

Cancer Policy Update: Agenda for the 2020s

Summary

Cancer kills 165,000 people a year in the UK, which represents 30% of all deaths. Two thirds of this mortality is amongst men and women aged over 65. Yet although the age standardised death rate for cancers amongst 'working age' adults, teenagers and children has halved since the 1970s cancer is today the largest disease related cause of lost life in all younger age groups except infants.

Half the UK population say cancer is the condition from which they most want protection for themselves and their families. Developing and having timely access to better ways of treating cancers and reducing the suffering and loss of life they cause is the leading disease treatment priority amongst British people of all ages.

Since the 1990s NHS cancer services have improved throughout the UK. They are good by global standards. However, only a third of the British population (who tend to be less highly educated) are confident that if they or their families develop cancer the NHS care available to them would be world-class. Another third believe NHS specialist care is excellent but are concerned about issues like how rapidly cancers are diagnosed before specialists are involved. The remainder have doubts about all aspects of NHS provision.

Cancer survival rates are improving in the UK. But there is evidence that they are still not up to the standard achieved in countries such as Australia, Canada and the Scandinavian nations, as well as in parts of the United States.

The cost of anticancer drugs has been controversial in the UK and the NHS has had a relatively poor record of investing in items like MRI scanners and other equipment needed for the delivery of high quality radiotherapy. There are also shortfalls in areas such as psychological and social support. Nevertheless, providing world-class cancer care should be seen as an affordable goal for Britain. Despite the fact that cancer causes approaching a third of all deaths in this country cancer services presently account for only 7%-8% of NHS outlays, or just 0.5% of GDP.

UK spending on anticancer drugs represents 0.1-0.15% of GDP or 20-25% of NHS oncology related costs. (Total pharmaceutical outlays of all types have – post discounting – stood at around 11-12% of NHS spending throughout this century.) Even if rising expectations amongst older NHS users and the introduction of cell-based and other advanced cancer treatments increase future costs any foreseeable rise will be financially affordable if policy makers choose to value the health outcomes achieved sufficiently.

Lung cancer causes 35,000 deaths a year in Britain. Historically, the disease has not normally been identified until a relatively late stage. But there is now evidence that low dose CT based screening for smokers and ex-smokers can detect lung cancers when curative surgery is possible. In addition, recent advances in immunotherapy and other targeted forms of cancer treatment have been shown to extend the lives of some people with advanced lung cancers for several years. The full benefits of using such drugs earlier or in combinations with other therapies are not yet known.

Current research is aimed at further improving screening and treatment through technologies like analysing blood samples for circulating DNA from tumours and finding ways of boosting the impacts of immunotherapeutic and other drugs, in part by combining their benefits with those of, for example, complementary forms of radiotherapy. The 5 year lung cancer survival rate stands at about 15% in Britain. The best-in-the-world rate is 25%, as is being reported in, for example, the State of New York. The UK should be able to achieve a nationwide 25% 5 year lung cancer survival rate during the 2020s. A more ambitious national target to set would be a 35% average 5 year lung cancer survival rate by the end of this decade.

Controlling cancer more successfully will not be achieved by single breakthroughs. Progress depends on incremental advances in multiple areas. These include prevention (by, for instance, immunisation as well as stopping tobacco smoking, which causes lung, oesophageal, kidney, bladder, liver and other tumours) and screening developments (including new approaches to prostate cancer management and enhanced bowel cancer detection and treatment) through to advances in imaging and surgical techniques, radiotherapeutics and pharmaceutical care. Better health education and psychological and social support also have important roles to play in fostering 'full engagement' in overcoming cancer.

Because of the complexity of delivering better cancer care and the dynamics of NHS funding and introducing better practices in the health service there is a strong case for developing new cancer strategies for all the UK nations for the 2020s. Britain could also benefit from leading an independent review of the ways the NHS and other health care systems value and control spending on cancer care. This should seek to ensure not only the affordability of better treatments for health service budget holders but protect wider public interests in ongoing scientific innovation and industrial policy objectives. The ultimate priority ought to be enabling people from every social class to have longer and happier lives.

Introduction

Advances in preventing and treating infections and conditions like coronary heart disease since the 1950s mean that cancer is now the leading cause of death amongst adults aged under 70 years in the UK and similarly developed nations (Dagenais et al, 2019). Cancer is also the most common disease related cause of childhood mortality after the first year of life. This is despite the fact that, as Figure 1 shows, age specific death rates due to cancers amongst younger people have halved in countries such as England since the 1970s. It is only amongst those aged 80 and over that both the overall number of people with cancer and the mortality rate are higher today than in the past.

Important progress has been achieved in contexts such as cancer prevention through smoking cessation amongst men and immunisation against conditions such as Hepatitis B (which is a major cause of liver cancer world-wide) and Human Papilloma virus (HPV) infection. Chronic forms of the latter are the dominant cause of cervical cancer and can also result in other malignancies, including head and neck cancers.

Cancer death rates have also fallen as a result of the early detection and treatment of breast, prostate, colorectal and other tumours. However, there remains much more that could be done to improve outcomes via primary prevention and optimally effective early intervention. It is also the case that, notwithstanding the growing abilities of modern anticancer therapies to check the progression of conditions such as – for example – leukaemias, melanomas and head and neck malignancies (the latter have recently been shown to respond well to first line immunotherapy – Burtneis et al, 2019) the great majority of advanced cancers cannot yet be treated in ways that extend the survival of people living with them for more than limited periods.

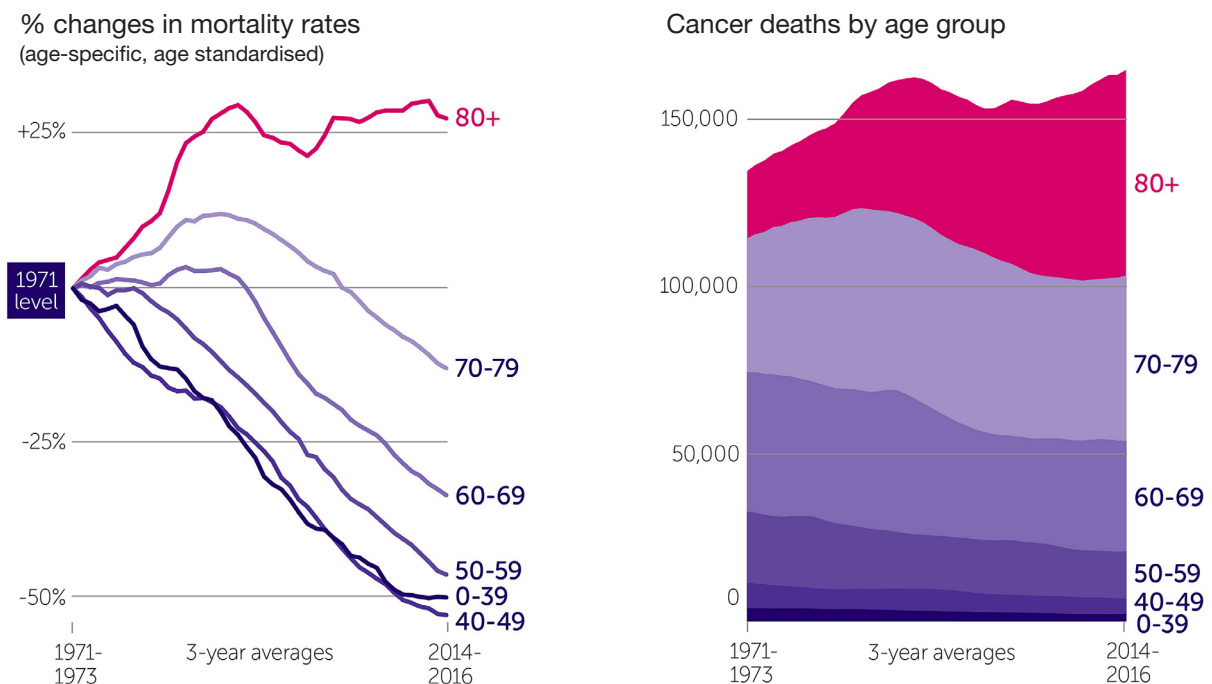
Most notably, lung cancer still kills some 35,000 people a year in the UK. At present there are some 85,000 individuals in this country living with the disease or who have recovered from it. Almost 20% of those whose lives it takes are non-smokers. The condition has to date normally been diagnosed only after it has metastasised – this is the key reason why median survival after a diagnosis of lung cancer in this country remains under a year. Yet recent developments mean that around a quarter of people with advanced lung cancers will live significantly longer if they receive the most effective treatment available, and early stage surgical interventions can be curative. Lung cancer is presently an important driver of class-linked life expectancy variations, inflicting suffering on both those who experience it directly and on those living with and after them.

There is robust evidence that in addition to wishing to see more effective prevention and enhanced rates of early diagnosis, improving treatment for advanced cancers is a major priority for the British public (Taylor and Heller, 2019). Finding and making universally available better therapies for metastatic disease will be one of the most pressing challenges – and opportunities – facing the NHS and other health care providers in the 2020s.

Against this background this UCL Cancer Policy Project (see Box 1) update report describes recent advances in cancer research, care and outcomes and outlines the main issues that will be facing policy makers and service providers in the 2020s. These include overcoming concerns about the future affordability for the NHS and other care providers of anticancer medicines (including cell-based and other advanced therapy medicines – ATPs) and the innovative radiological, surgical and other professionally led interventions needed for delivering high quality cancer care.

Figure 1: Cancer Mortality Trends by Age, UK 1971/73 to 2014/16

Source: Cancer Research UK and Shelton (2019)



The risk of UK cancer outcomes falling further behind the best in the world during the 2020s will increase if Britain leaves the European Union in ways which weaken the economy and reduce funding available for health and social services, or depress levels of domestic and inward investment in biomedical research and development. They will also decline if NHS funding mechanisms prevent – as may already have been the case in, for instance, multiple myeloma care – the timely use of not only individual innovations but beneficial combinations. Yet such outcomes could be avoided. One objective of this update is to offer evidence relating to combining appropriate economy in relation to population-wide health service provision with promoting excellence in individual care and pursuing public interest oriented industrial development goals.

Although cancers now cause about 30% of all deaths in Britain total spending on all forms of cancer care accounts for well under 10% of NHS costs. Even if private spending is added in, cancer treatment and service outlays represent less than 1% of GDP. New anticancer therapies are emerging and some existing forms of treatment (including, for instance, CAR-T cell based and other immunotherapeutic interventions) will be used more extensively in the coming decade. Even so, the starting point of this analysis is that in overall terms achieving better cancer survival is an affordable ambition for countries such as the UK. ‘Austerity minded’ assumptions that this is not the case could in time prove self-fulfilling in ways that not only disadvantage people living with cancer but will also undermine the prosperity and wellbeing of the wider community.

Box 1: Cancer Research at University College London (UCL)

The multi-faceted, world-wide, pursuit of enhanced treatments for cancer is arguably the largest scientific project in history (Sullivan, 2019). Its overall scale dwarfs that of, for instance, the US moon-shot of the 1970s or that of the human genome project. Even in individual cities like London thousands of NHS clinicians and health service, academic and industry based scientists are involved in trying to better understand cancers and how those living with them can be treated and if possible cured.

It would consequently be wrong to overstate the importance of any one institution or project. Nevertheless, voluntary organisations like Cancer Research UK are globally significant as cancer research funding and strategy setting agencies. The fact that per capita British voluntary contributions to cancer charities are high compared with all nations other than the US (where the fiscal system strongly encourages donations) reflects the priority the UK public gives to improving the treatment of cancer.

