also an increased role for dentists and ophthalmologists.

Equipment

In addition to ensuring that concerns around workforce capacity are managed, it will be important to ensure that the necessary equipment is also available to meet the rising demand. For example, making sure that high quality equipment such as CT or MRI scanners are available is important.

There are also new diagnostic modalities on the horizon, for example breath tests and blood tests that potentially have a good predictive value for some cancers, and could help to improve and speed up diagnosis.

Doing things differently

In order to improve the early diagnosis of cancer the following advances should be considered.

Teachable moments

Greater use could be made of teachable moments, for example when someone has been investigated for potential cancer but tests have proved negative. Information about reducing risk factors and identifying signs and symptoms should be provided at a time when people are likely to be receptive to such messages. Importantly, people should not be discouraged from seeking further help or made to feel as though they inappropriately sought help. Letters to GPs (copied to patients) should include this information.

Non-specific symptoms clinics

Many cancer symptoms are an indication that something is wrong, but are not definitively cancer. There is a risk that patients with such symptoms are subject to repeated visits to their GP (and potentially repeated referrals to secondary care) due to the absence of a clear diagnostic or referral pathway.

In order to more rapidly investigate undifferentiated symptoms, specific clinics or multi-diagnostic centres should be developed. It will be important that these clinics have access to a range of diagnostic tests and that appointment times are longer so as to enable detailed discussion and investigation. Work is being undertaken by the Accelerate, Coordinate, Evaluate (ACE) Programme through the Vague Symptoms Cluster Network, to investigate a specific pathway for people with vague, but concerning symptoms.

Urgent referral rights

Urgent referral rights should be extended to other healthcare professionals who are likely to see patients with symptoms (for example opticians for optical cancer, pharmacists for lung cancer, dentists for mouth cancer).

Secondary care clinicians should also be able to make 'internal urgent referrals' if they feel that another speciality should investigate potential cancer.

Case finding in primary care

There should be more effective case finding in primary care that would help to diagnose cancer earlier and avoid emergency admissions. For example:

- Chronic obstructive pulmonary disease (COPD) patients should be monitored and considered for regular imaging tests such as low-dose CT
- Patients with changing bowel habits would be referred for lower gastrointestinal endoscopy
- Smokers should be monitored
- High risk patients who may have secondary cancer should be monitored

Cancer rehabilitation and survivorship

With the increase in the number of people living with and surviving cancer, the demands on primary care to support people living with and beyond cancer will increase significantly. Although this will create capacity challenges, it also creates the opportunity for primary care to develop greater expertise in cancer, for example emulating the model that is used in diabetes. It also strengthens the business case for investment in cancer-specific nurses in primary care, and for enhanced training in cancer issues.

It was noted that the Dutch Cancer Society is undertaking activities to improve the quality of life for cancer survivors. For example, they have launched a central information platform and online meeting place for cancer survivors and their friends and families. Further investigation is needed into

what other activities are taking place and whether they provide any best practice examples for England.

Role of technology

There is an opportunity to increase the role of technology to encourage people to seek help at an early stage. These advances have the potential to improve the identification of symptoms and reduce barriers to seeking professional advice.

For example:

- Online information sources, such as NHS Choices, can make it easier for people to check potential symptoms
- Skype consultations or picture messages can make it easier to access professional assistance
- Symptom algorithms could be developed so that people can assess whether, when and how they should seek help. Such algorithms could be used as and when patients are considering booking a GP appointment, providing additional information to inform the consultation

Efficient use of data

There is an opportunity to harness the use of NHS data more effectively to improve the coordination of primary and secondary care services through the implementation of joined up primary and secondary care records. Ensuring that there is consistent coding will be key to success, particularly if records are to be used as the basis for case-finding.

Surgery

Attendees

Mr John Butler
Mr Michael Machesney
Professor John Primrose

Mr Ben Challacombe
Professor David Neal

Discussion

Pressures on services

Pressure on surgical services is likely to increase for the foreseeable future, due to a combination of factors:

- Rising cancer incidence – the number of new cases of the majority of cancers are likely to grow steadily, in part due to the ageing population, increasing demand for surgery
- Improving early diagnosis – the increasing focus on early diagnosis within the NHS will mean that more cancers will be diagnosed at a point at which surgical intervention is possible
- Improving active treatment rates – efforts to reduce under treatment and increase the proportion of patients receiving active treatment will inevitably create greater pressure on surgical services

- Increasing treatment of older people – as more older people with multiple co-morbidities are diagnosed with cancer, there will be an increasing demand for complex surgery
- Advances in other forms of treatment – greater efficacy of adjuvant drugs in shrinking tumours will enable more surgeries to be performed on more complex cases as more cancers will become operable
- Increasing use of diagnostic tests – the trend towards carrying out more diagnostic tests on patients will lead to the discovery of more tumours that may require surgery

However, it is also possible to identify a number of trends that will reduce demand for some forms of surgery:

- Advances in surgical techniques – the increasing use of minimally invasive surgical techniques may prevent complications from occurring, reducing the need for subsequent surgery
- Falling incidence of some forms of cancer – while incidence of the majority of cancers is projected to increase, some types of cancer, such as lung cancer, are likely to become less common, leading to a fall in demand for surgery. However this is a long term trend and the effects on demand for surgery may not become evident in the next five years
- Risk stratification – there may be greater adoption of active surveillance techniques for some forms of cancer (primarily prostate)
- Increasing effectiveness of other forms of treatment – as advances are made in chemotherapy and radiotherapy it may be possible to cure an increasing number of cancers using treatments other than surgery

Overall, despite the existence of factors that will limit demand for some forms of surgery, it is likely that pressure on services will increase over the next five years.

Capacity

Rising demand will require additional investment and resources in order to enable services to cope with higher volumes. However, it will also be important to take action to allow existing capacity to be utilised as efficiently as possible as services are already coming under strain.

Theatre capacity

One of the major issues with current capacity that is affecting the ability of services to manage rising levels of demand is a shortage of theatres. There is a particular shortage of theatres that are equipped to deliver specialised surgeries such as robotic and laparoscopic procedures. This can lead to an emphasis on carrying out surgery quickly, which can impact on outcomes, as quick surgeries are not likely to be as comprehensive. Without changes, pressure on theatre capacity is likely to worsen as demand increases.

Minimally invasive surgery could be made more efficient by making changes to the configuration of theatres and teams, with two theatres running multiple surgeries with the same surgeon each day to maximise turnaround time. Starting surgeries earlier in the day could also increase the efficient use of current capacity.

Optimising surgical output

Currently, the majority of specialist surgeons are only able to spend a small proportion of their time carrying out surgery compared to surgeons in other countries, such as those in the United States. Recruiting more generalists and specialised diagnosticians would help to ensure that specialised surgeons could dedicate more time to carrying out more complex surgeries.

The stability of personnel in surgical teams is a major factor in delivering good outcomes, as this enables a greater number of surgeries to be delivered safely and efficiently. Methods to ensure continuity in anaesthetists and theatre nurses should be considered.

Bed shortages

In some cancer centres, shortages of critical care beds is a major issue, creating bottle necks that impact on the number of surgeries that can be carried out. While it is possible that increasing the efficiency of perioperative procedures could go some way towards alleviating pressure on demand for critical care beds, it is likely that the number of beds will need to increase.

7 day working

The ambition to deliver 7 day working for surgical services is unlikely to lead to significant increases in capacity but may result in existing capacity being distributed differently. The priority for weekend care should be to ensure that sufficient expertise is available to deal with complications of operations that have taken place during the week, as the 'failure to rescue' these cases is one of the leading causes of poor outcomes in cancer surgery.

Workforce

Changes to the surgical workforce are required in order to deliver services that are able to cope with rising demand while delivering improved outcomes.

