All Party Parliamentary Group for Longevity

The Health of the Nation

A Strategy for Healthier Longer Lives

February 2020

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Preface

"Longevity is the single most important issue of society in the next 30 years." Sir John Bell

We are living nearly ten years longer than our parents' generation, and this offers great benefits. Many people already enjoy their longer later lives greatly, and we know why: by keeping in good enough health, not being too worried about money, living in a home and an environment that supports them and having meaning, purpose and good social relationships. This report by the APPG for Longevity explores what needs to be done, so that many more of us can live in good health for as long as possible. It describes both a shocking current picture – and an optimistic future one. This fits well with the underlying thesis of the APPG: that extra longevity is a welcome opportunity, not simply a route to new problems.

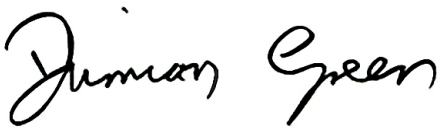
What is shocking is that far too many citizens get prematurely ill with illnesses that could have been avoided, making it harder to enjoy their longer lives. Moreover, the richest people in our country live on average for 20 years longer in good health than do the poorest. Premature avoidable ill-health is rampant, and it is bad for individuals, our society and our economy. The optimistic point is that we can change this, and our report, The Health of the Nation – a strategy for healthier longer lives, sets out how. This is not about trying to increase how long we live, but about how we can live in good health for longer.

To improve our country's well-being will require us to improve our national health; this is as important as improving our wealth and, in fact, the two are linked. We have been caught in a false view that our national health means the NHS. Our National Health Service is indeed a national treasure, but it does not make us well. It largely works hard to arrest or mitigate illness when necessary. To improve the health of our nation we must prevent ill-health. Our report sets out the evidence for this and an agenda to do so.

We want to start a public debate about how to improve the Health of the Nation, as doing so can bring great benefits to millions of people. It will require action by charities, local authorities, business, academia, central government and by citizens themselves and our report is addressed to all of them. It is possible to make this change and we set out how.

I hope many of you, across society, will read our report and consider how you and your organisation can help improve The Health of the Nation, as it is an issue for everyone.

I am grateful to MPs, peers and experts from many cross-cutting disciplines in the APPG for their great contributions to this analysis and report. Above all I thank Geoffrey Filkin and Tina Woods who have worked for over nine months to develop the report with great support from a range of eminent organisations.



Damian Green, Chair, APPG for Longevity

Introduction

The APPG for Longevity was founded in March 2019, recognising the need for a cross- sector response to turn the 'problem of ageing' into the 'opportunity of longevity'- by public policy and developments in science and technology to share the benefits of living longer.

The chosen mission of the APPG in 2019 was to devise a strategy and action plan to show how to realise the Government's great ambition: "for everyone to have five extra years of healthy, independent life by 2035 and to narrow the gap between the richest and poorest".

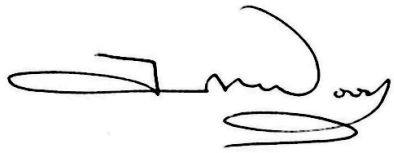
Our challenge was that the APPG had very little money nor many resources to mount a full cross-sector research programme. Our solution was to persuade the best organisations and brains in England to work with us to explore needs, opportunities and to develop ideas for a national strategy.

We are delighted how well the process has worked because of the great support and knowledge of many experts, partners and sponsors who have helped us. We are enormously grateful for the support of the Behavioural Insight Team, Centre for Ageing Better, The Health Foundation, The King's Fund and Public Health England and many other groups, plus top academics and senior individuals from science, technology and business who have taken part in our Boards and contributed evidence, analysis and framing.

We are particularly grateful to David Buck at The King's Fund, Tim Elwell-Sutton at The Health Foundation, David Halpern at the Behavioural Insight Team and Duncan Selbie and his team at Public Health England. The list of organisations and people in the Acknowledgments does not imply they agree with all our recommendations, though we hope they agree with most of them!

We hope you will read our report, discuss it with us and use your own role to promote action to improve the Health of the Nation.

Geoffrey Filkin,
APPG Strategic
Advisory Board Chair



Tina Woods,
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Summary

A strategy for healthier longer lives

The government has set a great and bold ambition – 'for everyone to have five extra years of healthy, independent life by 2035 and to narrow the gap between the richest and poorest'. These are great goals so that we can all enjoy our longer lives in good health. This 'Extra Time' [1] we have been gifted can benefit our lives and well-being if it is lived in good enough health. Improving the health of our society needs to become a national objective, owned and driven in all places, by charities, businesses and the public, as well as government. Improving the health of all groups in our society, especially poorer people and places, is vital. We sense a new commitment by government to do so.

Why this matters

We are living much longer, a marvellous gift which many already enjoy; but millions of people, from all social groups, become prematurely ill with avoidable illnesses, which can degrade the benefits of longer lives[2, 3,i] . Recently it was discovered that women on average get their first significant long-term illness when they are only 55 years old and so will live with ill-health for nearly 50% longer than we thought[4,ii].

Preventable poor health affects every place and every social group, but it is worst for poorest people and places; in these places, women get their first significant long-term illness when they are only 47 years old [4] and live in ill-health much longer than in the richest areas. Preventable poor health weakens our economy; if we were healthier more people would stay in work to help grow it. Poor national health has high economic and fiscal costs.

The number of major illnesses suffered by older people will increase by 85% between 2015 and 2035. Premature poor health will greatly increase demand and cost for the NHS and social care. Older people in the poorest areas have 35% more spent on them by the NHS than older people in the richest areas[iii]. Becoming ill early in our lives makes it more likely we will develop multiple long-term conditions, and this will increase demand for social care.

Change is possible

Our own society and other countries have shown that it is possible to reduce the incidence of premature ill-health. We made great progress to reduce smoking and stroke. We know where to start – we could prevent up to 75% of new cases of heart disease, stroke and type 2 diabetes, 40% of cancer incidence and reduce dementia risks if we cut smoking, unhealthy diet, harmful consumption of alcohol and insufficient physical activity[5]. Reducing these, whilst not the only action, must be a central part of a drive to improve our national health. We know more about how to reduce them; information alone does not do so, but influencing social and market pressures can, by offering easy, healthier choices. We must stop being timid or ideological about this.

We recommend

We need the Prime Minister to make improving our health a national ambition – to mobilise action, to allocate finance and establish a pan-government approach.

Central and local government, NHS and PHE jointly need to commit to reduce smoking, obesity, excess alcohol and increase physical activity by 2035 with clear action plans.

All government departments need to contribute – Department for Transport (DfT) to accelerate modal shifts for a greener and healthier country, Department for Environment, Food and Rural Affairs (DEFRA) to ensure the National Review of Food contributes to healthier diets, Education to help engrain healthy habits in our children, Ministry of Housing, Communities & Local Government (MHCLG) to make our housing stock healthier as it is decarbonised, and Her Majesty's Treasury (HMT) and Department for Work and Pensions (DWP) to make health a serious consideration in tax and welfare policy and practice.

NHS must do more to prevent ill-health and manage its demand. It spends less than 5% of its budget on prevention; this should increase to 15% by 2030.

Government needs to partner with the left behind places – to reduce health inequalities and support all places to agree health improvement goals with their public.

Business must be the solution, not the problem – a Business Coalition for Healthier Lives to incentivise socially-responsible business practices for health.

We must maximise our strength in research, technology, innovation and data to improve health. Research funders should give the prevention of illness a much higher priority. We need to develop an 'Open Life' Data Framework, to harness datasets across the life course and stimulate social and business model innovation.

Better population health will need a Champion – a visible and vocal public champion, to speak out for what needs to be done, and challenge key players to do more.

We need to promote social movements for healthier lives at local level to engage the public, and community leaders. Business, media and the third sector need to help change cultural norms about our health.

> *"There is a bunch of things that we know work that are simply not happening, but if they happened to most people at risk, things would improve really quite fast."*
> *— Chief Medical Officer, 2019[6].*

> *"It can't be right that a man born in Buckingham can expect 68 years of good health, but a man born in Blackpool can only expect 53. We need to make the 2020s a decade of prevention of ill health: redouble our efforts to be smoke-free, redouble our efforts on obesity, and embed a more proactive, predictive and personalised approach across the NHS. And we must hardwire good health into housing, transport, education, welfare and the economy."*
> *— Matt Hancock, Secretary of State for Health and Care. December 2019[7].*

1. Healthier Longer Lives

The government has declared a great ambition – 'for everyone to have five extra years of healthy, independent life by 2035 and to narrow the gap between the richest and poorest'.