University College London (UCL) and its partner organisations the University College London Hospitals (UCLH) NHS Foundation Trust and the Francis Crick Institute are important cancer research resources. So too in the London context are institutions such as Kings College London, which amongst other assets has a leading Institute of Cancer Policy, and the Institute of Cancer Research – ICR – which is partnered with the Royal Marsden NHS Foundation Trust. Examples of major cancer research projects in which UCL and UCLH are involved include:

- **The ReIMAGINE trials.** Funded by the MRC and Cancer Research UK, these are aimed at assessing whether or not MRI scanning can be used as a screening tool to detect prostate cancer and the extent to which a national screening programme using information generated by scans and as appropriate other data

such as urine test results or PSA measurements would be viable and beneficial.

- **TRACERx.** The TRACKing Cancer Evolution through therapy (Rx) lung study, again funded by Cancer Research UK, will take nine years to complete. Its aim is to radically improve knowledge of how non-small cell lung cancers (NSCLCs) develop and facilitate more precise and effective treatment.
- **The SUMMIT study.** This is seeking to detect lung cancers early amongst at-risk Londoners and support the development of a new blood test for the early detection of various cancers, including lung cancer. It is a UCLH Cancer Collaborative programme being taken forward by UCLH in collaboration with UCL and GRAIL, a US healthcare company.
- **ACED.** The recently announced Alliance for Cancer Early Detection (ACED) is a partnership between Cancer Research UK, Stanford University, the University of Cambridge, the Oregon Health and Science University, the University of Manchester and UCL. It aims to further accelerate progress towards the early stage detection of cancers and their optimal treatment.

The UCL Cancer Institute is a key element within the overall UCL ‘cancer domain’. It draws together over 400 research scientists and is conducting pioneering work on the development and use of cell based cancer therapies. By contrast the Cancer Policy Project responsible for this report is a small free standing initiative, funded by a grant from the US pharmaceutical company Merck (MSD in the UK). It seeks to increase understanding of the cancer policy formation process and to explore issues such as anticancer drug pricing and opportunities for the creation of stronger public interest focused partnerships between publicly and privately funded cancer researchers.

Global trends

Cancer presently causes some 10 million deaths a year out of an annual global total of just under 60 million. Worldwide, about 1 death in every 6 (approximately 16% of all mortality) is now recorded as being due to cancer. As countries develop and populations age this proportion rises. In nations like India and regions such as sub-Saharan Africa only 10% or so of deaths are identified as being due to cancer, as opposed to 1 in 3 in the most economically advanced settings (Mallath et al, 2014). But at the same time the majority of all cancer deaths already occur outside areas such as the EU, North America and Australasia, and the probability of a diagnosis of cancer resulting in loss of life falls as countries grow richer.

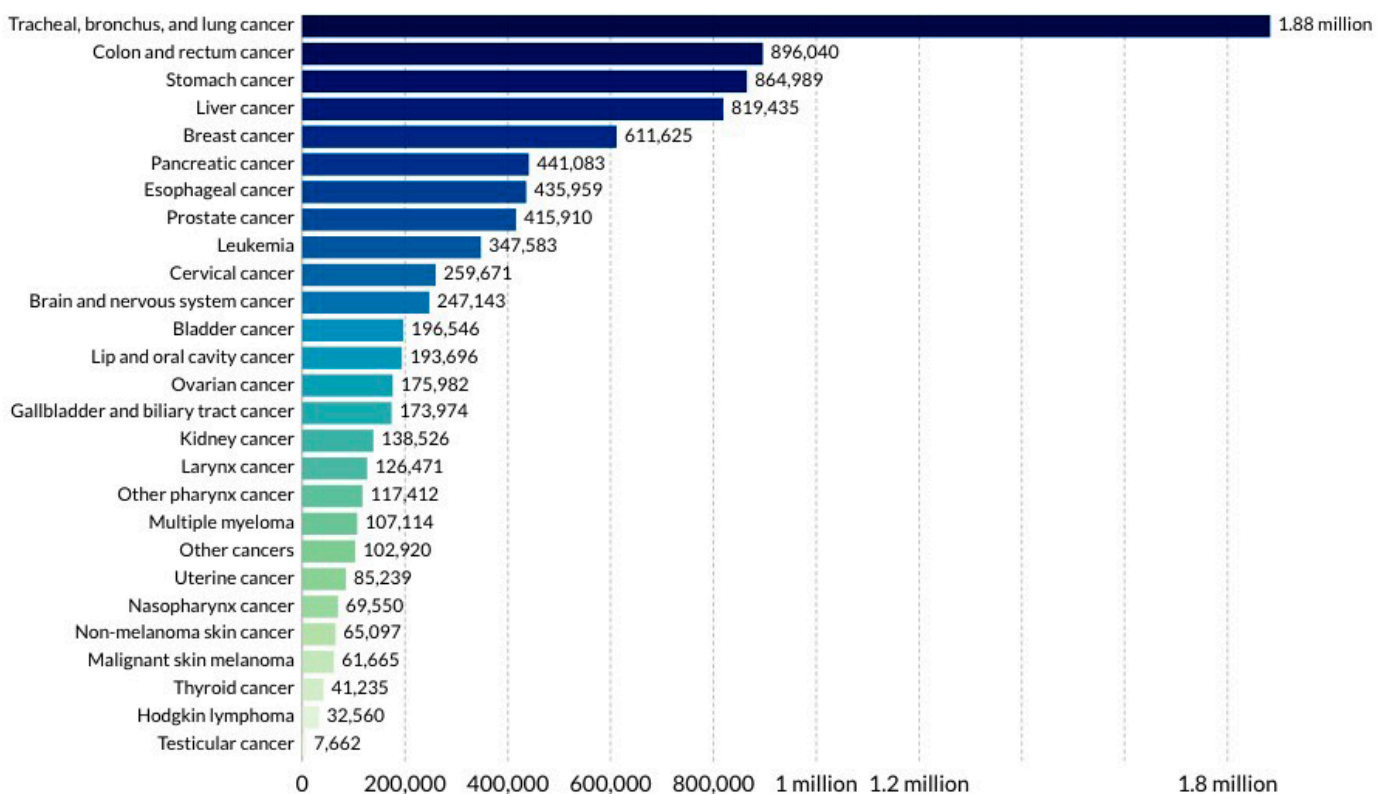
Earlier (and more complete) diagnosis and better treatment lie at the heart of the trend towards lower case fatality rates in more affluent settings, although it is also the case that the causes of cancer change as countries progress through social and economic development. In environments characterised by poverty infections are a frequent cause of tumours, along with public health problems such as foodstuffs containing aflatoxins because of fungal contamination. In countries like England and the other UK nations cancer is more often caused by cell division errors associated with ageing coupled with life-style linked factors like obesity, frequent alcohol use and – most importantly – tobacco smoking. This last presently causes not only most lung cancers in Britain, but also malignancies at sites ranging from the oesophagus and bladder to the liver and pancreas.

Blame should not be unfairly attributed to individuals affected by cancers. Life styles are in large part socially defined as opposed to being autonomous individual choices. In the case of smoking, rates are currently falling in high GDP nations and rising in many less advantaged communities. Likewise within countries such as Britain, smoking is now associated with relative poverty. By contrast, the rising incidence of sex hormone associated cancers of the breast and prostate seen in the twentieth century was linked to increasing wealth and better nutritional status. Similar points apply to obesity, albeit that genetic and ethnicity related variables should also be taken into account when considering its impacts on the occurrence of disease.

Cancer incidence and mortality globally and in Britain – see Figures 2 and 3 – reflect such factors, together with the selective impacts of preventive and other forms of health care. From a UK policy and practice perspective key points include:

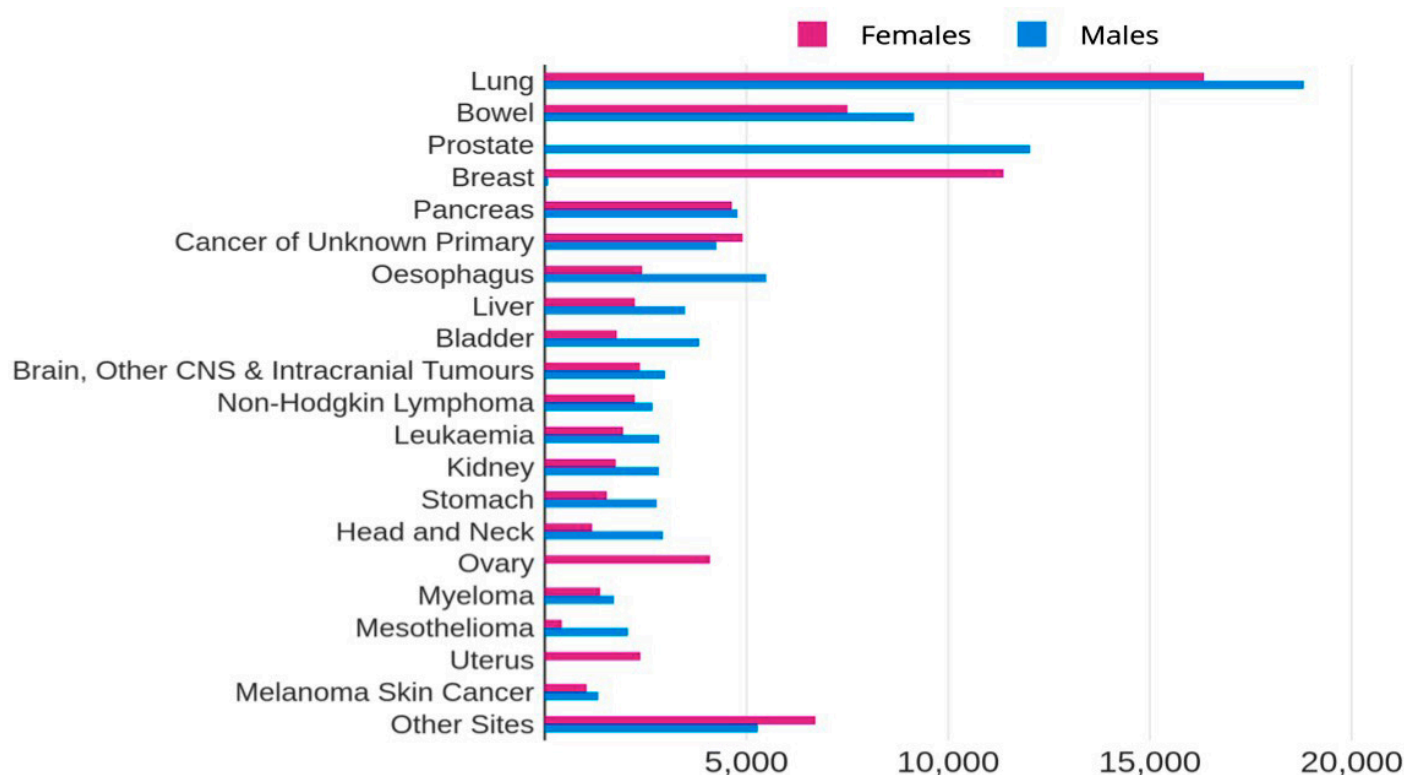
- Overall age standardised British cancer death rates were broadly stable during most of the twentieth century. But within the total burden there have been trends such as (in men) a major rise in lung cancer between 1925 and 1975, followed by a marked fall. At the same time long term declines in stomach and colorectal cancer mortality were until the end of the 1980s balanced by rises in breast and prostate cancer deaths.
- From 1990 onwards the overall age standardised cancer mortality rate has been declining by about 1% per annum. It is now some 30% lower than it was three decades ago. This matches similar trends in the US and Western