Maximising the efficiency of the workforce

As set out in the *Shape of Training Review*, there is an ongoing debate around the balance between specialists and generalists in the medical workforce, including within surgery³⁴. As the current surgical workforce was not in the scope of Shape of Training, there is a need for a comprehensive workforce assessment to be carried out in order to assess the current and future need for staff in surgical teams. Issues with the surgical workforce are not limited to cancer teams, so the problem will need to be tackled by a broader review of the workforce requirements across surgical services as a whole. The review would need to consider how to deal with the current undersupply of nurses,

oversupply of specialist registrars and how to incentivise a greater number of trainees to move into generalist and diagnostic roles where demand exists.

Increasing demand for surgery should not necessitate an increase in the number of trained cancer surgeons, but instead a redistribution of existing trained personnel, with more surgeons focusing on emergency and day case work.

Developing practice

There are a number of areas in which changes to clinical practice are likely to be required in order to deliver services that are able to cope with rising demand while delivering improved outcomes.

Perioperative medicine

Ensuring that patients are as fit for surgery as possible through exercise and smoking cessation programmes could deliver improvements in the efficiency of and outcomes delivered by units. Perioperative physicians should be included in multidisciplinary teams in order to provide specialised assessment of patients with complex comorbidities before and after surgery. Consideration should be given to whether examples of best practice in proactive care of older people going to have surgery could be implemented on a wider scale, such as the Proactive Care of Older People undergoing Surgery (POPS) model developed at Guy's and St Thomas³⁵.

Multi-disciplinary teams (MDT)

As demand for surgical services grows, pressure on MDT capacity is increasing. Steps should be taken to maximise the efficiency and effectiveness of MDT meetings, as they require the presence of large numbers of highly skilled staff for a considerable amount of time. Alternative models of MDT meetings could be explored in order to deliver efficiencies. For example, MDT meetings could be streamlined to focus on the most complex procedures or where there are different potential approaches to treatment, as many cases that currently undergo close examination do not require this level of scrutiny.

Treatment approaches for straightforward cases could be agreed by team leaders, including pathologists / radiologists. Subject to the agreement of the other leads, this would enable swift decisions to be made and free up time in MDT meetings. The establishment of such an approach would still require specialist review of treatment strategies where 'hub and spoke' approaches to the delivery of surgery are adopted.

The proportion of complex cases varies between surgical disciplines, but could be as low as 20% for some cancer specialties, meaning that a significant amount of MDT time could be used more efficiently.

Reconfiguration

Reconfiguring the design of surgical services to enable improvements in quality and reduce variations in access is a major challenge. The trend of recent years of centralisation of services is likely to continue. However, it will be necessary for a balance to be struck between centralisation and accessibility.

The case for further centralisation

While the majority of data suggests a positive relationship between volume and outcomes, the strength of evidence for centralisation of services varies between disciplines. The case is currently strongest for prostate, bladder, complex kidney and colorectal services^{36,37}. Further research will be required in order to assess which other services should be prioritised for centralisation. However, it seems reasonable to assume that surgical teams that perform higher volumes will achieve better outcomes.

It is important to note that given the interrelationships between different forms of surgery, it would not be appropriate to centralise cancer surgery services in isolation. Instead, surgery for particular disciplines will need to be co-located in the same centres.

Models of centralisation

The reconfiguration of trauma centres into different levels of service based on capability and capacity could be considered as a potential model for the redesign of surgical services. A top tier of centres could be established to carry out major resections and a secondary category of units could deliver more routine procedures. An accreditation system would be required to ensure that only those units that have the necessary capacity, workforce and expertise are certified within the various tiers.

It is notable that some international centres are now performing very high volumes. For example, the Martini Klinik in Germany carries out 2,200 radical prostatectomies each year, a greater number than any other centre in the world and 1,900 more than the highest volume NHS provider³⁸. Following this model may be currently unrealistic for prostate surgery in the UK as it would require a radical shift in configuration, but doubling the number of prostatectomies being carried out in leading units in England could mean that the number of centres could be reduced to 10 units across the country.

When designing models for service redesign, positive and negative lessons should be learned from previous reconfigurations of surgical services that have taken place in London, Oxford, Edinburgh and Leeds.

Local reconfiguration

The role of the District General Hospital (DGH) would have to change to enable the centralisation of surgical services. While complex surgical services may be removed from DGHs, some services could be move the other way, in order to reduce travel time for some patients.

For example, the establishment of difficult symptom clinics in local hospitals run by trained diagnostic clinicians could help to improve rates of early diagnosis. This would simultaneously allow people to be assessed closer to home and relieve the burden on specialist consultants to carry out diagnostic clinics in major centres.

In addition, delivering other cancer services such as oral and sub-cutaneous chemotherapy in the community could provide a trade off for patients who would have to travel further for major operations, as they would be able to receive follow up care and additional treatment closer to home.

Separating emergency and elective services

In some areas, making changes to the configuration of emergency and elective service pathways could help to deliver better use of existing capacity. If services do not have sufficient capacity to deal with emergency cases, this can have a negative effect on elective cancer surgery, resulting in patients having to stay in non-surgical wards, cared for by non-expert teams. Consideration should be given to whether more emergency and elective surgery services should be separated, in line with the changes that have already been implemented by several trusts, including Guy's and St Thomas', Oxford, Newcastle and University College London.

Making the case for centralisation

It is important that any reconfiguration of services takes account of the geography of England and the ability and willingness of patients to travel to major centres. Previous attempts to reconfigure services, both successful and unsuccessful, have demonstrated the need for the public to be persuaded of the case for reconfiguration. One way in which this could be done would be to ensure that patients are aware of the data that demonstrates the clinical case for centralisation.

Updating Improving Outcomes Guidance (IOG)

In order to establish and encourage the improvements to service that are required to deliver world-class outcomes, national level guidance must be consistent with the latest evidence on best practice.

Many of the original IOG documents are now over a decade old and therefore do not reflect the latest evidence or technologies. There is a need for the IOGs to be updated to take account of recent evidence on caseload, quality metrics, clinical practice and international comparisons.

Updating the IOGs should not be a lengthy process and, in order to realise improvements in the near future, any update would need to be carried out rapidly and supported adequately. NHS England and NICE should therefore carry out a rapid review of the IOG by the end of the 2015/16 financial year, utilising the expertise of relevant Clinical Reference Groups (CRGs) to produce service specifications to be included in contracts for 2016/17.

Technology

The NHS should be a world leader in the early adoption of technology, but historically this has not been the case. Better and wider adoption of technological advances will be required in order to deliver services that are able to cope with rising demand while delivering improved outcomes.