Our longer lives are a great gift, someone who is 65 years old can now expect to live to 85; nearly 10 years longer than their parents' generation. Being able to live longer in good health improves our well-being, allows us to contribute to family and friends, to keep socially active, keep in work for longer, save for our longer lives and to enjoy more life. But those living longer in good health are the affluent; the poorest have much worse health and well-being.

We have improved the health of our nation over the last 20 years, but it is still not good enough. Recently piloted and current measures show that women fall into poor health when they are only 55 years old, and live 9 years longer in poor health than we previously thought[4]. This premature, avoidable ill-health degrades our lives. Millions of people in England, young and older, rich and poor, are getting illnesses associated with old age that could be significantly delayed or entirely avoided. People in our poorest areas are ill for twenty years longer than those in the most prosperous ones. Yet policy and practice still focus overwhelmingly on illness mitigation rather than prevention. Governments have not done enough to pursue the gains that prevention, early detection and mitigation can bring. We now know better how to do so[iv], and we are optimistic that there is a new political commitment to change this.

Change is Essential

NHS and Social Care Demand

There will be very large increases in the number of cases of ill-health over the next 15 years, as our population ages. In 2035 there will be c. 16 million cases of dementia, arthritis, type 2 diabetes and cancers in people aged 65 and over – twice as many as in 2015. A quarter of the population now has raised blood pressure, 4 million people have untreated hypertension, there will be 5.5 million people with type 2 diabetes in 10 years and 70% of people aged 55+ have at least one obesity related disease[8].

As the NHS and social care face remarkable increases in the number of people who will need treatment and care, it is imperative to promote prevention and early detection. The NHS spends many millions trying to keep people alive in hospitals for a few weeks at the end of their lives. Yet it spends less than 5% of its budget to prevent or delay diseases and impairments that degrade people's lives for many years.

Health is Wealth

Levelling up our country economically and socially requires us to improve its health[9]. Poor health hinders productivity and labour supply; poor economic growth drives poor health. High levels of chronic illness in the North contribute to its lower levels of employment. If the number of working aged people with limiting long term health conditions were reduced by 10%, it would increase the economic activity rate by 3 percentage points in the Northern Powerhouse. Greater Manchester concluded that the (poor) health of its population and its available workforce was one of the top three barriers to its economic prosperity.

Poor health that is also improperly addressed causes people to drop out of work. Men aged 55 to 65 are less likely to be in employment now than in the 1970s. Government needs to radically review its Health and Work policy to change this. A healthier nation helps labour supply and productivity; businesses supporting workforce health helps society and themselves.

As stated by Public Health England, "For maximum economic benefit we must help people stay well for longer, help people to use the NHS less and later, help people stay in work for longer and help people when unwell to stay in their own homes for longer."

Change is Possible

"We could improve on where we are, because there are many countries that are similar to us where both life expectancy and healthy life expectancy are better than they are in the UK."
— Chief Medical Officer (CMO) 2019.

Preventable mortality rates are noticeably worse in the UK than in the Netherlands or Sweden[10]. Please click here to read the paper *What the UK could learn from the world leaders in healthy productive ageing* by Charles Alessi.

Many better-off 80 year-olds are still in good health because of good diet, good homes, enough income and healthy lifestyles. This should be our ambition for all of us. We have made big improvements to prevent ill-health before – reducing smoking and cardiovascular diseases, largely by prevention and for relatively low cost.

Good health does not mean treating illnesses, it means avoiding them. We broadly know what needs to be done to improve healthy life expectancy, by addressing the fundamental social and economic drivers of ill-health and by addressing their immediate manifestations[11]. The forthcoming Marmot 10-year Review will report on progress and re-state what needs to be done. There is a great deal that can be done now by focusing on the four big risks and changing behaviour by using fiscal and market measures.

As the CMO reported: "If we shifted four behaviours – smoking, unhealthy diet, harmful consumption of alcohol and insufficient physical activity, we could prevent up to 75% of new cases of heart disease, stroke and type 2 diabetes and 40% of cancer incidence. Furthermore, there is growing evidence that addressing these risks will also reduce dementia[5,v] ."

Change is Affordable

Addressing these four risk behaviours by adopting the easier, cheaper, better known actions makes an excellent place to start and will deliver large gains. Information alone does not change behaviour but interventions using fiscal and market nudges can do so and are usually low cost. The agenda we propose will require action by all parts of society - business, research, science and charities as well as by government, the NHS and local government. There will also be a need for a social movement, a Campaign for Health, to shift societal and political attitudes and rebut ageism and fatalism. It will also contribute to a new longevity industry.

2. What's the Goal, What are the Causes, What's Needed?

What's the Goal?

The Government's aim is to increase healthy life expectancy by five more years from birth and to reduce health inequalities[vi]. Government should aim to improve healthy life expectancy (HLE; click here to review ONS data), not just disability free life expectancy (DFLE; click here to review PHE data). Improving both healthy life expectancy and disability-free life expectancy is needed as is the mitigation of illness[vii] (click here to read the paper *How to Measure 'Healthy Life Span'* by Anna Dixon).

The measure of how healthy we are as a nation has been healthy life expectancy data (HLE). This is a subjective measure, obtained by asking a sample of people if they are in good health or not. It reports that women live in good health for 63.9 years old on average[12]. However, recently piloted objective population-wide the NHS data shows that on average women fall out of their 'generally healthy / well' status, by developing one of 26 serious long-term conditions, when they are only 55 years old. This indicates a 50% increase in the time they will spend in poor health. This has profound implications for individuals and for health and social care demand and costs. People living longer in poor health means that NHS and social care costs will be significantly higher. See the Key Paper G: Measuring National Healthy Lifespan Using Objectively Recorded Health and Care Data - Rupert Dunbar-Rees and Ellie Bragan Turner.

	HLE (2016-18)	HealthSpan (2018/19) median (yrs.)
MEN	63.4	56
WOMEN	63.9	55

What are the causes?

We know what determines how long we live in good health; fundamentally it is the physical, social and economic environments we live in. Surprisingly, little of our health – about 15% – is determined by conventional health treatments. The Key Paper A: The Social Determinants of Health by Dr Daniel Holman and Prof Alan Walker summarises the evidence. As these circumstances have major influences on whether we are healthy or not, they will need to be addressed by policy shifts across government in housing, employment and income support. As well as this Health-in-all Policies approach, our report focuses on fiscal and market-shaping measures and on the system leadership needed.

Inequalities

Premature poor health occurs in all socio-economic groups and in every locality, but it is worse in poorest areas. Women in the most deprived areas develop serious long-term conditions nearly twenty years earlier than those in the most prosperous ones. See the Key Paper B: Health Inequalities - David Buck. In the UK the health gap in society is bad; our lowest income group has 24% fewer people in good health than in the richest. In New Zealand, Greece and France, the gap is only 5–10% between the lowest and highest socioeconomic groups[13].

Many people who live in our left-behind areas become ill much earlier, get more illnesses and live for longer durations in poor health. Most of their neighbours suffer the same.

There is a big North-South divide on poor health and premature morbidity (click here to read *Evidence from Public Health England on the Causation of Poor Health*). It will be essential to improve the health of all left-behind communities in the Midlands and the North and elsewhere for them to have economic success. Places need health for jobs. Good jobs for local people contribute to better health. Improvement in health and health inequalities are necessary to unleash the potential of the whole country.

The worst health occurs in areas with other economic and social disadvantages – our left-behind places – so they will need additional support to make bigger improvements to benefit those with the worst health[13].