Figure 2: Cancer deaths by type, World, 2017



Source: Globocan 2018

Figure 3: The 20 most common causes of cancer deaths, UK, 2017



Source: Cancer Research UK 2019

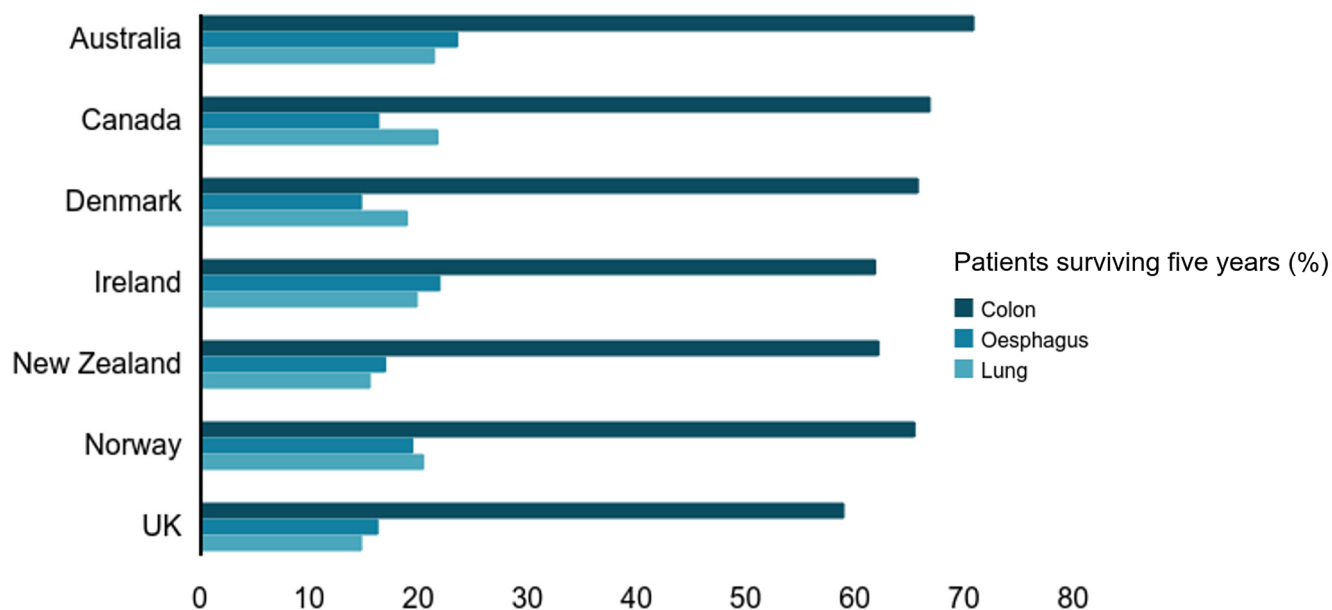
Europe and is linked to declines in male smoking, coupled with better treatment for breast, prostate, blood and a variety of other cancers. Although liver cancer deaths have increased and the age adjusted mortality caused by pancreatic cancer has stayed broadly constant (Cancer Research UK, 2019), these are exceptions. The reason why the absolute number of cancer deaths is rising is because older people now make up a higher percentage of the population than they did in the past. Today two thirds of all UK cancer deaths are amongst people aged 65 and over, albeit the disease also accounts for about 20% of child and younger adult mortality.

- NHS cancer services are good in global terms. Generally speaking the health service provides a high level of access to established therapies of well-proven value. However, there have been care quality concerns relating to the timeliness of cancer diagnoses, waiting times, the adequacy of investment in radiological and other medical equipment and the availability of new pharmaceutical treatments and combinations of therapies during periods when their cost effectiveness is uncertain or disputed. Historically, improving the treatment of multiple myeloma illustrates this reality, related to which there is evidence that UK survival rates for some conditions – including bowel, ovarian and lung cancers – still lag behind those achieved in countries like Australia and the Scandinavian nations (Figure 4). Although some claim that recent progress in Britain has reduced such discrepancies, the published evidence cannot as yet confirm this (Arnold et al, 2019; Richards et al, 2018).

- Worldwide, stopping tobacco smoking and interventions aimed at controlling and/or ultimately eliminating the communicable causes of cancer remain vital. The latter include not only Human Papilloma virus and Hepatitis B but also Hepatitis C, the stomach infecting bacterium *Helicobacter Pylori* and the less widely known Epstein-Barr (EB) virus. EBV is responsible several forms of cancer (including, for instance, nasopharyngeal carcinomas, mainly in the Far East) and is also linked to the occurrence of multiple sclerosis. Other major global priorities include diagnosing and providing affordable treatment for conditions ranging from child cancers to breast cancers. In more affluent nations there are also emerging opportunities for controlling and possibly curing advanced cancers.

The speed at which further improvements in British cancer outcomes will be achieved in part depends on global advances in fields such as immunology and genetics and their translation into effective therapies available on the world market. Developments in surgical techniques and, for instance, new forms of radiotherapy in the US and elsewhere also spread to benefit people in the UK. But within this country politically led policy decisions, which simultaneously reflect and help shape public attitudes, can influence the speed of NHS service improvement and the extent to which the nation benefits socially and economically from advances in cancer care.

Figure 4: Cancer survival rates, selected counties.



Source: Arnold et al, 2019

British Public Attitudes towards Cancer

There is an extensive literature on public attitudes to cancer and the extent to which they are similar to or differ from the way people regard conditions like heart disease and dementia. For example, Morrell et al (2017) noted that maintaining hope linked to a perceived need to take personal action to ‘fight’ the condition are important themes in the cancer context. There is also evidence that cancer has been feared more acutely than many other potentially fatal disorders, although this is not to say that the average person would support paying more for a year of life gained from better cancer care as opposed to one gained from improving the treatment of other types of illness unless there was a logical reason for prioritising cancer treatment development.

The UCL Cancer Policy Project commissioned the company Populus to survey just over 2000 people about their attitudes towards cancer research and treatment in 2019 (Taylor and Heller, 2019). Figures 5, 6 and 7 illustrate some of the findings of this research. Important observations include:

- Cancer is the public’s major research and health care improvement priority.** Half (49%) of the British population believe that cancer is the disease group for which they most want better treatments for themselves and their family members. About 6 people in every 10 (59%) think that stopping the suffering caused by cancer is one of the most important things that could be achieved by the 2050s. Although the perceived urgency of developing more effective ways of preventing and treating dementias rises as people age, protecting against cancer is the highest priority for all age groups and both sexes. This is in part because older people see cancer as a potential threat to the lives of their children and grandchildren, as well as people of their own generation.

Figure 5: Disease groups from which the public most want protection for themselves and their family members

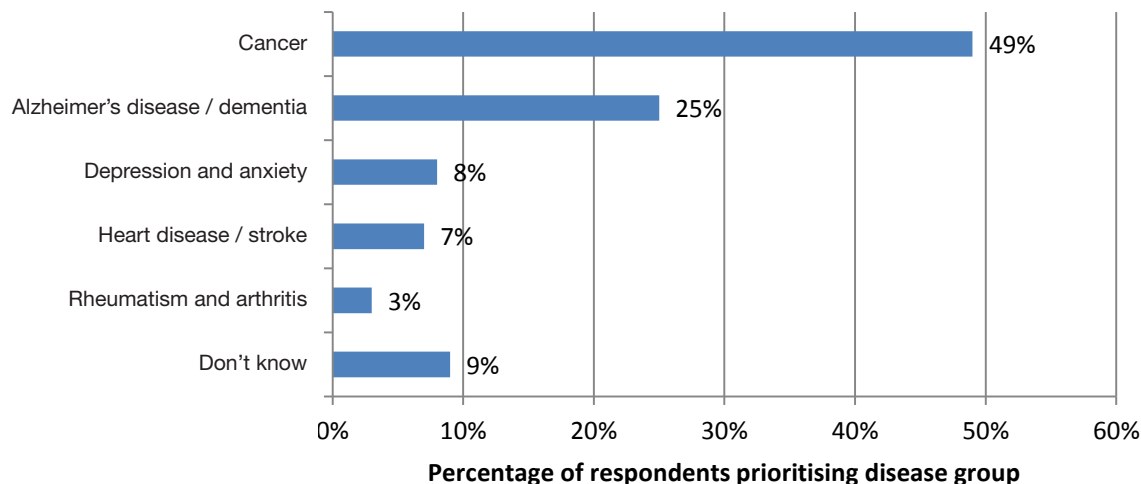
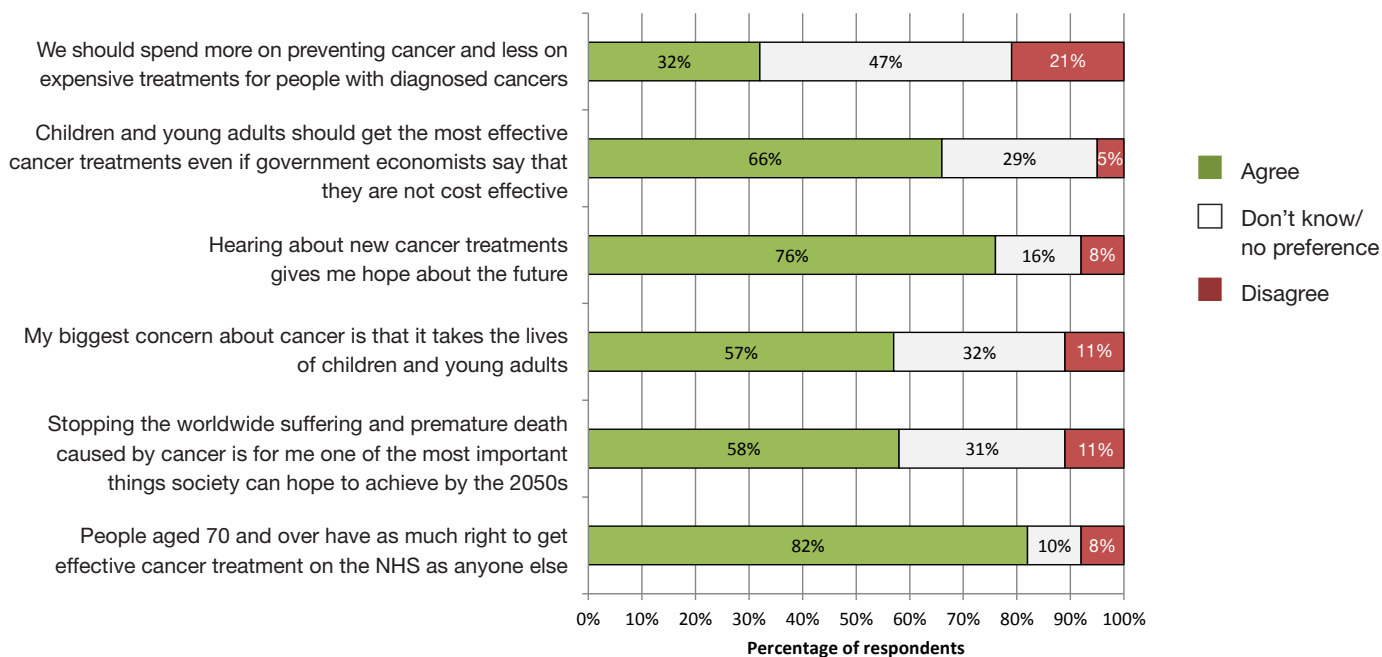
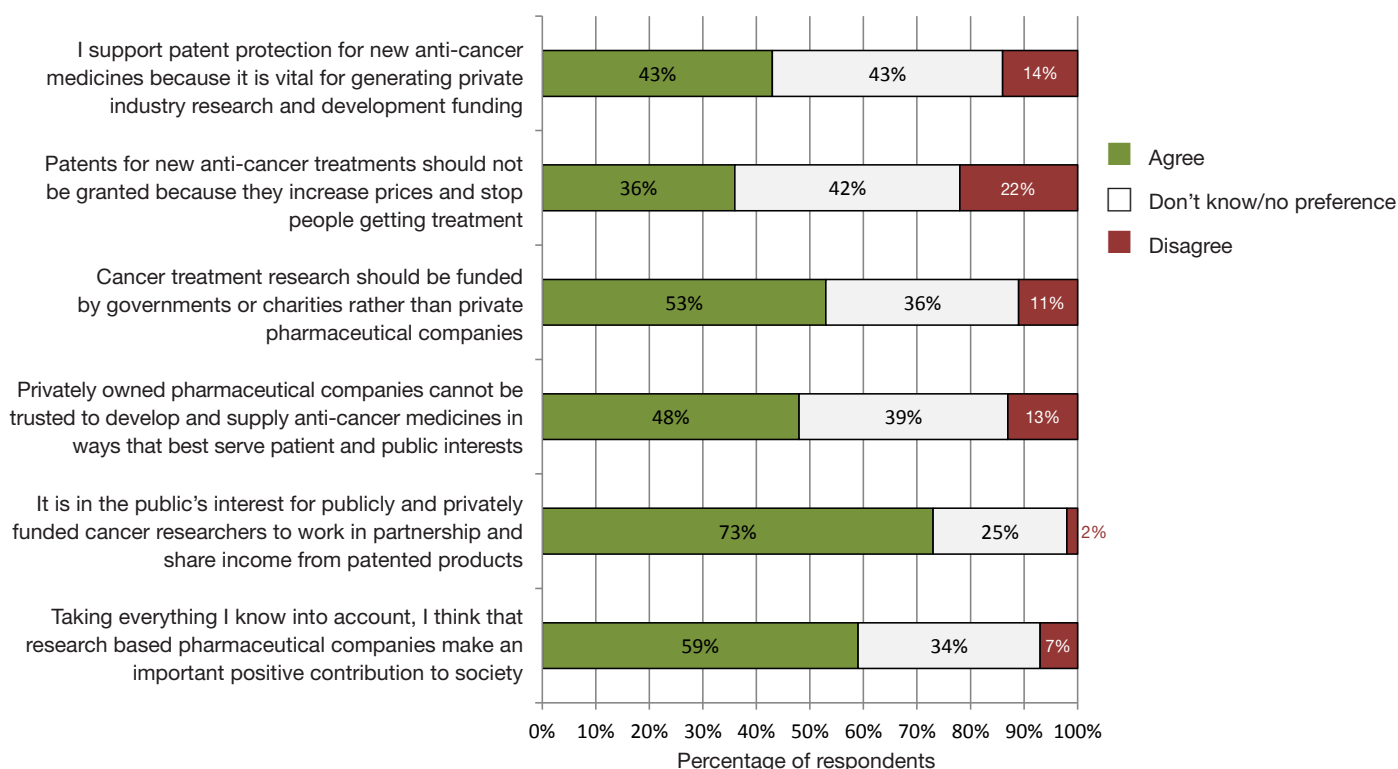