Barriers to adoption

A number of barriers have prevented the rapid adoption of advances in the past, including:

- Funding – the necessary capital funding has not been readily available for many surgical advances and the tariff has not been updated to reflect the increased cost of complex surgeries. This has meant that many hospitals have been forced to rely on charity funding for large capital investments in the past
- Pathway costing – costs for the patient pathway could be considered as a whole by a single commissioner, which would enable spending decisions on technology to be made as part of a broader consideration of the pathway. However this is difficult as no commissioner is responsible for the whole cancer pathway
- Commissioning prioritisation – commissioners of most surgery services are not experts in the field, so may be more difficult to persuade of the clinical case for the adoption of new technology and instead may prioritise other less complex areas of healthcare for expenditure
- Scale – some new technologies will require high volumes to be financially viable. These volumes may not always be achievable based on the volume treated with current technologies

Developments in surgery

Barriers to the adoption of technology must be overcome as investment in both current technology and future advances will be required to ensure that the NHS keeps pace with international standards:

- Image guided surgery – image guided surgery is the innovation that is most likely to transform cancer surgery in the near future. While such techniques are still in their infancy, it is likely that they will be increasingly used in prostate surgery in the next five years. Decisions will therefore need to be made about capital investment, including where these techniques are initially trialled
- Robot-assisted surgery – this form of surgery is becoming the standard for some procedures and it is likely that there will be increased use of robots in other disciplines, including colorectal surgery, when evidence shows patient benefit. This will require significant levels of capital

investment, as new machines will need to be purchased, while replacements will need to be bought for older, obsolete systems

- Intraoperative radiotherapy – although it is not currently routinely available, demand for this form of surgery will likely increase in the future and while it would be expensive to equip theatres to deliver it, it could deliver cost savings through reductions in the number of repeat procedures that are required

Given the constantly evolving nature of the field of surgery, it is likely that there will be additional developments to the existing technologies set out above in the next five to ten years which the NHS will need to adopt in order to keep pace with the rest of the world and improve outcomes

New surgical technology fund

In England, there is currently no centrally dedicated fund to provide the capital investment resources necessary to ensure that the NHS keeps pace with emerging international best practice in the use of technology. This situation has a number of drawbacks:

- There is no clear funding route for new medical technology or equipment
- Where technology is introduced, it is often done so in a piecemeal fashion, resulting in inequalities in access
- It is harder to support the introduction of new technology without appropriate training
- It is more difficult to evaluate the impact of new technology

The establishment of a dedicated Fund, together with leadership at the national level would be a significant step forward in enabling the NHS to plan the introduction and adoption of surgical advances that could deliver improved outcomes for patients.

Dedicated funding could be used to assess the business case for a technology and design a process of small-scale evaluation process that would generate evidence-based recommendations on wider adoption. Mechanisms for the administration of a fund at the local level should be explored, for example the ability of Academic Health Science Networks to evaluate local needs, make recommendations on funding and manage implementation, should be considered.

The establishment of a fund could also help to secure better value for taxpayers by making the procurement of technology more cost efficient. Perhaps surprisingly, in the past the NHS has not made much use of its considerable purchasing power when procuring expensive equipment. The NHS should make use of its power as a bulk purchaser in order to deliver better value. A procurement strategy could be developed alongside the establishment of the dedicated Fund to inform decision-making on capital investment in surgery. This could then influence the centralisation of services as strategic decisions on where to locate machines could be taken centrally, to ensure optimal population coverage.

Equipment replacement

It should also be noted that some high cost equipment is becoming obsolete. For example, the first generation of da Vinci robots will need replacing in the next five years. This demonstrates the need for a longer-term procurement strategy, to ensure that plans are in place to update and replace technology where necessary.

Levers to deliver improvements in quality

A variety of levers are available to system leaders that will enable them to drive the improvements in the quality of surgical services. These levers will need to be utilised in order to deliver services that are able to cope with rising demand while delivering improved outcomes. This will include the centralisation of services for indications where evidence of a positive relationship between volume and outcomes exists.

Data

Data are becoming increasingly powerful in the NHS as a tool for assessing and improving outcomes. Within surgery, patient awareness of outcomes data is starting to influence behaviour and choice of services. It is therefore becoming increasingly important to capture, publish and utilise data effectively.

Data collection should be standardised and streamlined in order to reduce administrative burden on staff. Data on surgery are already collected in surgical audits, through Hospital Episodes Statistics (HES) and by the National Cancer Intelligence Network (NCIN), so these datasets should be linked on the principle of 'Do Once and Share'. Standardising data collection would help to reduce the number of un-staged cancers, which represents one of the biggest gaps in the current knowledge base for surgical services and other parts of the pathway.

The primary measure of quality currently used to assess surgical services, 30 day mortality, is limited in usefulness and should be incorporated into a broader scorecard that takes a wider range of measures into account. These could be developed for each speciality based on updated IOGs but could include positive margins, functional outcomes, patient reported outcome measures (PROMs), the proportion of patients not receiving surgery, failure to rescue rates and longer-term survival.

Putting in place requirements for data collection to assess the quality of services may drive centralisation of services as smaller services may not be able to deliver the same level of outcomes as larger centres.

Publication and transparency

Transparency of data is important, however it is vital that openness does not lead to perverse consequences. It is possible that the publication of consultant level outcome data may have had a detrimental effect on clinical practice, as some surgeons may have become more risk averse.

Outcome data should therefore be published on a unit or team basis rather than individual consultant level. Performance management of individuals should be overseen by trusts.

Utilisation

The extent to which commissioners currently utilise outcome data to make decisions on services is unclear. Given the importance of data in determining decisions around pathways and reconfiguration it will be necessary for commissioners to make use of data on surgical outcomes to identify and encourage best practice and hold services to account. Equally, data should be fed back to units to ensure they are able to take action to improve performance where necessary.

Accreditation

Currently, the majority of outcomes data are self-reported, with limited regulation or accreditation. The establishment of an accreditation committee should be considered to review services every three years against a set of rolling IOG standards. This would help to assure data and provide a peer review function to highlight where improvements could be made in a constructive manner.

Funding

It will be vital to ensure that surgical services are properly funded if greater centralisation is to take place, as current tariffs do not fully reflect the costs associated with complex surgery. Centralising services would therefore concentrate losses unless action is taken to reform current funding mechanisms. For centralisation to be viable, major centres must be appropriately reimbursed through the tariff for carrying out greater proportion of complex cases. It is therefore important that if the IOGs are updated NHS England and Monitor ensure that the anticipated effects on caseload are taken into account in the tariff for 2016/17. If the tariff is not updated there will be implications for the potential for improvements to be made, as hospitals will not be able to resource their surgical services to the required standard.

Service specifications

The development of updated service specifications based on revised IOGs could drive further centralisation of services where appropriate as smaller units may be unable to deliver the requirements for type one units. In order to ensure services reflect specifications it would be necessary to have appropriate financial sanctions in place for underperforming units.

Chemotherapy

Attendees

Professor Martin Gore
Professor Adrian Newland
Ms Kellie Peters

Dr Janine Mansi
Dr Catherine Oakley

Discussion

Demand for chemotherapy

Demand for chemotherapy services has risen in recent years, as a result of a combination of a number of factors, including:

- Rising incidence of cancer – the overall number of people diagnosed with cancer has increased steadily in recent years, a trend that is expected to continue for the foreseeable future
- The development of new treatments – the growing number of new therapies has increased the ability of clinicians to treat more patients for longer and with more lines of chemotherapy
- Improved tolerability of some newer agents has meant that more patients are able to withstand chemotherapy than in the past

These trends have resulted in increased pressures on chemotherapy services, which are now operating at a much higher level of productivity than they were a few years ago. This context needs to be taken into account in planning to meet future demands – many of the ‘easy’ efficiency gains have already been realised³⁹.

In the absence of comprehensive information from the SACT dataset, it may be possible to use the cancer waiting times database to estimate changes in demand for chemotherapy.

Future demand

The trends of recent years will continue – more patients will be diagnosed with cancer and more will be able to benefit from chemotherapy. Increased investment will be required to ensure that the capacity is available to meet this demand in a safe and effective manner. There are, however, a number of factors that could serve to constrain future increases in demand to some degree.

Earlier diagnosis

Although outside the scope of this workshop, it was noted that diagnosing more people with cancer at an early stage would help reduce the demand for treatment for advanced cancer, of which chemotherapy is a core component.

Changing demographics

In some urban areas, such as London, there have been considerable demographic shifts in recent years, leading to populations that are younger than the national average. This may result in lower cancer incidence in such populations and a greater number of patients who are suitable for curative treatment.

Improved early stage treatment

Demand for treatment for advanced cancer can also be constrained by reducing rates of recurrence or relapse. This means further improving the effectiveness of treatment for early stage cancer. However, better early stage treatment may involve the use of more adjuvant or neo-adjuvant chemotherapy.