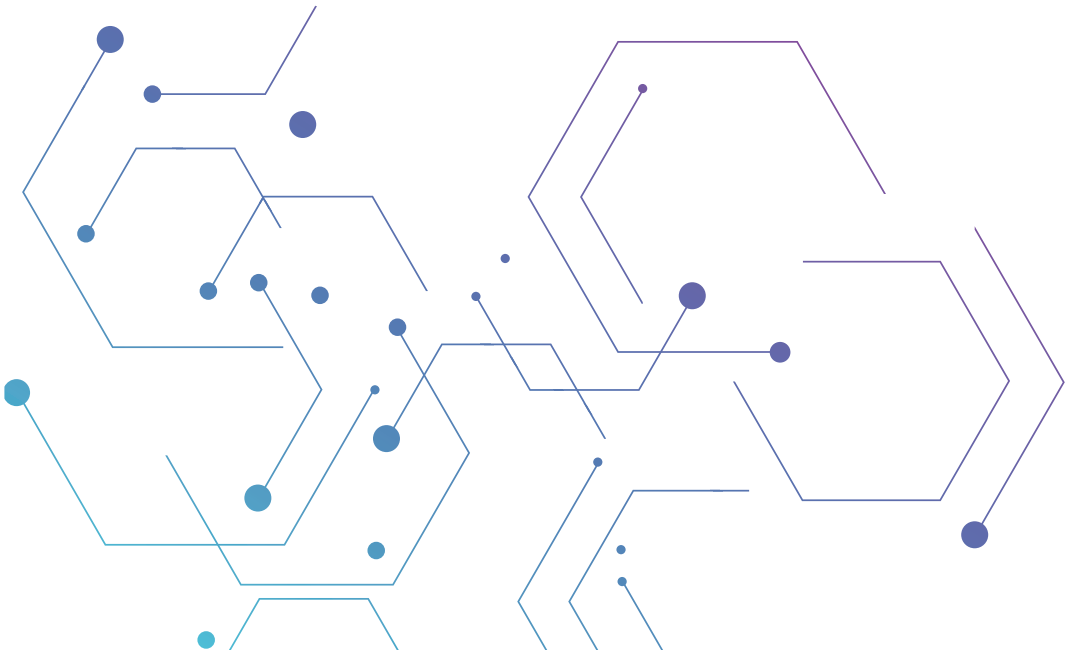
The Government's majority at the December 2019 General Election was built on seats in areas with low healthy life expectancies[14]. Levelling up our country requires improving the health of these areas and others and is critical to their economic and social success. More hospitals will not solve this – they only deal with the consequences of poor health. There is a need for a radical agenda, developed in partnership with localities with the greatest needs, to change their poor health over the next 10 to 15 years. This is critical for their regeneration and the well-being of local people.

The evidence suggests that government does not need to worry too much about the top two social deciles in our society, they are generally aware and basically healthy so we should focus on the rest. But the interventions that will work with most people will not be enough to help those in the very poorest groups become much healthier, as the social and environmental pressures are too great; additional actions will be needed.

What is needed?

Our report and Key Papers set out how we can improve the health of the nation and those with the worst health:

1. Make it easier to live well
2. National leadership
3. A National service for health
4. Harness local leadership
5. Enlist business as a stakeholder in health
6. Leverage developments in science, genomics and technology.



3. Make it Easier to Live Well

Behavioural and environmental factors now dominate years of healthy life lost[ix]. Smoking is still our most preventable factor, causing the loss of more than 2 million disability-adjusted life years, concentrated in the poorest in our society. Diet and high body mass cause between 2 to 4 million years of healthy life lost, as well as increasing other risk factors such as high blood pressure and bad cholesterol. Alcohol accounts for nearly a million further disability-adjusted life years lost. Stress, lack of purpose and social isolation also damage health. Depression is the commonest chronic condition in leaving work and in multi-morbidity but preventing mental illness is less well understood so there is a need for more research. Reducing the above risk factors will also reduce the incidence of dementia.

> *The heaviest drinking, smoking and mental health issues are highly concentrated in the most vulnerable sections of society and in the poorest areas. So, to reduce inequalities in health, it is essential to find ways to reduce them in the poorest parts.*

A range of interventions and nudges can help shift behaviours and Britain is a world leader in doing this. It is usually inexpensive, as described in the Key Paper C: Making it Easier to Live Well - David Halpern and Hugo Harper. It is within our grasp to reduce these four risk factors, the central idea is not to ban things, but by 'nudge, budge and shove[15]', to harness social and market pressures to change our environments and so offer easy, healthier choices.

Any strategy to increase healthy life expectancy and to reduce health inequalities must confront the risks that cause the greatest damage to health, by making it as easy as possible for people to quit smoking, eat and drink healthily and be physically active – using the mechanisms that work.

Smoking: If we got rid of smoking, we would have reduced health inequalities by 50%, so this needs a new big push. The Government's Prevention Green Paper said: 'We are setting an ambition to go 'smoke-free' in England by 2030. We know how to do so – by price, by expanding smoking cessation programmes and by promoting e-cigarettes to smokers. Smoking cessation services and social marketing do work to get people to quit, but we cut funding for both. We must do more to ensure that all pregnant women quit smoking[x].

Diet: Obesity has doubled from 13% to 26% in men over 20 years and is a high-risk factor for type 2 diabetes and other illnesses. It is essential that government fulfils the actions proposed in the Childhood Obesity Plan, 2019. We should also apply the mechanisms that worked with the sugar tax to re-formulate other high calorie, high sugar products[xi].

Alcohol: There is a strong case for maintaining real price increases through tax, to review the whole structure of alcohol taxation as it makes little sense from a revenue or health perspective[16] and to adopt minimum unit pricing too[17]. For both diet and alcohol improvements, we need to amend the 2003 Licensing Act and add 'protecting and improving public health' as a criterion[18] – as Scotland has done[xii].

Physical activity: We can improve our health, decarbonise our travel and improve air quality by reducing car use in cities and by making cycling and walking safer and more attractive – as other countries have done. This could be done relatively quickly, and the benefits would persist[19] (click here to read the paper *How Active Travel can Support HLE+5* by Andy Cope).

In aggregate, the effect of these measures would be striking: *'About 75 percent of Type 2 diabetes could be prevented if the causes were effectively addressed. This would go some way towards reducing the eight-year gap in life expectancy between the rich and the poor, and the 19-year gap in years lived in good health[xiii].*

4. National Leadership

National leadership from charities and businesses as well as by government is needed to improve our national health as set out in the Key Paper D: National Leadership - Tim Elwell-Sutton. Improving health needs to be a shared value, and a national consensus needs to be formed around the goal so that it is supported across sectors and political parties.

Government Leadership

Government will need to affirm this as a national priority, to establish a Health-in-all Policies approach and set out how to reduce inequalities and 'level up health' across the country. For example, DEFRA should use the National Review of Food also to address how to help reduce obesity and bad diets; the Department for Education should help engrain healthy habits in our children. MHCLG should aim to make our housing stock healthier as we de-carbonise it and support local government's contribution to health. DfT needs to accelerate the shift to healthier, climate-friendly transport (click here to read the paper *How Active Travel can Support HLE+5* by Andy Cope) . The Treasury could review its tax and regulation practice better to contribute to health.

The Treasury's new system for monitoring public sector performance needs to stimulate health prevention and make reducing health inequalities a criterion for policy and investment appraisals. The spending review should assess what resources this goal will require and ensure that the new machinery of government supports the goal. Government will also need to bind external partners to the goal – Public Health England (PHE), NHS, Confederation of British Industry (CBI) and the Local Government Association (LGA), and establish a National Health Leadership Board, led by the Secretary of State to do so.

Business Leadership

Businesses of all types have a key role in the health of the nation. As employers they directly influence people's income, work-life balance, mental health and whether people can keep in work. Their products and marketing can prevent illness or be harmful to health. Their services have a big impact on local populations. They can lobby government for policies to improve health – or to harm it. For example, we need supermarkets to work together to improve health and to be celebrated for doing so.

The CBI, BCC and other business leaders need to affirm that health is wealth, good population health is a national asset, that it needs to be invested in for a successful economy and that business is committed to helping.

There will be a need both to celebrate good achievements and for stronger challenges to businesses and sectors that damage health – with metrics to inform the public so that investors can avoid investing in them, as is happening with fossil fuels.

Health Charities

National health charities have a vital role to help improve our health and reduce health inequalities, given their rich experience and collective spend of £4 billion a year[20]. Most focus on individual diseases and their cure rather than on primary prevention. Some organisations have come together to increase their impact and lobby for more effective policies – e.g. the Richmond Charities, Obesity Health Alliance, Alcohol Health Alliance and Action on Smoking and Health. Health charities have also pooled resources for more research funding on prevention. All health and disease charities might review what more they can do to promote better health and support a social movement to do so.

Champion for Health

Better population health needs a visible and vocal public champion, to speak out for the opportunity and what needs to be done, and to challenge key players to do more. So, it is good that The Health Foundation is promoting a Collaboration for Wellbeing and Health, supported by ten major national bodies – to change the conversation on health; to promote national policies to support health; and support local actions to do so.

A Social Movement – Good Health for All

There needs to be social movements to promote better health, to support local ambitions and action and to embolden government (click here to read the paper on a social movement by Richard Meredith). The new Collaboration for Wellbeing and Health, above, might catalyse such social movements both locally and nationally.