Figure 6: Attitudes towards prevention, patients' ages and the hope generated by new cancer treatments



- Cancer and age.** The number of children and young adults aged under 21 killed by cancer in the UK is now about 500 a year, against an overall annual total of some 165,000 cancer deaths. However, the threat that cancer presents to the young remains an important driver of public attitudes. Two thirds of the population agree that children and young adults should receive the most effective cancer treatments, even if government economists say they are not cost effective. Over 80 per cent of the population (including 95% of respondents aged 65 and over) also say that people aged over 70 have as much right to effective cancer treatment on the NHS as anyone else. Such data raise questions as to the ways in which some NHS rationing decisions are made.
- Support for the NHS and more resources for cancer care.** There is strong British public backing for the principle of health care being publicly funded and universally available. Almost 4 in every 5 people say this is a desirable approach, with only 7% opposing it. But at the same time only a third of the British population think that if they need it NHS cancer care would be as good as that available anywhere else in the world. This group tends to be less socially advantaged than the rest of the population. Another third are concerned about not being diagnosed in a timely way, while the final third are worried about all aspects of NHS cancer care quality. The great majority (over 80%) of the British public say that they think NHS professionals need more resources to provide good cancer treatment.

Figure 7: Attitudes towards pharmaceutical patents and the pharmaceutical industry



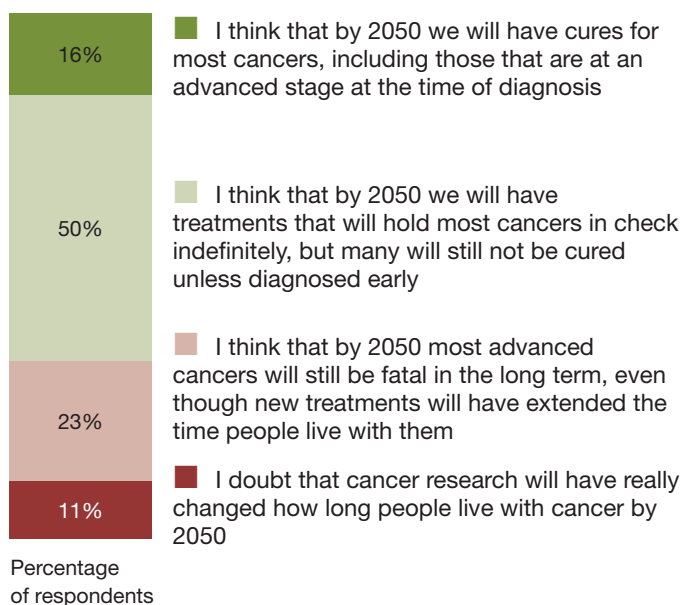
- **Early diagnosis.** There is also strong public support for improving access to early diagnosis coupled with more limited demand for increased spending on cancer prevention via public health measures. Only 3% of respondents disagreed with the statement ‘*If I were developing a cancer I would want it diagnosed as early as possible, even if it raises false alarms.*’ But this should not draw attention away from the high priority the public also gives to developing better treatments for advanced cancers.
- **Uncertainty about the costs of cancer medicines.** Many people in Britain are uncertain about whether or not new anticancer treatments are too expensive and say they do not know if it is right to grant patents or other forms of intellectual property right (IPR) in order to enable privately funded cancer R&D. About 1 person in 5 agrees that anti-cancer drugs are bankrupting the NHS and a similar proportion disagree. The remaining 3 in every 5 say they do not know. Likewise 43% of respondents agree with granting patents for new medicines because they see them as vital for research while 36% said they disagree because patents raise treatment prices. Just over 4 in every 10 people believe that the NHS should buy anticancer and other medicines as cheaply as possible. Yet nearly 6 in 10 say that it should pay prices that encourage industrial development and the ongoing development of better therapies.
- **Attitudes towards the pharmaceutical industry.** Half the UK population believes that cancer research should ideally be funded by governments and charities rather than private organisations. A similar proportion say that (without effective regulation) profit seeking companies cannot be trusted to develop and supply better treatments in ways that serve public interests. But 60% also say that – taking everything into account – they think research based pharmaceutical companies make an important positive contribution to society, while 70% of the British population believe that publicly and privately funded researchers should work in partnership and share income from patented products.
- **Brexit impacts.** Only 14% of those asked in 2019 agreed with the statement ‘*cancer research and care in the UK will improve after Brexit*’. Just under twice as many (26%) disagreed while 6 in every 10 asked said they did not know. Overall, those most supportive of Brexit tended to be less positive about the value of the NHS than the majority of the population, and more likely to agree that people should be able to purchase private insurance in order to enhance their cancer care. (The current reality is that some NHS patients are buying additional anticancer therapies out-of-pocket, when they find – for instance – that certain recommended combinations are not available via the health service.)
- **Improving global cancer outcomes.** As already noted, 3 in 5 people say that for them stopping the world-wide suffering caused by cancer is one of the most important things that could be achieved during the

twenty first century. Yet the British population appears not to be supportive of using aid money to help improve cancer care in poorer parts of Africa and Asia. Only 1 person in 5 says that they believe UK tax payers’ money should fund this form of development, as against a half of all the adults interviewed during the survey reported here expressing disagreement.

In summary, these and other data indicate that there is a ‘central ground’ of around 60 per cent of the population who are broadly supportive of the current mixed, public and private, system of anti-cancer and other medicines research, development and supply. However, many individuals in this group have questions about aspects of existing arrangements and at either end of the political spectrum there are groups with more critical ‘left and right wing’ views. People in them may be critical of profit seeking and believe that this causes poor health in poorer nations, or see current patterns of pharmaceutical regulation and the granting of patents/IPRs as inhibiting free market competition and keeping prices high in their own communities.

A significant majority of the population says that hearing about new cancer treatments gives them hope for the future and that they have positive expectations of cancer research. As Figure 8 shows, about half of all those interviewed for the UCL Cancer Policy Project said that they believe that by 2050 most cancers will be treatable in ways that hold them in check, even if they will not be fully curable by then. This compares with just 1 person in 10 doubting that cancer research will by the middle of this century have significantly changed how long people with cancer survive, and approaching 2 in 10 saying that they think most cancers will be fully curable by 2050.

Figure 8: Respondents’ beliefs about progress in cancer treatment by 2050



Cancer policy developments

Whatever the therapeutic improvements that emerge in the longer term, cancer will continue to be a major cause of suffering amongst people of all ages throughout the 2020s. Optimising clinical outcomes and minimising personal distress will require careful policy development and effective service coordination in all contexts, from prevention, early diagnosis and timely treatment provision through to late stage disease and end-of-life care and the supply of social and rehabilitative support for individuals and families living on with the direct and indirect effects of cancer and its treatments.

One of the key insights to be drawn from the work on which this update report draws is that the reduction in cancer mortality now taking place has not come from one major step forward, but rather from the cumulative impacts of multiple discoveries and innovations. This is not to deny that new therapies have on occasions had important impacts in specific areas of oncology. The use of, for instance, imatinib mesilate to treat chronic myeloid leukaemia (CML) illustrates this, as has more recently the immunotherapeutic application of checkpoint inhibitors such as nivolumab and pembrolizumab in contexts like that of the skin cancer melanoma and, more recently, the treatment of metastatic

prostate cancer (Antonarakis et al, 2019). Yet even so, no single 'cure' or 'breakthrough' will deliver the broad progress in controlling cancers that most people desire.

During the twentieth century important advances also involved the introduction of measures to stop tobacco smoking, through to the development of stereotactic radiotherapy and the marketing of medicines ranging from tamoxifen and taxanes to, subsequently, rituximab and trastuzumab (Box 2). There were in addition radical developments in surgical techniques and medical imaging to which individuals in the NHS contributed. However, by the early 1990s there were concerns that British cancer care standards and outcomes were falling behind those of the world's best health care systems. It was argued that waiting times were often unacceptably long and that the quality of hospital treatment was highly variable between different parts of the country.

In response to such criticisms the then chief medical officers of Wales and England, Drs Deidre Hine and Kenneth Calman, established an expert advisory group to explore how outcomes might be improved. This initially attracted limited bureaucratic and political support. But with the publication in 1995 of the Calman-Hine report (DoH, 1995), followed by the election of the first Blair government

Box 2: Anticancer Medicines

There are four main types of anticancer medicine now available. They are:

- **chemotherapeutic agents.** These kill or stop the growth of cells by inhibiting or disrupting their division. As cancer cells typically divide more frequently than others this can selectively impede the growth of cancers, albeit at the cost of unwanted side effects. Cancer chemotherapy was pioneered in the 1940s and remains a mainstay of cancer therapy. It can be highly effective. But over time cancers become resistant to its effects.
- **hormone antagonists and related treatments.** These products, which are effective against sex-hormone dependent breast and prostate cancers, also date back to the 1940s. They can slow the growth of relevant forms of cancer, and in adjuvant settings (that is, when used in conjunction with surgery) increase the likelihood of cures. In some instances such medicines can also be used as preventive agents.
- **targeted anticancer medicines.** From around the 1970s onwards improved understandings of the genetics of cancer and the role that 'driver' genes play gave rise to the idea of developing targeted anticancer drugs aimed at blocking the effects of specific proteins. From the 1990s onwards work based on this concept gave rise to medicines such as imatinib mesilate (used primarily for treating chronic myeloid leukaemia), trastuzumab (for HER2 positive breast cancers) and rituximab. The latter binds to a protein on the surface of B lymphocytes, causing their death and so modifying immune responses and controlling some cancers.