Improving decision making on treatment continuation

Earlier decisions about the effectiveness of treatment could help manage demand, meaning that patients are switched to other treatments more rapidly. 'Stop and swap' approaches would require a shift in clinical practice towards earlier assessment of patient response to treatment and following up in the weeks after treatment, instead of routine appointments every three months. One way in which this could be done would be to increase the use of functional imaging to ascertain whether tumour signals have been 'switched off' during treatment. This would provide more certainty to guide decision-making on treatment continuation.

A similar approach is taken in France and an assessment should be made as to how this could be replicated in England. However, functional imaging is more readily available in France, so investment would be necessary to enable clinical practice in England to follow suit.

Proactive approaches to 'stop and swap' are considered preferable to limiting costs by restricting the availability of treatments.

Although many cancers are increasingly treatable with drugs and in combination with other treatments, continuing treatment will not always be the most appropriate option. It is important that patients are offered early access to high quality palliative and end of life care. The Christie's Supportive Care Initiative should be considered as an example of best practice in supporting and assisting patients in making appropriate decisions on treatment⁴⁰.

Managing capacity

There are also steps that can be taken to manage capacity more effectively.

Improving efficiency of toxicity monitoring

One area in which services could be made more efficient is in blood count testing ahead of treatment, as testing patients on the day of their treatment can result in delays if they are not able to receive treatment at that appointment. Carrying out remote toxicity assessments before attending clinics could help to reduce strain on capacity, as patients would not have to attend appointments that are not appropriate. The findings of the eSMART trial of electronic symptom management monitoring that is currently being undertaken should be closely considered to ascertain whether there are protocols that should be adopted and standardised across England.

The use of remote monitoring systems should be focused on pragmatic aims as a starting point, with blood count monitoring the most pragmatic first step. However, given the growing availability of technology that enable patients to remotely self-monitor their condition, in the future systems could be developed to monitor other indicators, including tumour markers, symptom development and treatment adherence. In the longer term, to ensure that providers adopt technology where it could help improve service capacity, NHS England could develop a digital chemotherapy specification or add requirements to existing specifications as they are developed.

Improved prevention and management of serious side effects

The greater numbers of patients who are receiving chemotherapy will result in greater demand for acute oncology services. The neutropenic sepsis audit has highlighted that there are currently inefficiencies in the operation of acute oncology services, which will need to be addressed to provide additional capacity. Improving acute oncology services will require changes to be made across a number of areas:

- Improved communication and education to encourage patients to be more active in seeking medical assistance
- More effective triaging of patients who present at A&E, including through the presence of a cancer specialist within A&E services
- Create better links to primary care and local cancer services to ensure patients are referred appropriately and promptly

Optimising delivery of new treatments

Some new treatments, particularly immunotherapies, may require frequent intravenous (IV) administration to be effective. This could place further pressure on chemotherapy services that are already close to capacity. Steps should therefore be taken to develop a sub-cutaneous route for the delivery of appropriate treatments, which could enable them to be delivered in alternative settings, with fewer demands on chemotherapy IV services.

Workforce

There is a range of workforce issues that need to be addressed in relation to the delivery of safe, effective and convenient chemotherapy services.

Changing the workforce

The need for a greater number of chemotherapy nurses and clinical nurse specialists will become increasingly apparent as demand for services grows. However, the long-term problems in the retention and training of nurses mean that it is unlikely that this problem will be solved in the near future. Therefore, there is a need for alternative solutions to be found to enable the existing nursing workforce to focus on providing more specialised care and support to patients.

Role of pharmacists and others

This could involve training other staff to carry out the delivery of treatment in chemotherapy units, such as physician associates, technicians and pharmacists. This would free up nurses' time so they are able to provide more personalised support, including discussing the management of potential side effects. This could help to ensure that patients are better prepared for their treatment and are better equipped to manage side effects.

The current oversupply of community pharmacists in the NHS should be considered as a means to fill gaps in oncology staffing. As well as potentially taking on a new role in the delivery of treatment, pharmacists could have a greater role in medicines optimisation for chemotherapy services, helping to balance the medication that patients are taking and providing support for patients who are managing side effects.

Growing the workforce

Given the rising demand for services, increasing the workforce is also necessary to keep pace with pressure on units and deliver improvements in outcomes. There is a need for a whole workforce assessment to ensure that the future workforce is equipped to manage the demands associated with rising incidence.

Currently the ratio of oncologists to cancer patients in England is much lower than leading countries in Europe. High levels of demand on services and pressure on consultants' time could lead to patients not receiving the optimal level of treatment. For example, some consultants may not have the time required to enrol patients in clinical trials, which can be a time consuming process. Growing the consultant workforce would allow individual consultants to dedicate more time to patient-focused research, which could help to create more evidence based medicine within the NHS.

While increasing the number of specialist staff is a long-term process, given the requirement for training, efforts should be made by 2020 towards increasing the number of oncologists in the NHS in England. With an increasing proportion of the workforce employed part time, it will be important to ensure that the number of full time equivalent staff increases, as well as the total number of staff employed.

As demand for chemotherapy services rises, there will also be a growing need for other staff involved in the treatment of cancer including pathologists, radiologists, occupational therapists, nutritionists and psychosocial consultants.

Service reconfiguration

As a growing number of patients are living on active treatment for prolonged periods of time, it may not be appropriate for them to receive treatment in a hospital setting. However, access to appropriate specialist expertise is an important component in the safe and effective use of cancer

drugs. Therefore there is a need to consider how the configuration of chemotherapy services can adapt to the changing nature of cancer treatment.

Models of service configuration

Due to the varied geography and demographics of the UK, it is not sensible to have a 'one-size fits all' approach to the organisation of chemotherapy services. It is possible to identify three broad forms of local health systems, all of which present different challenges for chemotherapy services:

- Densely populated urban conurbations with several large teaching hospitals
- County towns with a single hospital
- Rural areas with poor transport infrastructure and a limited number of hospitals spread across a wide geography

While the variations between these types of local health system means that no single model will be suitable to be rolled out across the country, it is realistic that different forms of the 'hub and spoke' model could be developed to match the distinct requirements of these areas. This would involve the establishment of a central unit as a specialised 'hub', delivering certain services, while a variety of 'spokes' would deliver services in the community and closer to home. Given the need for the model to be flexible and responsive to the existing infrastructure in local areas, the size of the hub, the number of spokes and the distance between the hub and spokes will vary. However, the principle of a specialised centre overseeing the delivery of services at the perimeter would remain consistent.

While the hub and spoke model is currently used to different extents in different areas in England, it is possible to both identify additional services that could be moved from hubs to spokes in some areas and to identify current areas of practice in which efficiencies could be made. Improving the structure of the hub and spoke model could play an important role in improving outcomes in chemotherapy and helping services manage increased levels of demand.

Specialised treatment at the centre

It will be important to maintain specialist oversight over some elements of chemotherapy treatment. For example, decisions on treatment initiation and discontinuation should always be made by specialists in major centres, while management of toxicity should be overseen by a specialist either remotely or closer to home.

There is also a case for centralising some services where there may be economy or quality of scale. These include reconstitution services and the adoption of standardised treatment bands.

Moving services closer to home: treatment

Given the long-term nature of some chemotherapy treatment, there is a strong case for moving the delivery closer to home. However, with the exception of oral chemotherapies, it is not considered

feasible that most chemotherapy could be delivered in the home itself due to quality, safety and efficiency concerns.

A more achievable aim would be to move these services closer to patients' homes, delivering a greater range of treatment, including IV chemotherapy and sub-cutaneous chemotherapy in dedicated units within local hospitals and in primary care. Evidence based guidance should be developed by NHS England and NICE as to the treatments for each tumour type that are suitable for delivery outside of hospitals.