5. A National Service for Health?

The NHS has a major role in improving the health of the nation. It already acts to do so, for example, by immunisations and by acting to reduce high cholesterol and blood pressure. It has signalled its intention to do more in its Long-Term Plan. But to date the NHS has never truly embraced prevention as a primary goal, spending less than 5% of its budget on it. It defines its role as the delivery of care to sick patients, rather than the maintenance of health. This needs to be rebalanced and the best way to do so is by rewards for enhancing the health of the population. See Key Paper F: A National Service for Health - Richard Barker and Charles Alessi.

Premature poor health is bad for the NHS as well as for people – it increases demand and costs[4]; for example, the North East has high levels of premature ill health, so their NHS costs are 20% higher than average and still their health outcomes are poor.

So, better prevention of ill health and the compression of morbidity are essential for the NHS. The way to ensure this is to change the system's financial metrics to reward prevention and achievement of health status outcomes. The NHS is well placed to do more - to prevent, detect and delay some risk factors or illnesses, for example by reducing the number of people with untreated high blood pressure and high cholesterol:

- *Canada 'effectively treats' 50% of women and 69% of men with high blood pressure*
- *The UK only treats 37% of men and women[21].*

The reformed GP contract, Primary Care Networks and Integrated Care Systems enable the NHS and primary care to be more proactive to prevent ill-health. The NHS should financially incentivise prevention in primary care – e.g. through a dedicated Primary Care Networks (PCN) Service Specification to address behavioural risk factors and lifestyle choices such as smoking, blood pressure and physical inactivity. The NHS could also incentivise primary care to undertake additional prevention activity within existing payment systems by aligning with new Quality Improvement Modules which reward outcomes and not just activity.

The Key Paper F: A National Service for Health - Richard Barker and Charles Alessi sets how to transition to a more preventative NHS. This could be done by requiring it each year to increase its spend on prevention by 1% of the total NHS budget, so that its total spend on prevention rises to 15% by 2030. This could be funded from the NHS's new increased government funding. Unless this is done, we fear that the system will carry on as now. This will need a clear statement from Government and NHS leaders that is the direction of travel.

6. Harness Local Leadership

Local leadership is crucial to improving how long we live well and to reducing health inequalities. Local changes can only be led by local authorities who are responsible for the population health of their area, from an understanding of local needs and by engaging local people and organisations. Local government leaders need to convene and mobilise all local partners, the local NHS, business, charities, schools and community groups to improve the health of their village, county or city. A Health-in-all-policies approach is needed in local government too, leveraging powers, services and resources from across the authority. The Key Paper E: Local Systems and the Grand Ageing Challenge Goals - David Buck and Greg Fell sets out the components for doing this.

It will be essential to support community asset-based approaches and local social movements so that local communities develop a shared commitment to the goals of health improvement. Wigan has shown this is possible and can bring remarkable improvements (click here to read the case study of Wigan, *Lessons from the Wigan Deal* by The King's Fund).

Central government will need to support this local leadership, by affirming the goal and that central and local government will be joint partners in its achievement and that public health funding will at least march in step with NHS funding.

Health is wealth: it is critical for local economic success and wellbeing – so that children can progress and contribute throughout their lives, so that people can stay in work and to delay the illness and disabilities that increase the demand for treatments and social care.

7. Enlist Business as a Stakeholder in Health

With their distribution power, marketing, and consumer behaviour knowledge, employers, innovators, investors and businesses must act as key partners to improve healthy life expectancy and reduce health inequalities, as set out in the Key Paper H: Business as a Key Stakeholder in Health - John Godfrey and Tina Woods.

Socially Responsible Business and Health

Consumers, employees and many investors are increasingly looking to deal with socially responsible businesses and to select responsible investments by considering environmental, social and governance factors (click here to read the paper *The Rise of EGS and Responsible Investing* by Hiral Patel). We need business contribution to health – or not – to become a key consideration for responsible investors. An index is needed to inform this.

Business as Innovators and Investors in Health

The development of products and services for healthy ageing can be hampered by 'market failures' (click here to read the paper on *Longevity Market Failures - Summary of the APPG Business Boards*). Businesses need to develop more desirable products to enable people to live longer and healthier lives. Branding, marketing and advertising are powerful tools that could potentially drive positive messages on healthy ageing and growing older.

Businesses may need to be 'nudged' for better products and services to improve health and reduce inequalities; 'all-age' housing is an example (click here to read the paper *Business Model Innovation in Social Housing* by Alistair Wickens). Improving healthy life expectancy and reducing health inequalities could be a social responsibility metric – and through the right incentives, release capital for innovation (click here to read the paper *Investing for Social Impact* by Stephen Muers).

Britain's strengths in data, AI, life sciences, genomics, fintech, agetech and healthtech can drive new capabilities, industries, jobs and prosperity. We should apply the lessons from Open Banking where banking data is shared and has stimulated the fintech ecosystem. There are opportunities to harness datasets across the life-course and be a global leader in using longitudinal data and AI to develop new products and services.

Business as Healthy Employers

Employers' actions are vital to help people keep in work in their 50s by adopting age-diverse practices, challenging ageism at work, ensuring people can refresh their skills and provide better in-work health support. Department for Work and Pension (DWP) and Department for Health and Social Care (DHSC) need to review their joint health and work policies to deliver this. An index or kitemarking system could be developed to show how well a business is contributing to the health of the nation and become a source of competitive advantage for participating businesses in exchange.

Business as a Champion for Living Longer Well

Customers, investors and broader society will increasingly expect business to be part of the solution for better health, not the problem. Business leaders need to advocate and provide solutions to avoid criticism that their products and behaviours harm health.

8. Leverage Developments in Science and Technology

We need to maximise the contribution of science and the wider R&D value chain for healthier lives. See Key Paper I: The Economic and Scientific Case for Therapeutic Intervention in Ageing - Lynne Cox; and the Key Paper J: Science and Technology - James O'Shaughnessy and Tina Woods. There is a need for more research funding and focus on the prevention and mitigation of age-related disease and disabilities. Developments in science and technology need to be better exploited. Reducing health inequalities must become a mobilising goal for the science community.

Data is a precious national asset which can drive new capabilities, industries, jobs and prosperity within a future fit data ecosystem. The UK's rich and diverse datasets have the potential to bring significant societal and economic benefits by enhancing and maintaining the nation's health. We need a robust data infrastructure to leverage data, now the world's greatest asset, to support economic growth, just as we have a transport infrastructure. We need to broaden the view of data to encompass the wider determinants of health, including genomics, which determines 30% of our health, and to leverage insights from data science across the life-course to reduce health inequalities.

We need to promote a longevity industry to improve healthy life expectancy and minimise health inequalities. Healthy longevity should be a major cross-cutting theme and organising principle for the research community. Investment needs to be focused on the development and implementation of preventative strategies and products that delay the onset of ill health. This shift in mindset and funding strategy is the most important change.

Enhance Investment in R&D
More investment and long-term grant funding is needed in preventative technologies and mitigation strategies in genomics and ageing biomarkers.

Facilitate Adoption and Scale
We need to encourage investment to enable organisations to grow from early-stage to 'investment-ready' ventures and be commercially viable including specialist funds focused to achieve scale over a longer term.

Leverage Data Across the Lifecourse
We need an 'Open Life' data innovation ecosystem; harnessing citizen data will help to bring in representative populations and encourage civic and direct-to-citizen digital-self enablement (click here to read the paper *Harnessing the Potential of Data to Deliver a Longevity Dividend* by Annemarie Naylor; click here to read the paper *National Grid of Civic Data Cooperatives for Health* by Iain Buchan).

9. Making it happen

To sustain progress over 15 years we need:

1. **A Cross-Party Consensus** – All parties need to commit together to work to improve how long we live in good health and reduce inequalities.
2. **Spending Reviews** – Health improvement needs to be a key theme and the structure of government needs to ensure collective action.
3. **A Collaboration for Wellbeing and Health** – To change the conversation on health, to promote policies and support local actions.
4. **A Social Movement for Change** – To promote and support a social movement for healthier lives at the local level, to engage the public and community leaders.
5. **Business for Healthier Lives** – A coalition of businesses, signed up to a new contract for longer healthy lives with an annual award programme with an index or kitemark.
6. **'Open Life' Data Framework** – A collaborative ecosystem to stimulate social and business model innovation using ethical data models.
7. **Monitor Sustain and Challenge Progress** by Health Select Committee and charities.

We will look forward to discussing these proposals with the Government, local government, business, charities and research funders and welcome reactions and ideas.

Geoffrey Filkin and Tina Woods
February 2020.