- **immunotherapies.** The discovery and development of immune system checkpoint inhibitors as anticancer medicines resulted from the fundamental research of academic scientists such as Tasuku Honjo and James Allison, followed by different but also vital contributions by pharmaceutical industry based investigators. It offers important advances in cancer treatment based on the capacity of checkpoint inhibitors to prevent cancers shielding themselves from immune system attack. Examples of such medicines include ipilimumab (which targets a protein called CTLA-4) and nivolumab and pembrolizumab, which bind to PD1. The development of CAR (chimeric antigen receptor) T cells, which can be said to have been re-engineered to fight cancers, is another form of immunotherapy.

Many other medicines are used in cancer care for their palliative effects, and a number of vaccines (and some drugs) have important preventive impacts – see main text. It was hoped towards the end of the last century that as more precisely targeted treatments become available side effects would be avoided and cancer outcomes quickly improved. In some instances this proved true. But in many others there have been disappointments. This is because most cancers are more genetically diverse and unstable than was until recently understood. This often allows them to become resistant to targeted drug interventions more rapidly than researchers anticipated. Now this is understood therapeutic strategies will increasingly involve using combinations of new and existing drugs along with other treatment modalities in ways that can be adapted to match or anticipate the ongoing evolution of each tumour.

in 1997, an opportunity to implement innovative policies arose. The 'solution' to the by then widely accepted problem of poor NHS cancer outcomes offered by the Calman-Hine intervention centred primarily on replacing a generalist model of cancer service provision with more specialised oncology departments in hospitals, coupled with the creation of multidisciplinary cancer care teams.

This led relatively quickly to progress in fields such as breast cancer care (Morgan, 2019). Yet those seeking better treatment standards and improved recovery rates soon became aware of a need for more far reaching interventions aimed at strengthening performance in areas such as the early detection of tumours in primary care and other non-inpatient settings.

The ways in which goals such as achieving better primary/community, secondary and tertiary care coordination and promoting greater public and patient involvement in cancer prevention and treatment have been pursued cannot be detailed here. But in England they have involved the roll-out of a series of national strategies. The most recent publication relevant to this sequential development process was the 2019 *NHS Long Term Plan*. Amongst other aims, this set a target for increasing the proportion of cancers diagnosed at (the more treatable) Stages 1 and 2 to 75% in 2028, compared with the 50% recorded in 2018. It also highlighted the importance of improving the treatment of lung cancer, which presently causes over a fifth of all UK cancer deaths.

Current challenges

NHS cancer services are significantly better today than they were before the publication of the first NHS Cancer Plan (DoH, 2000) and are good in global terms. Yet at the same time the performance enhancements achieved in the last two decades have taken place more slowly than some sources believe should have been possible and concerns about NHS outcomes remain (Richards et al, 2018). There is some evidence, for example, that the impacts of the 2012 Health and Social Care Act interrupted the development of well integrated local cancer care pathways and drew attention away from other priorities. The ongoing pursuit of Brexit may have similar impacts.

Even with respect to facilitating earlier cancer detection (which coupled with accelerated diagnosis and timely access to effective treatment offers the NHS its best prospect of achieving world-class survival durations) British progress has been less impressive than that reported in Denmark. The latter has a primary care system more like that of the UK than most other European nations. At the start of this century Denmark was also reporting relatively disappointing cancer survival rates, as compared with other parts of Scandinavia and countries like Australia and Canada. But since then cancer detection and treatment there appears to have improved more rapidly than it in the UK nations (Arnold et al, 2019).

Initiatives such as the 2014 ACE (Accelerate, Coordinate and Evaluate) programme and the more recent establishment of the Cancer Research UK International Alliance for Cancer Early Detection (ACED) – coupled with the establishment of new NHS facilities like Rapid Diagnostic Centres – ought to open the way to enhanced outcomes in the 2020s (Duffy, 2019). Nevertheless, there are fears that the systemic factors that underpinned the problems that Drs Calman and Hine and their colleagues observed in the 1990s will continue to hinder timely NHS adaptation to its changing environment and so impede efforts to meet the evolving needs of its users.

The root causes of problematic NHS performance in part relate to the ways in which the health service receives public funds and remains at senior levels accountable to national politicians seeking acceptable levels of public health coupled with low taxation burdens for those voting for them. Despite the in some ways anomalous creation of its tax funded health service Britain's sociological approach to regulating public spending levels has been more like that of the US than that of countries such as France or Germany. There is a consequent hazard that within the NHS the prioritisation of budgetary control and cost constraint tasks on occasions retards the optimisation of health gain, up until the point that 'keeping the lid' on failures to achieve service excellence threatens public scandal.

Beyond the general challenge of accelerating cancer diagnosis and treatment, oncology policy issues likely to demand attention during the coming decade include:

- **Increasing the effectiveness of primary prevention programmes.** Further reducing the number of tobacco smokers from its current level of about 14% of adults (in England – the Scottish rate is 16%) remains a key public health objective. British policies on encouraging vaping as a substitute for smoking can be regarded as world leading and are likely to reduce both cancer and heart disease rates, notwithstanding criticisms and cautions from the WHO (Ghebreyesus, 2019). Other approaches to the primary prevention of cancer include avoiding sunburn and, as already noted, vaccinating against conditions like HPV and Hepatitis B and the identification and treatment of chronic infections like those caused by Hepatitis C and *Helicobacter Pylori*. In future it is also possible that forms of long-term medicine use (including low dose aspirin and that of hormone blocking agents) may also be recommended for the prevention of cancers such as those of the breast, prostate or bowel in higher risk groups.
- **The further development of NHS (or private) cancer screening.** At present just over 1 cancer in every 20 recorded in the UK is identified via health service screening programmes. These currently exist for bowel, cervical and breast cancer. Adult screening programmes in England have recently been reviewed on behalf of NHS England by Professor Sir Mike Richards, the Blair government's original 'cancer Tsar'. His report (Richards, 2019) was critical of the conservatism of the National Screening

Committee and the speed at which improvements in areas such as bowel cancer screening (including the move to faecal immunochemical testing) have been made. It called for new governance arrangements and drew attention to the ways in which advances in genetics, coupled with effectively targeted screening strategies, should lead to a significantly greater proportion of tumours being identified at an early (or even pre-cancerous) stage.

Examples of areas in which innovative forms of screening should prove viable include bowel cancer, prostate cancer (in, for instance, the context of the ReIMAGINE trial described in Box 1, page 3, which might open the way to a new national programme of risk assessment for men in middle life using MRI imaging combined with urine or blood tests) and lung cancer (see below). The scale of the emerging opportunities is partly indicated by the fact that in the case of the now relatively well-known BRCA 1 and 2 genetic mutations that, because of their impacts on DNA repair, significantly raise affected individuals' chances of developing ovarian, breast, prostate and pancreatic cancers, of the 70,000 plus people at risk in the UK it is unlikely that more than half are aware of their vulnerability.

- **Improving the quality of medical care for older people with cancer.** One of the historic reasons why UK cancer survivorship lags behind that of some other nations relates to the likelihood of older people receiving timely treatment. In the case of (non-small cell) lung cancer, for instance, there is evidence that individuals aged over 65 who present in England do so when the condition is at a later stage and less likely to undergo adequate pathological investigation and active (as distinct from palliative treatment) than is the case with their US counterparts (Andreano et al, 2018).

Towards the end of life there can be value in avoiding intrusive medical interventions and focusing on maintaining quality of life. Good palliative care can also extend life. But even so, it is likely that as the effectiveness and tolerability of cancer treatment increases so too will many older patients' preferences for having access to it even when they have later stage cancers. Given that two thirds of all cancer mortality now takes place in the population aged over 65 years this will significantly increase future demands on the NHS.

- **Survivor support.** The harm generated by cancers is not confined to causing the deaths of those immediately suffering them. Their impacts include trauma experienced during the processes of diagnosis and treatment, and distress for not only cancer survivors themselves but those who live with and – as and when deaths occur – after them. Despite the efforts of health and social care professionals and the contributions of voluntary sector bodies like Macmillan Cancer Support in fields such as countering the 'superstitious dread' of cancer and enabling patients and families to navigate cancer care more effectively, there is evidence of service shortfalls in areas such as post-interventional rehabilitative care. In the context of preparing for surgery or exposures to other

anti-cancer therapies (including immunotherapies) there are also unmet needs for 'prehabilitative' care, designed to help people to become as mentally and physically fit as possible to receive treatment (Red Consultancy, 2019).

- **Enhancing service user and wider public engagement in cancer care.** The 2002 Wanless report for HM Treasury on the future sustainability of health care highlighted the potential importance of achieving 'full engagement'. This in essence means creating conditions which encourage service users to take active and informed parts in protecting their health, seeking effective treatment and using support services to best effect. Yet evidence from organisations such as the Commonwealth Fund of New York has questioned the performance of the NHS in this context. It suggests that the culture and ethos of the UK health service tends to encourage paternalistic rather than equal relationships between service providers and users. While this may link back to the way the NHS is funded and can on occasions be seen as consistent with the pursuit of equity and the optimisation of overall public health via 'skewed paternalism' in a resource constrained environment it is unlikely to facilitate optimal personal outcomes for the majority of service users.
- **Information governance.** The NHS is often said to be in a good position to build comprehensive data sets about the treatments received by individuals with conditions such as cancers and their outcomes. This should be useful for developing improved patterns of intervention and 'artificial intelligence' driven (and other evidence based) algorithms for supporting research and clinical decision making. UK policy makers have shown awareness of such opportunities: a variety of current initiatives are aimed at using NHS cancer and other patient-linked information in an appropriate manner.

However, there are also concerns that controls intended to protect public interests in privacy and information security could needlessly slow progress. This is a politically sensitive area. But one danger for the UK is that public service value related restraints, despite being well intended, might mean that competitors located elsewhere will prove better able to gather and use 'big data' for beneficial – health outcome enhancing – purposes. In the USA, for instance, commercial collaborations might prove ultimately more able than the NHS to deliver innovative insights and tools in a timely manner, despite the potential advantages enjoyed by actors in the British system.

- **Assuring adequate capital investment.** One result of the NHS's cost limitation focused culture and the incentives underpinning it is that it has (as has been observed in other parts of UK economy) tended to spend less on capital stock improvement than health care systems in other advanced economies. For example, there is long-standing OECD evidence that England and the other UK nations have in aggregate fewer MRI scanners and other forms of advanced imaging and radiological equipment than, for instance, Germany.

The NHS may be able to use the resources it has more intensively and cost effectively than is so in other settings. Yet there is an obvious risk to cancer and other care standards if adequate levels of capital investment in medical equipment are not consistently assured. In the radiology context provisions made via the *National Cancer Plan* and successor documents – including *Achieving World Class Outcomes*, the preparation of which Cancer Research UK led (Independent Cancer Taskforce, 2015) – have helped to protect NHS care quality. But vulnerabilities remain. The development of a new national cancer plan for the 2020s could help to continue progress via, for instance, establishing clear capital investment targets linked to robust projections of how demand for cancer treatment will change in the coming decade.

- **Maintaining and extending the cancer workforce.**

There are also concerns about the quality of NHS workforce planning and development generally and specifically with regard to delivering cancer services. For example, Cancer Research UK has highlighted the fact that about 10% of all NHS posts relating to early diagnosis are presently unfilled. Similar shortages exist elsewhere, from primary care to the availability of specialist cancer nurses. The details of workforce development and the potential for a new NHS People Plan to help remedy such problems are not explored here. However, as computer based communication and clinical judgement support systems improve these ought to allow greater flexibility in the use of health sector labour to provide high quality care. For instance, the range of community pharmacy based services for people at risk of or who are living with cancers could in future be extended – see Box 3.

- **Assuring rapid access to effective new pharmaceutical therapies.**

Despite the apparent concerns of some observers about the cost NHS medicines, the four level system for limiting health service outlays on pharmaceutical products (Box 4) represents one of the most rigorous approaches to controlling public sector spending found in any part of the UK economy.