It is likely that an increasing number of treatments will be able to be delivered on a sub-cutaneous basis, increasing the potential for delivery close to home for those treatments that do not require close monitoring in specialist units.

Moving services closer to home: remote consultations

Currently, some hospital based consultants carry out e-consultations via email, phone and Skype with patients who find this arrangement more convenient than attending appointments in person. However no national protocol exists for when e-consultations are suitable or how they should be carried out. NHS England should consider producing guidance on e-consultations for cancer, including developing patient friendly toxicity sheets that would enable patients to easily set out their health status and guide their clinician's decision making during the e-consultation. Any national protocol should allow flexibility in the type of appointment that a patient wants to use, as different patients will have different preferences and technological capabilities.

While e-consultations can reduce the burden on patients travelling to appointments, it is important that patients have access to a local healthcare service that is able to assess their symptoms if necessary. The system that has been developed in some areas in America whereby a duty physician in a cancer centre is responsible for regularly checking an email account throughout the day to provide specialist advice in response to queries from primary care should be considered as a potential model. Following this model in England would require a considerable amount of consultant time to be dedicated to managing queries from primary care, but this could help deliver efficiencies overall by ensuring that referrals are only made when necessary. Such a system could at the same time reduce the burden on patients by only requiring them to travel into larger hospitals when needed.

Moving services closer to home: follow up

Patient follow up could also be delivered closer to home, provided that services have access to an appropriate level of specialist expertise. In the past, attempts to move elements of the management of cancer outside of hospitals have faced challenges as there is a perception that it is a completely specialist discipline. However, lessons could be learned from the community based management of other long-term conditions that require a similar level of specialist input, such as diabetes, that are

successfully managed outside of hospital. Models of long-term condition management in the community should be considered for some forms of cancer such as early stage prostate cancer.

The role of primary care in delivering diabetes management and follow up in Tower Hamlets should be considered as a model for cancer care. This involves a monthly multi-disciplinary meeting between hospital based consultants and GPs to discuss patient follow up and make decisions as to which cases require hospital based care and which can continue to be managed in the community.

It is important to note that any transfer of responsibility from hospitals to primary care must be carried out in a systematic way, with contractual arrangements setting out clear lines of responsibility and accountability, both professionally and financially. In addition, appropriate education and training programmes need to be available, to ensure that GPs are supported to play a greater role in the management and care of cancer patients.

Moving services closer to home: flexible staffing

Hub and spoke models will be most effective if there is genuine interchange and shared learning between clinical teams in different settings.

The model of staff rotation to deliver hub and spoke care used by trusts including the Royal Marsden and Guy's and St Thomas' should be considered for wider adoption. In this model, a variety of support services are based in smaller units, alongside a flexible roster of support staff including nurses and pharmacists who rotate between different units depending on the services that are required by different patients at different times. The rotation of staff both helps to ensure that services can be more responsive to the needs of patients and that staff in the smaller units are able to keep up to date with developing clinical practice in the centre at regular intervals.

While this model would be more difficult to replicate in more rural areas such as Cornwall due to the requirements for staff to travel greater distances, there are still ways in which it could be achieved while minimising disruption to the workforce. For example, staff in spoke centres could be required to work in the hub for one month of the year to coincide with reaccréditation or revalidation.

Moving services closer to home: electronic prescribing

In order to enable more patients to receive treatment in a greater number of hospitals, electronic prescribing systems need to be put in place. Electronic prescribing systems are a key component of moving services closer to home as they allow specialists in cancer centres to oversee treatment and intervene where necessary.

However, despite its importance, which is reflected in its inclusion in the chemotherapy service specification, not all trusts in England are currently equipped for electronic prescribing. NHS England should make e-prescribing capability a prerequisite for providers holding a chemotherapy services contract as soon as possible.

Improving quality

There is a range of ways in which the quality of chemotherapy treatment could be improved over the next five years.

Improved management of complications

As patients live for longer on active treatment, it is likely that they will develop more complex metastases and complications with the central nervous system. Managing these may require different combinations and approaches to treatment and it will be important that all patients are able to access these; doing so will mean ensuring that clinicians have sufficient time and support to consider different options.

Active treatment for older people

There is evidence that older people are less likely to be offered chemotherapy. This may in part be due to frailty and / or comorbidities. It will be important that approaches are developed to ensure that all patients are offered treatment if it could benefit them and that efforts are made to optimise patients ahead of treatment to minimise side effects.

Improved use of data to drive evidence based practice

Few other countries collect the level of data on chemotherapy treatment that is covered in the systemic anti-cancer therapy dataset (SACT), potentially creating an important resource to improve services. However, the existence of SACT has yet to translate into better outcomes, as it is still in the formative phase of development. When it is fully operational, there are a number of ways in which it could be utilised to improve standards and reduce variation in clinical practice, including:

- Identifying geographical and demographic variation in treatment rates and outcomes
- Enabling the identification and spread of good practice
- Informing capacity planning and service design
- Highlighting areas where efficiencies could be realised

Rapid evolution of guidelines

Evidence on good practice in chemotherapy is rapidly evolving, making it difficult for guidelines and algorithms to keep pace. Ensuring that guidance keeps pace with good practice will be important in maximising outcomes. At present, there is often a lag between changes in international guidance and their adoption in England-specific guidance. This could be addressed by simply adopting – rather than revising – credible international guidelines. For example, carrying out a critical assessment of ASCO and ESMO guidance on algorithms could help NHS England CRGs avoid unnecessary duplication.

Access to molecular diagnostics

The development of molecular diagnostic tests for cancer presents an opportunity to inform clinical decision making by predicting which patients will respond to certain types of treatment based on the presence of biomarkers. However, the current requirement for this form of testing is limited, as to date researchers have only found a small number of biomarkers that are useful in guiding therapy choice. While further research is required to identify additional tests that could guide treatment in future, a solution must also be found to the challenge of funding the growing number of tests that can already be used in clinical practice.

The current demand for molecular testing

Currently, due to the variable utility of molecular diagnostics in different types of cancer, the number of testing facilities that are required is limited. For example, the treatment of breast cancer, lung cancer, colorectal cancer and melanoma can be informed by different molecular tests which can determine which treatments patients will respond based on the presence or absence of certain genes. Although it is likely that further targeted therapies, requiring different diagnostic tests, will become available, it is considered unlikely that these developments will have a transformative effect on chemotherapy over the next five years.

While it is unlikely that molecular testing will completely transform the treatment of cancer, the discovery of more biomarkers and the associated development of new treatments and tests will provide clinicians with a greater number of treatment options. This could eventually lead to cost savings as treatment decisions are increasingly influenced by molecular testing, decreasing the use of ineffective treatments, as suggested by evidence from France where all cancer patients are offered molecular testing where it exists⁴¹. However, there are likely to be greater costs in the short term due to the costs of establishing a system capable of delivering wider testing.

Funding and configuration

Historically, pharmaceutical companies have funded the majority of molecular diagnostic tests, as they were often developed to accompany the launch and use of a specific targeted treatment. However, this model is not sustainable as:

- Some tests are valid for multiple treatments, often developed by different manufacturers
- Piecemeal funding does not allow for the development of expertise in molecular diagnostics

It was considered that funding for molecular diagnostic tests should be included within tariffs. It is likely that the costs associated with procuring the equipment required for some tests will necessitate a degree of centralisation and specialisation.

Guidance and accreditation

It will be important that tests are performed to appropriate standards of specificity and consistency. In addition to formal guidance on the efficacy and suitability of tests for the NHS, mandatory accreditation for molecular diagnostic pathology services could be implemented, similar to that currently run on an opt in basis by the UK National External Quality Assessment Service. This would provide quality assurance for the tests carried out in pathology centres and assess whether the staff responsible for carrying out the tests had the necessary experience required to deliver accurate results.