End Notes

i. *Professor Kenji Shibuya, Director of Institute for Population Health, King's College London writes about the English goal to increase healthy life expectancy: "Japan also set a similar goal of extending health life expectancy and reducing health inequalities. In our paper published in The Lancet in 2017, we showed that healthy life expectancy had increased by 4 years in 25 years". See also evidence from Charles Alessi: What the UK could learn from the world leaders in healthy productive ageing.*

ii. *The 2016-18 HLE and LE figures for women in England show LE of 83.2 years & HLE of 63.9 years, so 19.3 years spent in poor health. Outcomes Based Healthcare's 2018-19 data of Lifespan of 84 and HealthSpan of 55 means 29 years spent in poor health, 50% more years then the HLE data above.*

iii. *The distribution of healthcare spending: an international comparison. IFS Nov 2016.*

iv. *This is true for younger cohorts, less true for older people as "70% of those aged 55+ have at least one obesity related disease so we need to concentrate on treatments that ameliorate the disabling consequences" (Kingston et al., 2018)*

v. *"Dementia is by no means an inevitable consequence of reaching retirement age. There are lifestyle factors that may reduce, or increase, an individual's risk of developing dementia. More childhood education, exercise, maintaining social engagement, reducing or stopping smoking, management of hearing loss, depression, diabetes, hypertension and obesity could all contribute to prevention or delay of dementia". Lancet International Commission on Dementia Prevention and Care. London. 2019.*

vi *This would mean that healthy life expectancy at birth for men would rise from 63.1 to 68.1 years and for women from 63.6 to 68.6 years. We suggest that the rate of improvement by 2035 for the lowest two deciles in the population should be at least double the rate of improvement for the rest of the population.*

vii *Should the goal be improving healthy life expectancy or improving disability free life expectancy? Avoiding illness and disabilities both matter to people and so both should be addressed; they largely have common causes but need different interventions to address them.*

viii. *Women's experiences of health, ill health and disabilities is different from men's and these differences matter. BME groups have different risks and manifestations of ill health. These are both explored more fully in the Key Paper on Inequalities in Health by David Buck, The King's Fund.*

ix. *The number of years lost due to ill-health, disability or early death.*

x. *The NHS Long term Plan: "2.9 The NHS will make a significant new contribution to making England a smoke-free society, by supporting people in contact with NHS services to quit based on a proven model implemented in Canada and Manchester26. By 2023/24, all people admitted to hospital who smoke will be offered NHS-funded tobacco treatment services. 2.10. Second, the model will also be adapted for expectant mothers, and their partners, with a new smoke-free pregnancy pathway including focused sessions and treatments. 2.11. Third, a new universal smoking cessation offer will also be available as part of specialist mental health services for long-term users of specialist mental health, and in learning disability services". On the advice of PHE, this will include the option to switch to e-cigarettes while in inpatient settings. But no commitments on outpatients or primary care as yet.*

xi. *The Obesity Health Alliance propose that the soft drinks industry levy (SDIL) should be extended to milk based sugary drinks. To incentivise further reformulation the SDIL threshold should be lowered and levy rate increased above inflation rises with revenue raised reinvested in measures to improve public health. The Government should explore widening the levy to other product categories where sugar reduction is not in line with Public Health England targets.*

xii. *LGA survey, 2015 showed overwhelming expert support for a public health objective in the Licensing Act 2003*

xiii. *Marteau, Theresa. "The fiscal case for prevention is also strong given that, to use the same example, treating Type 2 diabetes consumes around £1 in £11 of the NHS budget." Personal communication. London. 2019.*

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[4] *See the Key Paper G: Measuring national Healthy Lifespan Using Objectively Recorded Health and Care data – Rupert Dunbar-Rees and Ellie Bragan Turner.*

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Key Papers

A. The Social Determinants of Health
Daniel Holman - Research Fellow, University of Sheffield
Alan Walker - Professor of Social Policy and Social Gerontology, University of Sheffield

B. Health Inequalities
David Buck - Senior Fellow, Public health and health inequalities, The King's Fund

C. Making it Easier to Live Well: addressing the behavioural and environmental drivers of ill health
David Halpern - Chief Executive, The Behavioural Insights Team
Hugo Harper - Head of Health, The Behavioural Insights Team

D. National Leadership for Achieving HLE+5
Tim Elwell-Sutton - Assistant Director of Strategic Partnerships, The Health Foundation

E. Local Systems and the Grand Ageing Challenge Goals
David Buck - Senior Fellow, Public health and health inequalities, The King's Fund
Greg Fell - Director of Public Health in Sheffield

F. A Service for National Health - An NHS fit for 2035
Richard Barker - Health Innovation Network, New Medicine Partners
Charles Alessi - Public Health England, HIMSS

G. Measuring National Healthy Lifespan Using Objectively Recorded Health and Care Data
Rupert Dunbar-Rees - Chief Executive, Outcomes Based Healthcare
Ellie Bragan Turner - Senior Health Outcomes Analyst, Outcomes Based Healthcare

H. Business as a Key Stakeholder in Health
John Godfrey - Corporate Affairs Director, Legal & General
Tina Woods - CEO Longevity International, APPG for Longevity Secretariat Director

I. The Economic and Scientific Case for Therapeutic Intervention in Ageing
Lynne S. Cox - Department of Biochemistry and Oriel College, University of Oxford

J. Science and Technology
James O'Shaughnessy - Chair, APPG for Longevity Science, Genomics & Technology Advisory Board
Tina Woods - CEO, Longevity International, APPG for Longevity Secretariat Director

Key Paper A:
The social determinants of health

A policy priority to achieve HLE+5 and to begin to close the social inequality gap

Dr Daniel Holman - Research Fellow, University of Sheffield
Professor Alan Walker - Professor of Social Policy and Social Gerontology, University of Sheffield

It is now irrefutable that the major upstream social determinants of health – the circumstances in which we are born, grow, live, work and age – are the key drivers of HLE and inequalities in HLE, contributing around 45-60% of the variation in health status – more than health behaviours, health care and genetic factors combined (Donkin et al., 2017). Downstream health behaviours, while important, contribute much less to socioeconomic inequalities in health – smoking, alcohol consumption, physical activity and diet in combination comprise around 25% (Petrovic et al., 2018). Therefore, if we want to achieve HLE+5 and to begin to close the social inequality gap, the social determinants of health must be a policy priority. This requires that all national and local government agencies and departments work together to implement healthy public policy, ideally aimed at reducing **both** upstream and downstream causes of poor HLE and inequalities in HLE.

The Marmot Review (Marmot, 2019) set out six key priorities for action: give every child the best start in life; good education and lifelong learning to maximise capabilities; fair employment and good working conditions; healthy standard of living for all; healthy and sustainable places and environments in which to live and work; and taking a social determinants approach to prevention. Although little has been done to achieve these policy priorities, they remain strongly underpinned by evidence. Addressing this agenda will require both a life-course perspective and a place-based approach to policy. There is ample evidence of the sorts of policy and stimuli needed at each life stage – from early years right through to advanced old age – and in different geographical areas to enable better HLE (Marmot et al., 2010). These social determinants influence health through various pathways. For example, in relation to non-communicable diseases, four significant pathways of how the social determinants influence health behaviours, trigger stress and mental health problems, are associated with adverse environmental factors such as pollution and low-quality housing, and influence availability and quality of healthcare (Marmot and Bell, 2019).

The Marmot Review task force on priority public health conditions – cardiovascular disease, cancer, obesity, risk-taking behaviours and mental ill health – suggested a set of five key proposals (and numerous secondary proposals) based on the best available evidence on what works, cost-effectiveness, and implementation and delivery (Bambra et al., 2010).

Their five priorities were:

1. Reduce smoking in the most deprived groups by focusing on price and availability, while providing stop-smoking services targeted to help the poorest groups quit;
2. Improve the availability of and access to healthier food choices among low income groups;
3. Improve the early detection and treatment of cancer, diabetes and CVD, especially among the more susceptible groups;
4. Introduce a minimum price per unit for alcohol;
5. Improve physical health care for people with mental health problems and mental health care for people with physical health problems. As the authors note, however, it is important to see these in the context of wider upstream determinants (such as the six priorities above) that 'reach across sectors and create an environment (economic, social, cultural and physical) that fosters healthy living'.