At the same time the NHS record in supplying innovative medicines to people with cancer has to date been relatively strong. Disputes about individual product prices and overall treatment costs may result in highly visible delays between a new pharmaceutical treatment being licensed and its being available to NHS patients. However, the long term record of the health service in supplying access to medicines of well-proven effectiveness has been robust.

At this point in the accelerating cancer treatment revolution a significant challenge facing policy makers is to build on this achievement in ways which allow new pharmaceutical treatments for cancers (whether these are single entities or novel combinations) to be used in a timely manner, even if there is uncertainty about the outcomes achievable. This task ought to be resolved in ways which are affordable from NHS and other State budget-holders' perspectives but which also respect national and international public interests in achieving patient-centred clinical excellence and incentivising continuing public and private research investment.

The final two sections of this UCL Cancer Policy Project report briefly consider issues linked to the prevention and treatment of lung cancers which relate to the points made above, and examine the affordability of cancer care and treatment in the 2020s. However, before this a final issue to note here relates to the funding of social care for people living with cancers and similar conditions, and its implications regarding health and related policy making processes in Britain.

Since the 1970s the definition of social care has tended to broaden while that of health care has in some ways narrowed, even though the number of medical specialisms has increased. Despite their importance to ageing populations, services like district nursing have declined and over the last decade the funding of health related social care has also been cut. Overall social services outlays have fallen by about a third, while total NHS spending has been held roughly constant at around 7.5% of GDP.

Box 3: Pharmacists' Contributions to Better Cancer Care

The origins of pharmacy lay in making medicines and – at least in the British, as opposed to the European, tradition – recommending treatments directly to patients. In the second half of the 20th century, however, much of the profession's work became more narrowly centred on the drug supply process, coupled (in the aftermath of the thalidomide tragedy) with an emphasis on safety assurance in hospitals.

Today there is an increasing interest in pharmacists acting as clinicians and direct care providers. This implies a growing overlap between pharmacy roles and those of doctors and nurses. Specialised oncology pharmacists are in hospitals responsible for the storage and make-up of anticancer medicines. They also advise on treatment decisions and support patients with regard to how their medicines work and any problems they may encounter in taking them. But the administration of anticancer drugs remains a nursing role.

In the community pharmacists also add value by supporting anticancer medicine users and helping them to navigate the wider health and social care system. One opportunity for 2020s could be to develop pharmacies as not only healthy living and self-care support centres but as early diagnosis hubs. In the oncology context this would have the objective of enhancing prevention and when possible identifying cancers before they have metastasised. The introduction of technologies such as AI backed risk assessment and diagnostic programmes or blood sample based cancer testing will offer pharmacies new opportunities to contribute to health improvement. Such service extensions could either be funded by the NHS or – should there prove to be sufficient willingness to pay on the part of those who could benefit – directly by the public.

Box 4: NHS Controls on Pharmaceutical Spending

Standards of medicines prescribing and use in Britain are amongst the best in the world, albeit improvements will always be possible. The NHS also has a series of mechanisms in place for controlling the cost of the medicines it supplies. These make NHS pharmaceutical outlays one of the most rigorously controlled areas of UK public spending. In England the provisions involved include:

- **The Voluntary Pricing and Access Scheme for branded medicines (VPAS)**, which from January 2019 replaced the PPRS (Pharmaceutical Price Regulation Scheme). VPAS amongst other things sets a cap on the total amount the health service spends on medicines and allied items supplied under the Scheme in any one year. Excess earnings must be returned by pharmaceutical companies via the Department of Health and Social Care. Recent annual repayments have been in the order of £500 million.
- **The National Institute for Health and Care Excellence.** NICE has since 1999 undertaken a wide range of work relating to public health and social care as well as on health care guidelines and cost effectiveness studies – see main text and also Box 7, page 18. In relation to its work on pharmaceutical value-for-money NICE does not have direct authority over medicine prices. But it can decline to recommend for NHS use products that it believes to be too expensive.
- **NHS England.** Disputes about using medicines for HIV prevention, coupled with fears about the costs of treatments for Hepatitis C, recently led to NHS England (which was first established in 2013) taking powers to limit the numbers of NHS patients receiving treatments deemed cost effective by NICE unless their suppliers offer further price reductions in order to limit overall budget impacts.

To some critics this check on the volume use of selected medicines and the associated non-pharmaceutical costs of care might appear unnecessary, given the existence of VPAS. At worst it could seem to threaten the unregulated use of monopsonistic powers in relation to specialist NHS medicines procurement, despite the fact that a new Commercial Framework is being put in place.

In addition to the above provisions (and parallel structures in Scotland and the other UK nations) there are also networks of incentives and procedures designed to support the local efforts of NHS doctors, pharmacists and other professionals to use pharmaceuticals economically and to good effect. Together with the fact that the fundamental dynamics of medicines development and supply normally cause pharmaceutical prices to drop as products move through their life cycles, the existence of these arrangements explains why per capita NHS medicine costs are relatively low in global terms. Total NHS pharmaceutical costs have remained at around 12% of the overall health service budget since the 1990s.

During the run up to the December 2019 General Election it was suggested that there is a risk that NHS medicine costs could double because of new trading relationships with the United States. In fact this is very improbable, not least because the actual amounts paid for pharmaceuticals in the US are about half those commonly quoted. But from the perspective of those interested in incentivising investment in better cancer therapies it might be added that although low/discounted prices for new products benefit purchasers they may also act against public interests in stimulating innovation. World-wide, an informed approach to defining the value of novel anticancer medicines should arguably seek to avoid this hazard, as well as that of paying ‘too much’.

From a cancer policy perspective it is important to stress that as survival rates increase and the proportion of people living with or after cancer who are in their 70s and over rises (their total in the UK is already in the order of 1.5 million) the inputs needed from social care and providers like nurses working in the community will, together with those of GPs and other primary care practitioners such as pharmacists with community roles, become progressively more significant. Failures to address health care related aspects of social and community care in recent decades can be thought of as being a major weakness in UK policy making, which questions the integrity of all those involved.

During the December 2019 general election campaigns the health related political discourse centred mainly on broad promises of funding for ‘new hospitals’, together with attempts to stimulate fears about ‘privatisation’ and allegations that NHS pharmaceutical costs might more than double because of pressures applied by the United States. Hopefully in 2020 British public debate about cancer and other health policy matters will become more constructively focused on adequately resourcing and otherwise improving all parts of the health and social care system, given the extensive socio-economic challenges that the nation faces.

Improving lung cancer outcomes – a British priority for the 2020s?

Lung cancer is a set of disorders which are divided between small cell (SCLC) and non-small cell (NSCLC) conditions. The latter account for about 85% of all cases. As already noted, lung cancers presently cause about 35,000 deaths a year in Britain and some 1.8 million globally.

Lung cancer was known to European physicians in the eighteenth century, although in practice it was rarely diagnosed until after World War 1. In 1900 there were only 400 or so reports of the disease in the entire world literature. But following the introduction of mass cigarette manufacturing and sale from around that time, coupled subsequently with the encouragement given to the armed forces to smoke during the 1914-18 conflict, the incidence of lung cancer diagnoses began to increase. From the 1920s onwards doctors in countries like Britain also became better able to recognise the condition than their Victorian forebears.

The mortality due to lung cancer amongst men in the UK peaked in the middle 1970s, over twenty years after cigarette smoking reached its immediate post-war zenith.

Box 5: Immunotherapy for Lung Cancer

Recent trials have shown that in the case of advanced non-small cell lung cancers (NSCLCs) providing immunotherapy can at 5 years more than double the time lived by patients, as compared to the survival of those receiving chemotherapy alone. The published findings show a mean survival time increase from about 10 months in the latter case to over 22 months (ASCO, 2019). The significance of an average extra year or so of life gained in such testing circumstances may be questioned by some observers. However, for those directly involved benefits of this magnitude can be important. A proportion will enjoy much greater gains. The five year survival rate for those receiving the immunotherapeutic regimen referred to here was over 20%.

It would be wrong to overstate the value of any one advance in cancer care, or underestimate the extent of suffering still caused by the disease. Yet it would also be

misleading to deny that over time step-by-step biomedical innovations are certain lead to further benefits. Professor Mick Peake (whose current roles include being Clinical Director at Centre for Cancer Outcomes for the North Central and East London Cancer Alliance, based in UCLH) commented during the research undertaken for this report:

“The series of very carefully conducted clinical trials in childhood leukaemia from the 1940s onward clearly demonstrated that advances in extending survival and achieving ‘cure’ in cancer do not come in huge leaps, but in small or modest incremental steps. We have seen the same in the management of advanced non-small cell lung cancer where in the 1980s median survival was well under 6 months: now, with the application of evidence from hundreds of clinical trials, many patients, even with metastatic disease, are living two to three years and beyond.”

Reflecting a similar relationship between smoking levels and the disease, lung cancer mortality in British women continued to rise until recently. It is now more or less stable for the female population as a whole. Presently, women in the UK are still about 30% less likely to die of lung cancer than men.

In part because of the past lack of effective treatments for lung cancers – together with the fact that their principal cause in modern European populations has for over half a century been known to be tobacco smoking, making it seen by some as self-inflicted – caring for those with the disease may have been a relatively neglected priority. In addition to the lack of informed sympathy on occasions shown to the victims of smoking and other life style related diseases there have been fatalistic assumptions that lung cancer is certain to kill, whenever and however it is treated. However, with the advent of better diagnostic technologies and more effective therapeutic options this situation is now changing. The position of lung cancer care today is in some ways comparable to that of the treatment of childhood leukaemia during the 1950s and 1960s and where breast cancer was in the 1980s and 1990s (Peake, 2019 – see Box 5).

Following on from the above, important observations include:

- **It is in many if not all instances ethically inappropriate and functionally counter-productive to blame smokers for contracting diseases associated with their habit/addiction.** It is also relevant to note that (allowing for tumours that occur in smokers but which may have other primary causes) today approaching a quarter of lung cancers might be seen as mainly due to factors other than voluntary smoking. In addition to direct or indirect (nicotine dependence linked) genetic vulnerabilities these include exposures to indoor and outdoor air pollution or to asbestos and other oncogenic substances in workplaces and elsewhere.

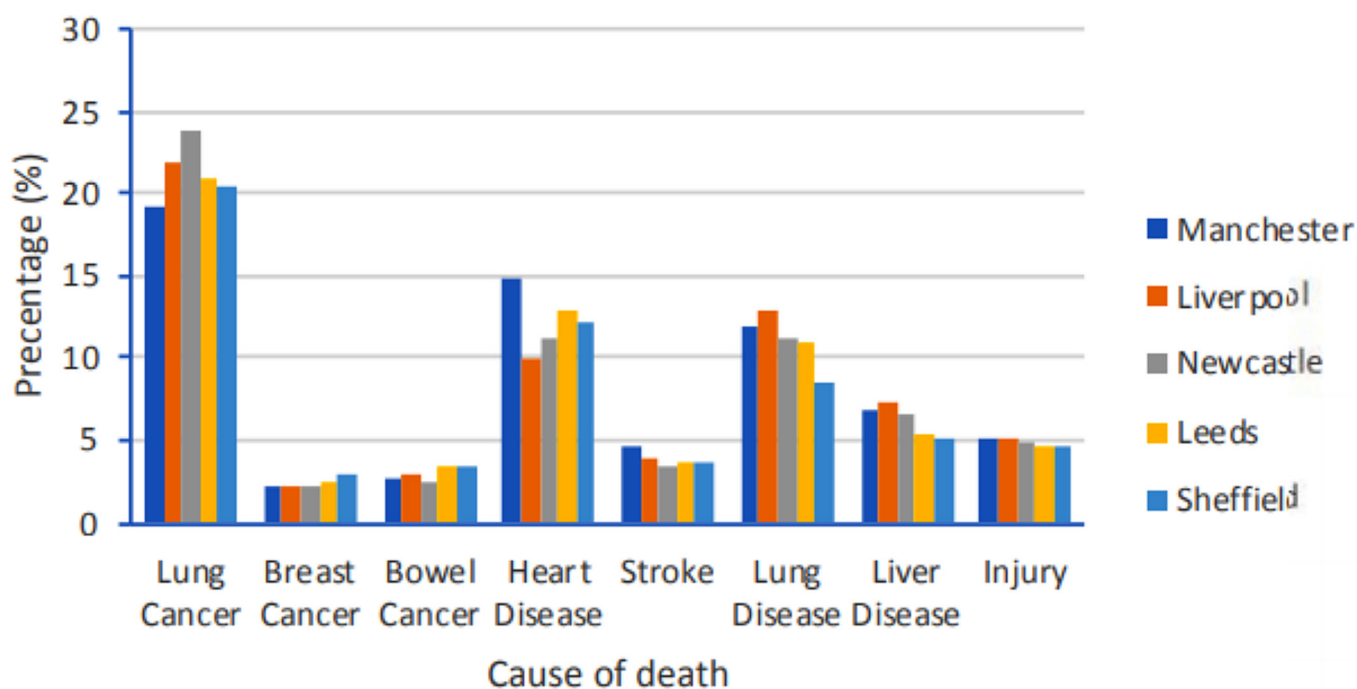
- **Smoking rates in British men are now less than a third of those recorded in the 1950s.** But because less advantaged people are now far more likely to use tobacco than the rest of the population lung cancer is still a major cause of class-linked life expectancy inequalities. Likewise, despite the fact that the average age at diagnosis of people with lung cancer in the UK is in the early 70s, it has a major impact on premature death rates (defined as occurring before the age of 75) in settings such as the north of England – see Figure 9.