The future need for molecular testing

As the evidence base for the use of molecular testing grows, there will be a growing need for capacity within pathology services to carry out tests. Although it is not currently viable outside of research, the use of genome sequencing to guide treatment is also likely to increase, which will add to the requirement for specialist pathology services. One way in which further evidence on the utility of both molecular and genome testing could be generated would be to adopt the model that has been established in France and link translational research labs to diagnostic laboratories to create a network of molecular diagnostic labs which routinely share data.

Alongside the development of molecular testing, advances in functional imaging are likely to play a greater role in future in helping to stratify patients and optimise treatment. Creating the level of functional imaging capacity necessary to deliver tests as part of routine practice will require investment, but could lead to cost savings, if implemented properly, through making treatment more efficient.

Support for patients

As the number of patients undergoing chemotherapy increases, support requirements will also grow. The level and form of support that each patient needs will depend on their individual circumstances, but it is possible to identify two main groups of patients, who have different support needs:

- Patients on active therapy, including patients with metastatic cancer who receive multiple lines of therapy to prolong their lives
- Patients who have completed treatment but who may live with the consequences of their disease or its treatment

Supporting patients to make decisions about treatment

When making decisions about their treatment it is important that patients are provided with meaningful information that enables them to make an informed decision based on what matters to them. Currently, discussions about potential treatment outcomes are often based around median survival data, despite the complexity of this measure and the limitations of its utility on an individual

patient level; patients often want to know the likelihood of them reaching a particular survival landmark instead.

It is also important that patients fully understand the nature of the side effects that are associated with the treatments that they are prescribed. Different side effects will have a different impact on patients based upon their personal circumstances. For example, peripheral neuropathy may have a more significant impact on a patient whose livelihood relies on the use of their hands than a patient whose does not. Therefore, detailed information on the exact nature of side effects should be provided before treatment commences to enable patients to make informed decisions.

Further work is required to improve the way in which information about the benefits and risks of treatment are communicated. The impact of the patient information resources developed by Cancer Research UK for the London New Cancer Drugs Group should be formally reviewed and adopted more widely if demonstrated to be effective in helping patients feel more informed about their treatment.⁴²

Supporting patients on active treatment

Evidence indicates that patients find it especially difficult to manage side effects during the course of the first two chemotherapy treatments that they receive. Improving the monitoring of patients and the levels of support available to them during this period should be seen as a priority. The development of innovative remote monitoring systems such as those being tested in the eSMART trial will help to assess patients' experience of treatment in real time, however it is important that patients have the opportunity to talk to a healthcare professional about their treatment in its early stages. The findings of the system currently being trialled by Barts Health to carry out early follow up with patients after treatment to assess their experience of side effects should be reviewed to consider whether there would be value in rolling it out more widely in future.

Currently, concordance with oral chemotherapy regimens is suboptimal, although the reasons for this require further exploration. Pharmacists could help improve adherence and also maximise efficiency by responding to patients' needs in cases where there is intentional non-adherence due to toxicity.

Supporting patients following successful treatment

As the treatment of cancer with chemotherapy becomes more effective, both as a single therapy and in combination with surgery and radiotherapy, a greater number of people are likely to survive their cancer and live with the longer-term consequences of treatment. These patients may be at risk of other malignancies or other consequences from their previous treatment, but may not recognise the symptoms early and seek medical care. Improved education tools for patients on the issues that they may have once they are clear of cancer should be developed and more active follow up should be considered to monitor their wellbeing and provide support where necessary.

Sampling techniques of people living beyond cancer could be considered as a way of identifying ongoing or late effects of treatment that might not otherwise be detected and managed. In addition, checklists should be provided to patients, with a direct point of contact in their cancer unit to call if they see any of the signs of long-term consequences of treatment.

Digital support

There are opportunities to enhance the support available to patients through the use of digital channels. These could include:

- Information on side effects
- Decision aids
- Treatment reminders to promote concordance
- Monitoring and surveillance
- Remote advice and support

Workforce implications of providing better support for patients

The gold standard of patient support is that which is offered to patients taking part in clinical trials, as patients receive more individualised support with regular and detailed check ups with healthcare professionals. Lessons should be learned about how this can be replicated in routine care. Given the pressure on chemotherapy services, the majority of chemotherapy nurses are currently unable to provide the level of support that patients would ideally receive they are necessarily focused on the delivery of treatment.

Alleviating the burden on nurses to deliver treatment would enable them to have more frequent and detailed conversations with patients about their treatment and its side effects. As set out above, this would require a shift in the workforce to hire more technicians to deliver chemotherapy and to train pharmacists and physician associates to deliver treatment. In addition, chemotherapy nurses would require additional training to enable them to provide more of a supportive role.

Radiotherapy

A different process was adopted for radiotherapy. A position paper on future changes in radiotherapy services was developed using evidence and analysis from a range of existing publications and the input of clinical experts, who were asked to comment on the paper in the context of a range of specific questions.

Experts

Dr Adrian Crellin
Dr Helen McNair
Dr Gillian Whitfield

Professor Phil Evans
Mr Tony Murphy

Discussion

Pressures on services

Pressure on radiotherapy services is likely to increase for the foreseeable future, due to a combination of factors:

- Rising cancer incidence – the number of new cases of the majority of cancers is likely to grow steadily, increasing demand for radiotherapy
- Improving early diagnosis – the increasing focus on early diagnosis within the NHS will mean that more cancers will be diagnosed at a point at which radiotherapy is a treatment option
- Improving radiotherapy treatment access – efforts to reduce variation in access to radiotherapy and bringing access rates up to those of the best localities will, by definition, create greater pressure on services
- New more targeted techniques – different forms of radiotherapy which are more targeted and have reduced side effects may mean that more patients will be eligible for radiotherapy and may opt to receive it
- Existing techniques are being tried in new areas of radiotherapy treatment, where previously no treatment may have been given, for example Stereotactic Radiosurgery/Therapy
- Changing demographics – as more older people with multiple co-morbidities are diagnosed with cancer, there will be an increasing demand for radiotherapy
- Advances in other forms of treatment – advances in chemotherapy and personalised medicines may mean more patients become eligible for radiotherapy

Service capacity

Evidence suggests that access to external beam radiotherapy varies from 25% to 49% of cancer patients, depending on the centre in England, with the average around 38%⁴³. This is despite modelling that suggests that rates of access should be around 41%⁴³. However, debates continue about the true proportion of patients that should receive radiotherapy, with some studies indicating around 50% of cancer patients should receive it. Nonetheless it is clear that some patients who could benefit are not currently receiving treatment.

The pressures set out above means that demand for radiotherapy services is likely to rise over the next five to ten years, which will have consequences for service capacity. There is insufficient capacity in radiotherapy centres to meet these rising levels of demand in the short term.

Although it is possible to identify efficiencies that can be made to ensure that existing capacity is utilised as effectively as possible, these will not be sufficient to enable all patients who could benefit from radiotherapy to receive it in a timely manner. It will therefore be necessary for NHS England to invest in additional capacity, both in terms of treatment and workforce.

Equipment

There is a need to ensure that radiotherapy services have sufficient numbers of linear accelerators (linacs) to deliver the necessary volume of treatment to meet demand. This involves both buying new machines and replacing existing machinery. The 2013 radiotherapy equipment survey showed that 101 Linacs were 8 years old or more, including 56 that were 10 years old or more⁴⁴. Therefore, compliance with the recommendation of replacing linacs over 10 years old could mean replacing over 150 machines by 2016, requiring considerable capital investment. Given the number of linacs in current operation that are already beyond or approaching 10 years old, urgent action is needed to replace outdated machines.