There is also a strong economic case for focussing on the social determinants of health. Health inequalities are estimated to cost the economy £50-70 billion per year, in terms of lost productivity and taxes, additional welfare payments, and costs to the NHS (Frontier Economics, 2010). Thus, addressing the social determinants of health is the best way to both close the social inequality gap and reduce its cost to the economy. Evidence is now emerging that many social policies and interventions based on the social determinants of health can increase both equity and efficiency. The World Health Organisation (WHO) reviewed a range of interventions / policies and concluded that:

> *In more than a few cases (e.g. early child development) efficiency and equity have been shown to have the potential to mutually enhance each other. There are efficient policies that can lead to equitable outcomes and policies or interventions based on equity arguments that lead to increased efficiency. This effect is known as the 'double dividend' (WHO, 2013).*

The report analysed three major components of the social determinants of health: education, social protection, and urban development and infrastructure (including housing and transport). These were chosen for their potential for intersectoral action, the amount of empirical evidence available, and the inclusion of interventions that were both designed and implemented, and at different government levels: central, regional and local.

With respect to education, there is abundant evidence that quantity and quality of education results in individual-level benefits, and there is a growing body of evidence that economic and health returns from school-age interventions, especially targeting early years, far outweigh costs. Lifelong learning and training result in productivity gains as well as improved brain health (as a protector against cognitive decline) (Baumgart et al., 2015).

With respect to social protection, interventions aimed at improving the nutritional status of young children show positive long-term outcomes. Maternal education (e.g. on breastfeeding and vaccination) offers a clear opportunity to reduce social and health inequalities. Some studies identify positive net benefits from insurance-based interventions, safety nets and social protection targeting young children.

Urban development and infrastructure have an impact on many aspects of personal, social and economic life. Air pollution is a major environmental determinant of ill-health, and there is strong evidence that it has a significant impact upon the incidence and severity of CVD and lung diseases. It has both short and long term health effects and has a particular impact on children (Cosford et al., 2019). Children are also particularly susceptible to internal housing threats such as carbon monoxide and extreme temperatures, and external threats such as antisocial behaviour and dangerous traffic. Urban improvement interventions entail large quantifiable gains. Transport-related interventions in particular provide benefits by reducing harmful health impacts. The WHO report advocates traffic calming measures such as 20mph zones and intelligent speed adaptation which have been shown to mitigate widening causality inequalities and provide substantial economic returns.

The evidence is strongest that policies in these areas are likely to have the highest 'double dividend' effects: increasing the health of the population whilst also closing the social inequality gap. They are also likely to have many other beneficial effects, such as reducing mental ill-health and domestic violence.

In the UK, one of the main dimensions of the gap in health and productivity is the North-South Divide. A key reason for low productivity in the North is that health is worse, and reducing this gap would therefore generate substantial gross value added, estimated at an additional £13.2 billion (Bambra et al., 2018). The Greater Manchester Prosperity Review (Coyle, 2019) found a correlation between limiting long-term health conditions and productivity equating to a £4.1

billion per annum loss to the local economy. Improving the health of working age adults would reduce up to 30% of the productivity gap between Greater Manchester and the UK average.

Public Health England's Report on how to reduce the North-South health divide set out four sets of recommendations:

1. Tackle poverty and economic inequality;
2. Promote healthy development in early childhood;
3. Share power over resources and increase the influence that the public has on how resources are used to improve the determinants of health;
4. Strengthen the role of the health sector in promoting health equity (Whitehead et al., 2014).

More broadly, evidence suggests that healthy public policy in domains including (but not limited to) social security, work, housing and the built environment will have the greatest impact on mental health and wellbeing across the life course. Poverty exposes children to many risks that can have a long-lasting impact on their mental health and wellbeing (The Children's Society, 2016). Against a backdrop of rising child poverty (Joseph Rowntree Foundation, 2018) this is of serious concern for the current and future mental health of this large and vulnerable population. Fiscal interventions to eliminate child poverty should therefore be a top priority for the Treasury in supporting the mental health and wellbeing of the population. In addition, good quality and affordable housing is essential to mental health and wellbeing and an absence of secure and good quality housing can lead to poor mental health (Bambra et al., 2010; Gibson et al., 2011). Ensuring a good quality housing stock, particularly in the private rented sector where people with poor mental health are overrepresented (Mind, 2018), is an important foundation of good mental wellbeing. Finally, access to good quality green space is associated with lower levels of mental distress and higher life satisfaction scores after controlling for socioeconomic factors (Public Health England, 2014). In recent years, parks and green spaces in many of our urban environments have deteriorated due to substantial local government funding cuts, and so reversing this trend should be a priority to both promote mental (and physical) health and wellbeing and reduce health inequalities.

The evidence is strongest for housing and work environment interventions to have a positive impact on inequalities and / or on the health of specific disadvantaged groups (Bambra et al., 2010). At the same time, an overview of systematic reviews suggests that downstream interventions that aim to target individual behaviours rather than upstream interventions on the social determinants of health are much more likely to **increase** health inequalities (Lorenc et al., 2012). Behaviourally-oriented measures such as media campaigns and workplace smoking bans **increase** inequalities between socioeconomic groups, while structural workplace interventions, provision of resources, and fiscal interventions such as tobacco pricing have the potential to **reduce** health inequalities.

A recent synthesis of the available evidence suggests that behaviour is much more powerfully driven by physical, economic, social, and commercial environments than it is by personalised information or technological interventions that aim to motivate people to change their behaviour (Marteau et al., 2019). The review shows that we now have strong evidence that various fiscal and economic-, marketing-, and availability-based policy interventions affect tobacco use, unhealthy diet, alcohol consumption, and physical inactivity. The strongest evidence in terms of size of effect and potential to reduce health inequalities is for fiscal and economic interventions reducing the affordability of tobacco and alcohol, and there is also growing evidence with regard to sugar-sweetened drinks. By contrast, if individual approaches e.g. weight loss programmes, are not used in tandem with changing the environment, they are 'akin to treating people for cholera and then sending them back to communities with contaminated water supplies.' (Marteau et al., 2019).

Addressing these so-called wider determinants of health requires a transformational shift to a whole government policy approach that recognises, understands and delivers health and wellbeing in all policies. As noted by Mytton et al. (2019), **all the important social determinants of health lie outside the health sector**. They suggest that all government departments should be health-oriented, for example: 'the Department for Transport should have supporting health (e.g. reducing transport related air pollution, injuries, increasing physical activity) as a key goal (as Transport for London does), in the same way that it has goals to reduce congestion and facilitate economic growth.' Thus, to achieve HLE+5 there should be an HLE impact assessment for all policies.

This health in all policies, and especially ill-health prevention in all policies, is crucial because it is very difficult to achieve truly joined-up policy implementation in a top-down way (Carey and Crammond, 2015). Therefore, embedding a preventative strategy in all policies at all levels would operate **within** existing departmental boundaries. Across government, there is a need to strengthen understanding of how health and well-being are shaped by wider determinants, how public policy can be designed to improve health and reduce health inequalities, and recognise the negative consequences of public policy that does not privilege health creation alongside other outcomes. Further, there is need for a sustained long-term outlook so that population health strategies supersede political cycles. The starting point is to place ageing and the prevention of the multimorbidities that curtail HLE at the top of policy agendas at all levels of government. At the moment, however, there is a policy vacuum with regard to the prevention of chronic diseases (Walker, 2018). Moreover, while politicians have to some extent prioritised NHS spending, resources to tackle the social determinants of ill-health have been, at best, ignored, or, like the public health budget, cut significantly (25% reduction in spending per person between 2014/15 – 2019/20). The majority (63.9%) of government health spending goes on curative and rehabilitative care with only 5.1% being spent on prevention (and, what is more, on forms of prevention that do not typically target the causes of poor health) (Centre for Progressive Policy, 2019).

There is no doubt that a national prioritisation of action on the social determinants of ill-health is urgently required. First, health inequalities are widening. The most deprived, whose LE and HLE were already the lowest, are seeing the least improvement and, for the most deprived women, life expectancy has fallen (Centre for Progressive Policy, 2019). These inequalities are driven by reductions in public investment rather than changes in health behaviours. Therefore, increased investment targeted on the main determinants of poor health, outlined above, is going to be the most effective way to improve HLE and reduce social inequalities (Taylor-Robinson et al., 2019). Second, LE and HLE are being truncated by social inequality on a continuous basis. The Centre for Progressive Policy (2019) has estimated that in England as a whole, 170 million years of healthy life are being lost currently. There are 80 million life years being lost, 69 million of which can be attributed to inequalities in the social determinants of ill-health: 30 million explained by differences in education, 18 million by differences in disposable income, 15 million by employment inequalities and 8 million by crime and housing. Third, as explained above, inequalities in HLE have substantial negative economic consequences, while conversely action to raise HLE brings substantial productivity dividends. Fourth, there is considerable public disquiet in the UK about inequalities in LE between socio-economic groups (McNamara et al., 2019).