Early detection via screening

In the last few years the evidence base in favour of screening smokers and former smokers for lung cancer has strengthened. In Europe the results of the large-scale NELSON trial confirmed the value of low-dose computed tomography (CT) screening in people at high risk, especially women (De Koning et al, 2018). This research showed that CT scanning for lung cancers decreased mortality in men in their 50s, 60s and 70s with a record of smoking by a quarter over a ten year period, and by 60% in similar women. Similarly, the US National Lung Screening Trial (NLST) showed a 20% reduction in lung cancer mortality due to annual screening over 3 years using low-dose CT scanning as compared to the outcomes achieved through using chest radiography.

Some commentators remain doubtful about the cost effectiveness of screening for lung cancers. Nevertheless, lung health check pilot schemes are already being undertaken in 14 English areas. Those seeking better outcomes hope that in the early 2020s a targeted National Lung Cancer Screening Programme will be established. This could also contribute to the early detection and treatment of disorders such as COPD (Chronic Obstructive Pulmonary Disease), which will increase its economic and welfare returns.

Figure 9: Causes of premature death, 2014-16



Source: PHE 2017 (Premature death defined as occurring under 75 years.)

Judging by the experience of other countries, using current knowledge and technologies to best effect should allow 5 year survival rates for lung cancer in Britain to be increased to 25% by the mid-2020s (UKLCC, 2016). (In the US the reported average 5 year survival rate for lung cancer is presently 22%, with States such as New York already at 25% – American Lung Association, 2019). This compares to a reported UK level of about 15%. However, this is a conservative goal. It does not take into full account the probability of further improvements in the technologies available for the early diagnosis of cancers or the impacts of more effective life extending (and perhaps on occasions curative) treatments for the disease.

Research now being conducted globally – including in settings like ULC and UCLH – could, for instance, during the coming decade open the way to the use of blood tests that identify circulating DNA released from cancer cells. In addition to perhaps in future helping find more lung (and other) cancers before they have metastasised this might permit better targeted forms of drug use, tailored to mirror and/or anticipate the genetics of tumours as they evolve in each individual.

Accelerating the lung cancer pathway

It is possible that such advances could, coupled with necessary service changes, raise average 5 year lung cancer survival rates to 35% or more towards the end of 2020s. Such a figure might be a reasonable target for a new national cancer plan to set. However, for the present it is worth emphasising that, alone, the early identification of a cancer cannot ensure an enhanced outcome. Finding an early stage tumour needs to be followed by rapid progress towards a precise diagnosis and the delivery of effective treatment and good psychological and social care.

A National Optimal Lung Cancer Pathway (NOLCP) was published in August 2017. Its application could, those involved with its development believe, reduce the time between the initial identification of the disease and the delivery of definitive treatment to under 50 days.

However, a recent report from the UK Lung Cancer Coalition (UKLCC, 2019) pointed to significant variations in the use of the NOLCP and in local performances against key measures. The UKLCC offers a series of best practice related recommendations for oncology professionals and agencies like NHS England and each of the 19 Cancer Alliances in England aimed at reducing delays in processes such as cancer staging and the delivery of, for instance, high quality NHS radiological services.

Affording world-class cancer care in the 2020s

In the UK the cancer death rate amongst people aged under 60 has halved since the 1970s. Even in the population aged 70-80 years the cancer mortality rate has fallen by over 10% since 2000, and the pace of scientific and clinical progress shows no signs of abating. Recently, for instance, reductions in the time taken before surgical intervention – facilitated in part by imaging technology advances – have led to a near doubling of the 10 year NHS patient survival rate for people with stage 1 and 2 gliomas (a form of brain cancer). This achievement has been accompanied by similarly striking declines in the occurrence of post-interventional neurological disabilities (Solomons et al, 2019).

By or during the 2050s cancer may have been overcome as a major cause of mortality amongst people aged under 80 years, at least in communities with the resources needed to deliver high quality cancer prevention and treatment

services (Gill et al, 2015). Yet some critics of the mixed public plus private approach to biomedical innovation currently in place warn against the creation of false hopes in case they should lead to the use of treatments than cause more harm than benefit. There are also fears that the increasing costs of cancer care may become unaffordable, even in more affluent nations. These may be linked to claims that the prices of items such as new anticancer medicines are too high relative to the research and development (and associated risk capital) costs involved.

Such beliefs are disputable. One of their implications is that publicly funded rather than private sector resourced innovation programmes could offer more efficient ways of finding better cancer treatments (UCL Institute for Innovation and Public Purpose, 2018; The Labour Party, 2019). An associated idea, which (as already noted) received high profile attention during the run-up to the December 2019 general election, is that the finances of the NHS will be undermined if in future medicine prices in the UK were to increase to US levels. It was suggested that this could raise UK pharmaceutical costs 'by £500 million a week', an even greater amount than the £350 million a week that it had previously been suggested the NHS might gain as a result of Britain leaving the EU.

Managing the overall costs of cancer care

It is to be expected that in fields such as oncology, where there is often a high level of anxiety and considerable potential for disputes between privately (or publicly) owned suppliers of products like novel drug treatments or new generations of medical equipment and the funders and providers of health care, that there will be conflicts about costs. But the occurrence of such events does not mean that the 'market' for better treatments is failing, or that the NHS is collapsing. The view offered here is that seeking to 'weaponise' aspects of public policy debate about health service provision in ways that generate needless alarm are undesirable.

Precise figures are not available. But in the UK nations' cancer services currently account for less than 10% of all health related outlays, including private spending. A figure of 7-8% (or 0.5% of GDP) is a realistic estimate of the proportion of NHS funds currently being spent on cancer care of all types. Anticancer medicines, the costs of which are no less difficult to estimate accurately because of factors such as discounts, account for 20-25% of this total. This in the UK NHS context represents a sum of around £2-2.5 billion, or 0.1-0.15% of the present UK GDP. As indicated in Box 6, the latter proportion is about

Box 6: Global Spending on Health Care, Cancer and Anticancer Medicines

The average OECD nation now spends about 10% of its GDP on health care. Within that, approaching 1.5% of GDP is commonly accounted for by pharmaceutical and allied costs. Poorer nations with lower wage levels and relatively large informal economies have in the past spent less of their recorded national incomes on health services and proportionately more on drugs, although this picture is changing. At the upper extreme the US now spends some 17% of its GDP on health care, albeit OECD data indicate that the proportion of the health budget going (at least at list prices) on pharmaceuticals is – at about 12% – similar to that spent in the UK.

Pooling currency based information from different nations is inherently problematic. But in nominal US \$ terms the estimated World Gross Product for 2019 was approaching \$90 trillion. Of this \$9-10 trillion was accounted for by health care costs, with \$3.5 trillion being spent in the US alone. This compares with a total of a little under \$250 billion spent on public and private health and related care in the UK in 2019. (Britain has almost a quarter of the American population.) World drug spending was reportedly in the order of \$1.2 billion in 2019, of which the available market research figures indicate that \$150 billion was accounted for by anticancer drug purchases.

Under a tenth of the world's health care budget is devoted to oncology. Because cancer is more common and of greater relative significance in 'old', richer, countries, and also because using anticancer medicines to good effect normally requires extensive health service infrastructures, the great majority of cancer related pharmaceutical spending takes place in the most economically developed nations. Yet most cancer deaths, especially amongst children and young adults, already occur elsewhere. Of

the \$150 billion total anticancer drug cost estimate, up to \$70 billion is paid by US purchasers. In part because of laws relating to cancer care provision in the United States, price discounting for oncology products there does not occur to the same extent as in other therapeutic areas.

Some commentators believe that Americans are making unfairly high contributions to the world-wide cancer R&D effort. However, it can be argued that as a proportion of national health care costs US outlays on anticancer treatments are not – at about 2% – unduly high, especially given US public's treatment expectations, the quality of care delivered and US strategic economic interests in the biosciences. The equivalent UK figure is closer to 1%. Those for countries like France and Germany are nearer the US figure.

From a global humanitarian perspective a more serious concern relates to cancer care standards in poorer countries such as, for instance, India, where only about 1% of GDP is currently being spent on all forms of publicly funded health care. Simply improving the supply of established and innovative medicines – desirable though this is – cannot make up for problems in areas such as access to early and accurate diagnosis and imaging services, or shortfalls in the provision of radiological and surgical care. Immediate priorities include decreasing smoking (Indian policy makers have recently acted to ban vaping, while tobacco products remain freely available) and ensuring the take up of protective vaccines and medicines that, like appropriately prescribed tamoxifen, can be expected to be beneficial relative to the harm they cause even in resource-poor settings – see main text. Better coordination of existing facilities' work is also important.

half of the equivalent figure for the US, which probably stands at 0.3% of GDP. It is also likely to be below that for nations such as France where the expected figure is about 0.2% of GDP.

Such data mean that although the costs of cancer care are appreciable they should not be thought unaffordable in the UK, given that the disease accounts for almost 30% of all deaths plus a considerable morbidity and disability burden. For comparison, outlays on alcoholic drinks in Britain (which have fallen in relative terms this century) are at retail prices equivalent to over 1% of GDP. This is ten times the cost of all anticancer drugs, calculated at actual NHS payment levels. In addition to the pleasure drinking alcohol generates and the employment associated with its production, considerable mental and physical harm is created. It may therefore be seen as ironic that developing and supplying cancer treatments can be more likely to be regarded as unaffordable.

As more anticancer therapies emerge and more people survive to develop the disease and demand their effective treatment the relative costs of cancer care will rise. Less certainly, modifications in the ways in which the prices and overall costs of innovative medicines are set by the NHS could in theory increase some outlays. But in a context which can be said to have long been one of the most effectively managed fields of British public spending any such developments are most unlikely to lead to unplanned, let alone unaffordable, changes in the health service's pharmaceutical spending. This is partly evidenced by the fact that total pharmaceutical costs have in terms of manufacturers' returns been broadly stable as a percentage of NHS outlays since the 1990s. They now stand at circa 11% of NHS costs.

The fundamental problem relating to cancer treatment prices and costs to be resolved in the next few years does not realistically relate to any threat of the NHS being 'bankrupted'. It instead centres on how in complex circumstances the amounts paid for innovative treatments and treatment combinations can be set in ways which balance the benefits of cost (and tax) limitation with the British and global communities' medium and long term interests in continuing biomedical and biopharmaceutical research and trade in order to gain greater wealth and reductions in the burdens caused by illnesses like cancer.