While it is the responsibility of NHS trusts to replace equipment, this clearly is not working well and support at the national level is needed. A more coordinated approach to the replacement of equipment could yield benefits in terms of capacity planning and reduced procurement costs. A sustained programme of investment should be created to bring radiotherapy equipment up to date and to the minimum specification. It will be important that any new machinery that is purchased is of high specification and that it has the ability to be upgraded throughout its lifetime, to ensure that further advances can be integrated to machines where possible.

It is vital that a similar situation does not arise in future where many radiotherapy machines are over the recommended age. Innovative funding models should be explored that provide NHS trusts with a long-term and sustainable means of replacing and updating equipment to keep pace with the latest technologies.

Staffing

Overall staffing levels throughout England remain below desired levels.⁴³ There are clear shortages in the radiotherapy workforce, with a particular lack of medical physicists and radiographers, providing challenges to delivering the best treatments to patients. Whilst the numbers of radiographers, clinical oncologists and physicists have increased fractionally in recent years, it has been suggested that rates of increase needs to more than double in order to meet anticipated demand.⁴³ Shortages are linked to low levels of staff retention across all bands, and particularly for trainee radiographers.

Pressure on services, through staffing shortages and increasing demand, means that radiotherapy centres have a culture of over-working, affecting staff morale. This allows little time for staff to share learning and to undertake the necessary planning to implement new technologies and techniques. Patient safety is also a prominent concern when services come under greater pressure. In addition, pressures on staffing may also affect centres' ability to participate in clinical trials involving radiotherapy. Even in the best centres, co-ordination between the three key professions, therapeutic radiographers, clinical oncologists and radiotherapy physicists, could be improved.

Efficiencies in capacity

While it will be important for additional investment to be made in radiotherapy services in order to meet demand, it is also possible to identify efficiencies that could be made to free up capacity in the short to medium term.

The adoption of advanced techniques has the potential to drive efficiencies through better use of existing capacity, for example in terms of shorter treatment times through the use of arc therapy and hypofractionation techniques for more common cancers. Shorter treatment times will lead to a larger number of patients being treated per machine. Innovations in software and imaging technology will allow for upgrades to be made to existing technology to keep pace with advances as much as possible.

Seven day working and extended working hours may lead to more efficient use of existing machine capacity and offer the opportunity to run trials of different treatment models. However, the service would need significant additional support, workforce and incentives to achieve this, including technical support from manufacturers if maintenance work to equipment is required during weekends. Current pressures on staffing mean that plans for extending the hours of radiotherapy centres to increase radiotherapy capacity could be difficult to implement, especially in smaller centres.

In general, increasing automation of treatment planning and delivery has the potential to provide efficiency savings, or at least offset the increased demands placed on staff by the increasing complexity of their roles. Automated planning systems may increase efficiency with better processes and smoother pathways.

Advances in technology

Radiotherapy has become significantly more sophisticated in the last decade, with the development of advanced radiotherapy treatments that target tumours more accurately and reduce the irradiation of healthy tissue, improving patient outcomes and reducing side effects.

While technological advances are continually being made, historically the NHS has not adopted innovations into clinical practice speedily and in a consistent and equitable way in radiotherapy centres across the country. However, the role of NHS England as the current sole commissioner of radiotherapy services offers a real opportunity to drive improvements consistently across the NHS.

Innovative treatment equipment

While investment to replace existing technology is needed, it is also essential that improvements are made in other areas to improve patient access to newer, advanced forms of radiotherapy. The introduction of machines that produce a variety of types of beam with different energies will allow greater flexibility as to the type and dose of treatment given by individual devices, such as Proton

Beam Therapy (PBT), Intensity Modulated Radiotherapy (IMRT), Image Guided Radiotherapy (IGRT), Stereotactic Ablative Radiotherapy (SABR) and other forms.

In the short term, the major new innovation in treatment devices is likely to be incorporation of real time imaging and tracking of tumours. For example, integrating an MRI and linac into one device or placing a scanner on rails within the treatment room. This development will allow for greater use of enhanced adaptive radiotherapy. It is also likely in the medium term that smaller, cheaper versions of existing devices, such as smaller PBT systems and more compact linacs, will be developed. The use of intraoperative radiotherapy involving intra- and peri- operative implants, markers and transponders, including spacer devices, is also likely to increase, though timescales for adoption will vary.

Innovative imaging technology

The greatest improvements in radiotherapy over the next ten years will likely be driven by advances in imaging technologies. Images already play a crucial role in the diagnosis of cancer and the planning of radiotherapy treatment. However, increased use of real time and multi-modality imaging will provide more personalised and adaptable treatment. Tumours that may move during treatment will be easier to track and target accurately, which will be particularly crucial in better treating cancers in parts of the body such as the lungs or bowel.

The NHS needs to be able to adopt advances in imaging when evidence of cost effectiveness can be demonstrated. Potential developments over the next five years include⁴⁴:

- Increased use of MRI in treatment planning and verification, possibly through an integrated MRI/linac or by incorporating MRI into treatment rooms
- Higher quality cone beam CT scanning
- Increased use of functional imaging (PET, MRI) during treatment to assess the response of the tumour and surrounding tissue to radiation
- The use of novel biomarkers or tracers to improve specificity – allowing better targeting and characterisation of cancer cells which are more sensitive to radiotherapy
- Integration of ultrasound technology into treatment delivery, both in brachytherapy and external beam radiotherapy
- More accurate image registration and deformation to optimise treatment planning
- Greater integration between imaging, planning and dosimetry and the fusion of multi-modality imaging
- Non-invasive methods to verify the radiation given to the patient at the time of treatment

Therapeutic radiographers are ideally placed to coordinate the adoption of new imaging technology, due to their involvement in every stage of the radiotherapy pathway. However, to realise the benefits of these developments, it will be necessary to ensure that staff are formally designated time to evaluate and implement new workflows and liaise with multidisciplinary teams.

Investing in software

With more sophisticated computing, the time taken to plan, acquire images and deliver treatment is expected to decrease. Computing advances are likely to speed up processing times, increasing automation. Higher performance computers will also facilitate adaptive radiotherapy in real time. The use of image based biomarkers, anatomical atlas libraries and dose painting are expected to become increasingly developed within radiotherapy software. This will make faster and easier replanning possible during the course of treatment. Although software does not have a defined lifetime in the same way as hardware, it is vital that centres find a way to continually invest in updates.

Funding investment in technology

Given the array of advances set out above, NHS England should develop a planned programme of investment and support over the next five years to modernise radiotherapy in England and ensure that all patients have access to the best, evidence-based treatment for their condition.

To deliver the necessary improvements, NHS England should build on the success of the Radiotherapy Innovation Fund and establish a Radiotherapy Transformation Fund. Cancer Research UK has estimated that at least £300million would be needed to ensure equipment is up to date over the next two to three years.⁴⁵ Additional funding is also likely to be required to provide an adequately resourced and skilled workforce to deliver the best treatments. Ring-fenced funding would help to deliver the levels of access to advanced treatment that are needed to improve outcomes¹³:

- Around 50% of cancer patients having access to radiotherapy
- At least 50% of radiotherapy patients (on average) receiving IMRT
- All radiotherapy patients receiving IGRT as appropriate for their treatment
- Equal access to new, evidence-based technologies including SABR, proton beam therapy, and image guided radiotherapy and brachytherapy

The national commissioning structure in England provides the opportunity for better deals for new technology, especially if the procurement power of the NHS is sufficiently harnessed through the NHS supply chain. The £30 million contract agreed by the Department of Health in 2013 to purchase 20 new linacs in England shows how this is possible.⁴³ The Department of Health, NHS England and NHS Trusts should continue to work with the NHS Supply Chain to ensure sufficient numbers of up-to-date linacs across England and capitalise on the economies of scale for the purchase of new technology, which can be delivered through coordinated procurement.