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Key Paper B:
Health inequalities

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Introduction

This Key Paper sets out high level information on inequalities in healthy life expectancy and some other core measures of health inequalities in England. It also briefly provides some guiding principles that can help when designing national, regional and local policies to address them.

Inequalities of what and between who?

We define health inequalities as unfair and avoidable differences in health between different groups of people. Health inequalities exist between people in terms of the factors that are likely to lead to poor health (wider determinants and risks), the experience of services (access and experience), and measures of health itself (outcome and health status). In England and elsewhere health inequalities are often reported, studied and discussed in relation to four inter-connected themes: socio-economic factors (for example levels of income, wealth or employment, often summarised by deprivation indices); protected characteristics (legally important aspects of people's identity such as gender, ethnicity and disability); socially excluded groups (where circumstances combine to be strongly challenging for health risks, outcomes and status for groups such as the homeless, sex workers and prisoners); and finally geography (often broken down by 'natural' or administrative units e.g. region, city, town local authority, or clinical commissioning group).

How are we doing in England on health inequalities?

Given the many ways to understand health inequalities, there are many ways of thinking about and measuring them. This section therefore sets out some examples of health inequalities, but it cannot be exhaustive.

Life expectancy and deprivation by area

Life expectancy, as implied by the title, is a measure of expected length of life (ONS[1], 2018) and available at different levels of geography, for different groups of the population, and over a long period of time. It is a good indicator of how all the things that drive inequalities are expressed in a final outcome – length of life. Common ways to look at inequalities in life expectancy are by levels of deprivation, and by geographical area.

The most common measure of deprivation, used in many official data sources and wider studies, is the 'index of multiple deprivation' (IMD), produced by the Ministry of Housing, Communities and Local Government (MHCLG). This is updated periodically, the latest being the 2019 IMD set (MHCLG, 2019). The IMD is comprised of seven domains that contribute to deprivation: income, employment, education skills and training, health and disability, crime, barriers to housing and services, and living environment. Each area gets a single indexed score based on how well it is doing across these domains.

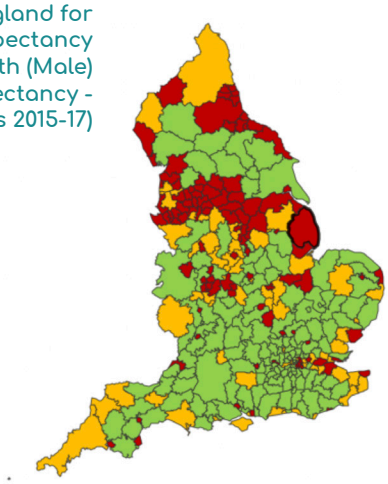
In England, there is a systematic relationship between deprivation and life expectancy. The Office for National statistics publishes regular reports (ONS[2], 2018) on inequalities in life expectancy. The latest statistics, for 2015-17, show that at birth, males living in the least

deprived areas can expect to live 9.4 years longer than males in the most deprived areas. For females, this gap is 7.4 years. This is also reported at age 65, reflecting inequalities at older ages; males from the most deprived areas can expect to live 5.1 years less than those from the least deprived areas once they reach 65; and females 4.8 years less.

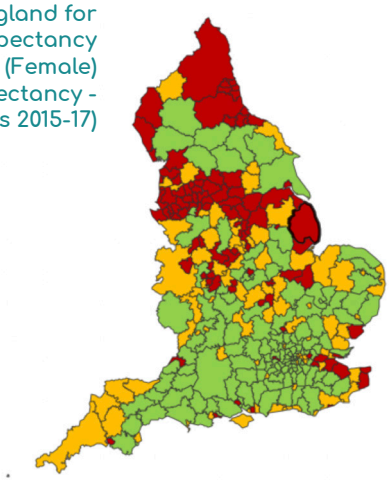
Importantly, these relationships between deprivation and other socio-economic indicators and health measures hold across every level of deprivation, not just between the most and least well off. This is known as the 'social gradient in health' since it affects everyone in the population; inequalities in health are not just experienced by the poorest or the most socially excluded, they affect us all systematically.

Another way to visualise inequalities in life expectancy is through maps in different parts of the country. The maps below, from Public Health England's Fingertips tool, illustrate differences in life expectancy at birth in 2015-17 for females and males by local authority areas. For females, the gap between the lowest area (Manchester, at 79.5 years) and the highest area (Camden, at 86.5 years) is 7 years. For males, the gap (between Blackpool, at 74.2 years, and Hart, at 83.3 years) is 8.9 years.

Map of District & UAs in England for 0.1ii - Life expectancy at birth (Male) (Life expectancy - Years 2015-17)



Map of District & UAs in England for 0.1ii - Life expectancy at birth (Female) (Life expectancy - Years 2015-17)

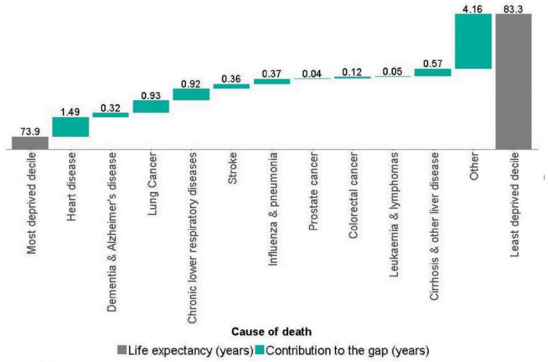


Inequalities in the diseases and conditions we die from

PHE's Health profile of England report in 2018 (PHE, 2018) reports on what we die of as a population, and how this contributes to inequalities in health. The charts below show how inequalities in the top 10 recorded causes contribute to the overall life expectancy gap between areas of different levels of deprivation.

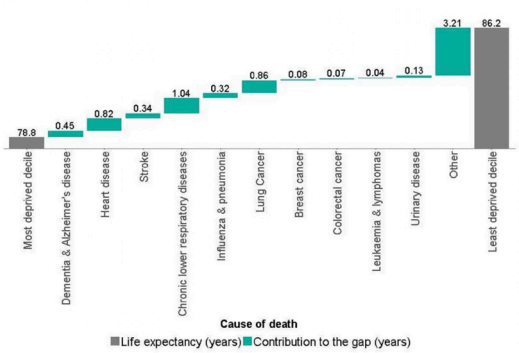
The biggest specific contributors to the gap for both females and males were heart disease, lung cancer and respiratory disease, although the ordering differs by gender. The 'other' group is comprised of deaths from a wide range of causes. Among males, the largest contributions to the 'other' group were from higher mortality rates in the most deprived decile from accidental poisoning (contributing 0.5 years), and suicide (contributing 0.3 years). Among females, the largest contribution to the 'other' group was from higher mortality from cirrhosis and other liver disease (contributing 0.3 years). In early adulthood these inequalities are less apparent, but by the thirties for both sexes those in the most deprived areas start to see excess deaths compared to those in the least deprived, with this excess growing throughout the age-range and reaching its greatest for those in their seventies.

Figure 6: Breakdown of the life expectancy inequality gap between the most and least deprived deciles, males, England, 2014 to 2016



Source: Public Health England analysis based on mortality and population data from ONS and Index of Multiple Deprivation 2015 from Ministry of Housing, Communities and Local Government

Figure 7: Breakdown of the life expectancy inequality gap between the most and least deprived deciles, females, England, 2014 to 2016



Source: Public Health England analysis based on mortality and population data from ONS and Index of Multiple Deprivation 2015 from Ministry of Housing, Communities and Local Government

Inequalities in the burden and risk of ill-health

Health is not simply about the length of life; more important to many of us is the experience of health throughout our lives, given how good health is critical to our capabilities and allows us to do many other things we value in our lives, however long they are. Below we illustrate some of the inequalities in measures of how healthy are lives are.

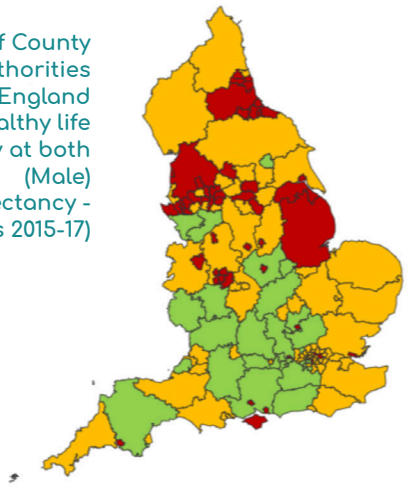
Inequalities in healthy life expectancy

Two common measures of how healthy our lives are, are 'healthy life expectancy' (HLE) and 'disability-free life expectancy' (DFLE). The former is based on self-reported information on how healthy people feel, the latter on whether people have limiting long-term illnesses; both can then be combined with life expectancy to give a measure of how long people are expected to live in good health (ONS[3], 2018).