Equitable medicines pricing and appropriate overall cost control

The reason why NHS drug costs expressed as a percentage of the total health service budget have stayed stable in recent decades links to the fact that, unlike the case with labour-based inputs, outlays on medicines and other products with high fixed development costs and comparatively low marginal costs of production fall as they mature. When intellectual property rights expire and as, over time, production processes improve and clinical knowledge strengthens, the cost effectiveness of drug use increases and overall outlays decline. This is as true in oncology as it

is fields like cardiology, albeit the issues to be addressed in pricing anticancer treatments fairly differ radically from those associated with products such as statins or beta-blockers used in the prevention and treatment of heart disease. This is fundamentally because of the time and effort needed to learn the full value of anticancer medicines, especially in the early disease context.

It is understandable from a political economics standpoint that governments of all complexions should want to be assured that communities do not pay 'too much' for patent and other intellectual property protected treatments. Although pharmaceutical costs account for little more than a tenth of all health spending in the US and much of the EU, as well as in the UK, they can be made highly visible to electorates. In this country health care is widely regarded as a form of 'public good', in which context the provision of medicines by private sector innovators with (albeit temporary) exclusive supply rights may seem anomalous.

Agencies such as NICE and NHS England and equivalent bodies in the devolved nations together with the UK wide regulatory mechanisms in place do not only set an overall cap on total pharmaceutical costs so that the revenues received by pharmaceutical companies over that amount are repaid. They can also limit budgetary impacts by curbing the numbers of patients accessing given therapies in any one year and via setting cost-per-QALY linked affordability thresholds (Box 7). These are used to define the maximum prices that the NHS is prepared to pay for treatments.

Further detailed work on the political economics of cancer treatment will be published later in 2020. But for the purposes of this Cancer Policy Project update the questions to highlight range from '*how should affordability thresholds be set?*' to '*how best in conditions of uncertainty can the producers and purchasers of therapies for use in early stage cancer treatment work together to agree fair prices?*'. Key points include:

- **Even in the case of medicines used to treat late stage cancers it can take years after they are approved to fully quantify their efficacy for Health Technology Assessment (HTA) purposes.** When innovative therapies are used to treat Stage 1 or 2 disease, including in adjuvant and neo-adjuvant (pre-surgical) settings, much greater outcome gains may well prove possible. Yet in this case it could require decades after new medicines have been licensed for trials to generate robust overall survival (OS) data.

Similar points apply to the development of novel anticancer combinations, and with regard to treatments provided via early access initiatives. Such observations underline the point that today's issues relating to the appropriate pricing of anticancer treatments differ greatly from those that previously surrounded medicines, like – for instance – anti-hypertensives. This is why new approaches to assessing value and agreeing payment levels are needed. Examples of possible solutions range from fresh approaches to Outcome Based Pricing presently being explored by

Box 7: The cost per QALY Approach to Valuing Better Treatments

Through the work of health economists such as Professor Alan Williams of the University of York, Britain pioneered the ‘cost per QALY’ approach to determining the value of innovative medicines and (when the necessary data are available) other health care inputs. In the United States political pressures resulted in the closure during the 1990s of the until then world-leading Office of Technology Assessment (1972-95). By contrast, in the UK the election of the first Blair administration in 1997 opened the way to the establishment in 1999 of the originally titled National Institute for Clinical Excellence (NICE).

NICE has been a global success. It in many respects embodies the rational thinking of the York based and other British health economists of the late twentieth century, and has brought new rigour into thinking about the delivery and value of health care. However, some aspects of the methods it employs and its underlying approach to fostering biomedical innovation may now be outdated.

Quality Adjusted Life Year (QALYs) are at the centre of NICE evaluations. They are units of utility, defined as being the sum of the duration of the benefit a treatment gives (as typically expressed in terms of extra years lived) and the quality life improvement yielded. When the costs of alternative interventions are known the cost per extra QALY gained can be calculated on an incremental basis, and the ‘better buy’ identified. In other cases a cost effectiveness (or affordability) threshold can be set, so that interventions with a cost per new QALY below that level can be identified as affordable. Those with a higher QALY cost can be classified as non-cost effective. Negative NICE evaluations can – rightly or wrongly – be taken to mean that a treatment ought not morally to be supplied, because funding it would deprive other NHS users of greater benefits. However, judgements of this sort can also be seen as colluding with public service underfunding.

Having a simple and widely credible tool for determining what products and services the NHS or other health care providers should or should not fund can serve as a valuable management and demand control instrument. But there are also cautions and limitations relating to the ‘cost per QALY’ methodology. Examples of relevant concerns include:

- **measuring quality of life is problematic.** In addition, any inference that a person with a poor quality of life or

with a short life expectancy because of their age or other factors is less ‘worth saving’ than an individual without such disadvantages would be ethically questionable;

- **setting affordability ceilings is an essentially arbitrarily process.** Some economists may argue that the cost effectiveness thresholds being used by NICE are too high. Others believe that NHS (and/or other welfare related) spending has been set too low, and that thresholds should be higher;
- **the retrospectively oriented ‘evidence based’ cost per QALY methodology used by NICE may be unduly rigid and narrow, and only appropriate for short-term health service resource allocation purposes.** Robust policy decisions are also likely to need systematically to take into account factors such as the possibility of wider societal and/or industrial development gains that incentivising research and development will generate in the medium to long term.

In bodies like NHS England there have also been concerns that cost per (incremental) QALY calculations and their applications to pharmaceutical and other pricing problems fail to take into account issues such as the possibility of savings to scale on the supply side and overall budget impacts on the demand side. Those arguing in favour of creating differential incentives for fostering investment in rare (low volume) disease treatments also refer to such factors, but from a different – individual patient group centred – standpoint.

Taken in the round, such caveats do not mean that in complex, heavily regulated and intellectual property law dependent, environments the pricing and supply of products like novel anticancer medicines can satisfactorily be left to the working of a ‘free market’. Assuming that policy makers and regulators wish to promote both equitable health care provision and publicly and privately funded innovation they rather indicate a need for appropriately balanced approaches to HTA throughout the world, designed to take into account all the public’s interests in areas such as treating cancer in the present and overcoming it in the future.

Cancer Research UK and further development of the ‘coverage with evidence’ model underpinning the Cancer Drugs Fund in its current format.

- **The NHS affordability thresholds presently in use range from a basic £20,000-£30,000 per QALY to the £50,000 applicable in the end-of-life care and the £100,000 that can be used in highly specialised (very low volume sale) contexts.** Some commentators argue that these thresholds, although below those used in most other developed nations with major interests in biomedical innovation, are too high, and should be cut to £10,000-£15,000 per QALY. But this would leave Britain very isolated and ignore the fact that medicines use typically becomes

much more cost effective after the point of launch, when initial prices are set. Other commentators believe that current NHS affordability thresholds should be revised upwards in contexts such as cancer care to reflect public preferences regarding where research and development efforts should be prioritised and the opportunities available at this point in the history of overcoming disease.

- **QALYs are presently calculated in a relatively narrow and static way.** They do not take into account the full spectrum of societal value considerations related to saving lives and reducing suffering, or industrial, scientific and human development policy issues. Health sector managers and allied interests may welcome a

comparatively simple and politically credible way of legitimating purchasing and rationing decisions needed to keep public spending within defined targets. Yet there is a case for revisiting in depth the way the utility of therapeutic innovations is assessed by the NHS and health care funders outside the UK. Changing the basis of QALY measurements cannot in itself influence overall NHS spending abilities. Yet it could at least make more apparent the cost and benefit trade-offs being made when budgets are decided and treatment purchasing decisions made.

Recent British political debate is likely to have reinforced the uncertainties many people have about whether or not NHS drug costs are 'too high'. Fears and prejudices about 'American' (and to a lesser other) international pharmaceutical companies have been actively promoted. Yet at the same time the UK has to date enjoyed both a significant research based pharmaceutical industry that works in partnership with University and other publicly funded researchers together with some of the lowest *de facto* domestic pharmaceutical costs in the developed world.

From a global perspective this raises important future policy questions. If the Brexit process continues and this country seeks to define its place in the twenty first century world there are likely to be valuable opportunities to support progress towards achieving better cancer outcomes in all settings, ranging from the poorest African and Asian nations to those in countries such as the USA. One future UK contribution could be to help further develop HTA methods and health care management strategies that fully reflect global public interests in more effectively controlling conditions like cancer and promoting scientific and industrial progress, now and in the future.

Conclusions

NHS cancer services have improved significantly since the start of this century. So have the outcomes achieved. Yet there are still service quality shortfalls to be addressed, and in areas like lung cancer survival Britain still lags behind the highest performance levels achieved in other developed nations.

There is reason to hope that during the 2020s these problems will be more effectively addressed, in part because of proposals already being implemented in the wake of the 2019 NHS Long Term Plan. Current initiatives are aimed primarily at enhancing early cancer diagnosis rates. However, there is now a strong case for investing in new national cancer plans for England and the other UK countries.

Such plans could help maintain the pursuit of higher quality NHS cancer care in the coming decade. Key goals range from establishing more effective screening programmes for conditions such as lung, colon and prostate cancer through to assuring the optimal use of immunotherapies in conjunction with other medical, surgical and radiotherapy

based treatment options. The further development of supportive psychological and social care for people at every stage of living with cancer is another important priority.

In Britain today well over a half of the people who receive a cancer diagnosis live 5 years or more. Yet the reported 5 year survival rate for lung cancer is still only 15%. An achievable target for the mid-2020s will be to raise the latter average to 25%, in line with the best levels already to be found globally. A more pro-active one would be to raise it to 35% before the end of the decade. Achieving this could put the UK in a leading position.

Surgery and radiotherapy were the mainstays of cancer treatment in the twentieth century. They continue to deliver the great majority of cancer cures achieved today. But as new medicinal and allied anticancer treatments like CAR T cell and other advanced anticancer therapies become available and are accompanied by enhanced diagnostic capabilities and more knowledge about how to use combinations of interventions to good effect the contributions of anticancer pharmaceuticals will increase.

Cancer care affordability should not be a major problem if those responsible for setting relevant budgets value service satisfaction and better health outcomes sufficiently relative to alternatives like lowering tax rates or cutting compulsory insurance contributions. Yet there are at present problems to be overcome with regard to establishing what are accepted as fair prices for new anticancer medicines, particularly with respect to those used early in the development of disease. This is in large part because of the extended periods of time needed to generate definitive data on the benefits gained.

Simplified approaches to setting treatment prices, focused in part on creating effective incentives for ongoing innovation, should prove possible if the stakeholders involved genuinely wish to optimise the public's welfare. Britain has an interest in ensuring that medicinal and allied treatments for cancers are not only domestically available but paid for in ways that appropriately incentivise continuing private and public investment in ongoing research and development, nationally and globally. As the UK seeks to build its modern role, policy makers might usefully seek to take forward the work to date undertaken by organisations like NICE and NHS England in order to foster new approaches to Health Technology Assessment that can comprehensively help to meet twenty first century needs and hopes.

Any such initiative should be aimed at achieving long term scientific and industrial policy objectives, as well as serving more immediate health sector ends. In combination with the preparation and implementation of new national cancer plans, it could help prepare the country for the economic and health care challenges of the 2020s. From the perspective of this report it could most importantly increase the chances of most if not all forms of cancer becoming functionally curable by around the middle of the present century. In the final analysis the value of this end-point for people across the world is likely to far exceed the costs of all presently available forms of health care.

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This report was written by Professor David Taylor, who is accountable for its content. He thanks all those who helped and advised during its preparation. The UCL Cancer Policy Project was funded by a 2019 grant to Professor Taylor and Professor Mark Emberton at UCL by Merck and Co. Neither Merck in the US nor MSD in the UK has played a role in planning or directing the research undertaken for, or the content of, this report.