Service configuration

Evidence suggests that there is currently a large gap between the quality of radiotherapy services delivered in different NHS trusts in England.⁴⁴ At a time of constrained resources and rising demand, there is a need for a review of the configuration of services to assess whether changes could enable trusts to better cope with increasing pressure while delivering improved outcomes and enhanced access to advanced technology.

Multi centre collaboration

Increasing collaboration between radiotherapy centres to better coordinate the delivery of services across wider populations could help to improve outcomes, deliver efficiencies and ensure better adoption of advances in technology. This could be done through the adoption of 'hub and spoke' models whereby larger centres could concentrate expertise so as to better deliver specialised treatment and test innovative technologies, while acting as 'treatment facilitators' to optimise work flows and support delivery of contingency treatment where there is patient demand. A range of smaller centres and some linked satellite delivery sites could provide less complex treatments closer to patients' homes, providing a compromise between local access and specialisation.

This approach could serve a wider population base than current services, potentially with single teams working across multiple centres. This could help to deliver a number of improvements:

- Alleviating the recruitment challenge by enabling existing teams with the appropriate skills mix to support larger populations
- Improving the management of the treatment of patients with rarer cancers by ensuring that they are managed by integrated teams at specialist centres
- Ensuring sufficient levels of staffing and expertise at all centres regardless of where the patient is treated
- Delivering consistency of standards across populations, helping to ensure that more patients receive best practice in treatment

Workforce

Sufficient capacity and expertise in the radiotherapy workforce is vital in order to meet rising patient demand and support the appropriate delivery of advanced techniques. However, evidence suggests that improvements must be made in the recruitment, training and retention of staff in England in order to achieve these aims.

Education and training

As radiotherapy becomes more sophisticated, there is an ongoing need for specialist training to ensure that staff are able to deliver advanced forms of treatment. However, many centres, particularly smaller ones, provide fewer opportunities for staff to develop their existing skills, learn

new ones and engage in research. Evidence suggests that training for advanced treatments could be inadequate in the UK in comparison with other countries such as the US, Canada and the Netherlands.⁴³

Attracting physics and oncology staff, and trainees, is understood to be easier in larger centres due to a perception that these can better provide effective education, training and continuing professional development.⁴⁴ If current trends continue the gap between smaller and larger centres is likely to widen.

Health Education England should therefore work with professional bodies to ensure that all staff are provided with the skills required to deliver advanced and innovative techniques. Centres should support the introduction of already successful educational programmes, such as those for IMRT, as they are easily transferable.

Skills mix

Given the multidisciplinary nature of radiotherapy services, it is important to get the right skills mix and levels of team working within centres. The right numbers of appropriately trained individuals must be available in each profession, with skills to match service needs and leadership to ensure effective team working.

Multidisciplinary workforce planning should take place in all centres. There needs to be an appropriate balance between services being delivered in smaller centres and smaller centres becoming affiliated with larger ones to allow them to tap into a larger skills base.

Planning the future workforce

The radiotherapy workforce needs 'future proofing', for example, by developing capacity around proton beam therapy – with two new centres opening in the UK in 2018⁴⁶ and another under construction⁴⁷ – and other advanced and innovative techniques. Addressing deficiencies in staffing numbers and enhancing the skills of all staff to be able to deliver advanced and innovative techniques should be a priority. As imaging becomes increasingly important, it is especially important that staff are appropriately skilled in imaging and image interpretation.

Health Education England, working with the professional bodies through the Radiotherapy Board, should develop and implement a strategy to address radiotherapy workforce needs. This strategy should consider investment in education, compilation of best practices domestically and internationally, and develop clear national educational targets. It is particularly important to address the insufficient number of medical physicists and the attrition rate of student radiographers.

As well as recruiting additional staff to fill existing roles, in future more advanced and consultant non-medical, therapeutic radiographer roles may be required to undertake more complex

procedures. This could have significant benefits on services' ability to develop and respond to patients' needs.

Levers to deliver improvements in quality

A variety of levers are available to system leaders including NHS England, Public Health England, Health Education England and Monitor, that will enable them to drive the improvements in the quality of radiotherapy services that are necessary for services to be able to cope with rising demand while delivering improved outcomes.

Use of data

The collection and analysis of data generated by radiotherapy services in England has significant potential to add to our understanding of the service and how to best improve it.

Datasets have an important role to play in identifying variation in the service and benchmarking performance. Underfunded or underutilised resource can be revealed, as can geographic variation in access to advanced and innovative radiotherapy. Outcome data is key to long term quality improvement, with the potential for it to be used to establish key performance indicators with which to assess performance and monitor adherence to national guidelines. However, in order to enable proper evaluation, collection of agreed and standardised outcomes data needs to be improved.

The potential value of the Radiotherapy Dataset (RTDS) is widely acknowledged and its use should be expanded. NHS England should work with PHE to ensure the RTDS provides up to date, high quality data to inform commissioning and service development, including streamlining patient pathways. The RTDS should also routinely collect patient reported outcome data. Better collection and analysis of outcome data, for example linked with staging and treatment type, will allow assessment of impact of advanced and innovative radiotherapy approaches. Data collection systems will need to be versatile enough to ensure that information on new technology and techniques are captured as they are adopted. Data on patient safety should be monitored at a national oversight level to identify issues and action taken to improve services and raise awareness of best practice where necessary.

An additional future aim should be to enable the use of real-time data to inform treatment options and predict patient outcomes. Radiotherapy data should be linked with the Cancer Outcomes and Services Dataset (COSD) and other datasets that may provide greater insight, such as the Systemic Anti-Cancer Treatment (SACT) dataset. The routine collection of patient tumour (imaging and biomarker) and treatment related data could provide a wealth of information on outcomes that could influence treatment decisions. Robust datasets could help to eliminate the need for some clinical trials in future.

Using data to plan services

Data are critical to effective national strategic planning, as they provide an indication of equipment and staff resource, allowing NHS England to plan for service reconfigurations as well as targeted recruitment and training. Providing an equitable service requires adapting the service to the needs of the local population; population level data could be used to build predictive models and inform reconfiguration of services and planning.

Cloud computing and improved data sharing will have an important role to play in the future of radiotherapy services. They will be used to promote consistency by sharing best practice and allowing timely analysis of the quality of service being delivered.

Data on asset replacement are particularly significant given the concerns about aging machinery. Robust evidence is essential to the effective procurement policy necessary to overcome asset shortages.

Flexibility of funding mechanisms

NHS England and Monitor must ensure that the tariff is flexible enough to keep pace with emerging evidence-based treatment options. Many research projects are not properly remunerated under the current system, resulting in successful centres facing budgetary imbalances if they focus on the development of new forms of practice. Contracts and funding need to also fully reflect the patient and relative/carer support required to deliver radiotherapy effectively, including providing information and education; delivering practical advice and support; reducing anxiety; ensuring patient involvement in service planning; and measuring satisfaction with treatment and care.

Flexibility should be built into the national tariff to support the development of specialist and complex techniques and practices. This would require much more rapid evaluation of new techniques and the imposition of a price that reflects the clinical effectiveness and demand for the procedure. This would mean that techniques that may reduce the number of fractions needed to treat a patient are over-compensated initially to make them attractive to centres to invest in and deliver such techniques.

It may not be cost effective for all centres to evaluate and adopt novel treatments. Regional centres may have a role to play in piloting new innovations and delivering more specialised techniques to deliver an appropriate balance between patient access and cost.

Standardised treatment protocols

Service specifications should be regularly reviewed together with quality dashboards and other NHS England guidance to ensure they reflect the most up to date practice and encourage innovation. This will ensure that NHS England is in a position to routinely commission these improvements and take action where trusts are failing to deliver treatment in line with requirements.

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