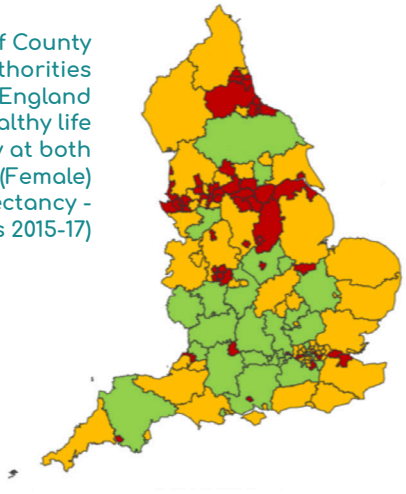
Inequalities in both HLE and DFLE are wider than inequalities in life expectancy. This means that in England today, on average those in more deprived areas spend a far greater proportion of their much shorter lives in poor health than in less deprived areas. This difference is stark, as Office for National Statistics show (ONS[4], 2019). In 2015-17, males in the most deprived areas are expected on average to spend around 30% of their lives in poor health, twice the proportion spent by those in the least deprived areas. Females in deprived areas are expected to spend an even higher proportion – a third – of their shorter lives in poorer health.

Again, inequalities in HLE can be visualised by maps, from PHE's Fingertips tool. Those below show HLE at birth for males and females in 2015-17. Females in Nottingham had the lowest HLE at birth of 53.5 years, compared to 71.6 in Wokingham; for males the lowest HLE was in Blackpool, at 54.7 years, compared to the highest of 69.8 years in Rutland.

Map of County & Unitary Authorities (UAs) in England for 0.1i - Healthy life expectancy at both (Male) (Life expectancy - Years 2015-17)



Map of County & Unitary Authorities (UAs) in England for 0.1i - Healthy life expectancy at both (Female) (Life expectancy - Years 2015-17)



Inequalities in long-term health conditions

One factor strongly associated with measures of less healthy lives, such as HLE, is having one, and especially multiple, long-term health conditions (MLTCs). The Department of Health's Compendium of Long-Term Conditions (DHSC, 2012) states that compared to social class I, people in social class V have 60% higher prevalence of long term conditions and 30% higher severity of conditions. Other evidence using data from almost 500 general practices (Charlton et al., 2013) shows that rising deprivation channels more people into having multiple LTCs, as opposed to single or no LTCs; 1 in 3 patients from the most deprived postcodes have 3 or more LTCs, compared to only 7 per cent from the least deprived. The onset of MLTCs has been estimated to occur 10-15 years earlier on average for those in the most deprived areas (Barnett et al., 2012).

As MLTCs are - by definition - conditions that people live with every day, they have a direct impact on patients as people, as employees and in terms of economic status. We know that earlier onset of MLTCs is linked to a reduced likelihood to enter the labour market - and an earlier exit too - if the LTC limits everyday activities (DHSC, 2012). Overall, more than half of those with an LTC consider their health is a barrier to the type or amount of work they can do, rising to more than 80 per cent when someone has 3 or more conditions.

Inequalities in avoidable, preventable and premature mortality

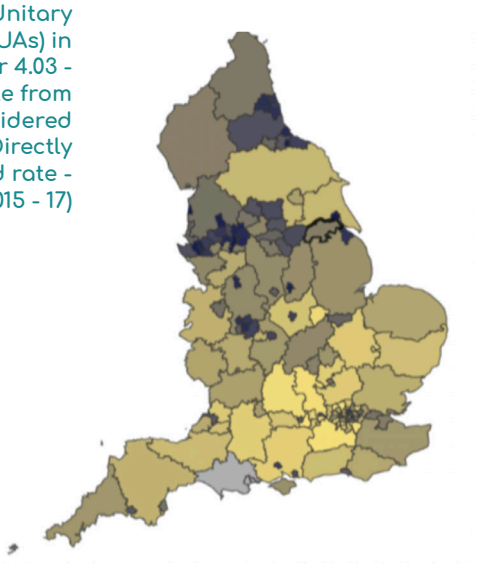
Long-term conditions are in part preventable, as are many health risks and outcomes. Below we discuss some of the further inequalities in preventable health problems and deaths that could have been delayed, that is prevented at the time they occurred.

The Office for National Statistics collates and publishes statistics on deaths from 'avoidable causes' (ONS[5], 2019). The 'avoidable mortality' is defined as being preventable through timely, effective healthcare ('amenable mortality') or wider public health and other interventions ('preventable mortality').

There are stark inequalities in avoidable mortality. In England, in 2017, 16% of male avoidable deaths were experienced by those living in the most deprived areas, compared with 6% in the least deprived areas; for females it was 14% and 7%, respectively. This translates into the likelihood of dying from an avoidable cause for those in the most deprived areas in England compared to the least deprived areas – this was 4.5 times higher for males and 3.9 times higher for females.

This map shows preventable mortality by local authority area between 2015-17 and is from PHE Fingertips – darker areas have higher rates of preventable mortality. The City of London had the lowest preventable mortality rate at 116.3 per 100,000, almost three times lower than the highest in Blackpool (323.2 per 100,000).

Map of County & Unitary Authorities (UAs) in England for 4.03 - Mortality rate from causes considered preventable (Directly standardised rate - per 100,000 2015 - 17)



Most recently, Lewer et al (Lewer et al., 2018) have drilled into the detail at the role that socio-economic inequalities play in premature mortality (defined as deaths before the age of 75), breaking it down for 156 causes of death.

Over 2003-18, their analysis suggests that:

- One in three early deaths can be attributed to socio-economic position and that one premature death every 10 minutes was due to socio-economic inequality;
- If everyone had the same outcome as the least deprived in society over 870,000 fewer premature deaths would have occurred;
- Premature deaths related to socio-economic inequality is higher in men (37%) than women (33%) and peaks in early childhood (1-9 years) and in middle-age (40-49 years);
- Three-quarters of premature deaths among men aged 35-49 years in the poorest areas was attributable to socio-economic inequality;
- More than half of premature deaths in three major causes (COPD, liver disease and flu and pneumonia) are attributed to socio-economic mortality. The causes of premature death with the most socio-economic inequality were TB, opioid use, HIV, psychoactive drug use, viral hepatitis and obesity. Most cancers had low inequality, larynx, lung and mouth cancers being exceptions;
- The proportion of premature deaths related to socio-economic deprivation varies by area (as expected), with Manchester being the highest and South Cambridgeshire the lowest.

Changing inequalities in health over time

The above paints a – partial – snapshot of inequalities in health in England. But, inequalities in health are not static, they change over time. The Office for National Statistics has published various statistics on trends in inequalities in avoidable mortality and its components (ONS[5], 2019).

Trends in inequalities in premature mortality

Most recently Lewer et al (Lewer et al., 2018) looked at trends in premature mortality between 2003 and 2018 using data on almost 2.5 million deaths under the age of 75. Their study highlights some positive news, and some negative. Over this period, premature mortality rates fell for men and women in all deprivation groups, and reductions in absolute mortality

This figure provides details on these trends. It shows mortality attributable to socio-economic mortality (MASI) widened by 5.5% between 2003 and 2018 for males and 12.3% for females, whilst the means years of life lost (YLLI) per person fell as all groups in society benefited from falling premature mortality. But this improvement was not received equally, as shown by the difference in the falls in standardised premature mortality rates.

	2003–06	2007–10	2011–14	2015–18	All years	Change (%)*
MASI						
Male	36·1%	36·7%	37·3%	38·1%	37·0%	5·5%
Female	31·6%	32·7%	34·2%	35·5%	33·4%	12·3%
YLLI						
Male	1·73	1·60	1·46	1·34	1·53	−22·5%
Female	0·97	0·91	0·86	0·82	0·89	−15·5%
Standardised premature mortality rates per 100 000 person-years						
Male						
Most deprived†	865	796	725	694	770	−19·8%
Least deprived‡	331	293	259	239	280	−27·8%
Difference	534	503	465	455	489	−14·8%
Female						
Most deprived†	511	478	449	443	470	−13·3%
Least deprived‡	220	197	176	164	189	−25·5%
Difference	291	281	272	279	281	−4·1%

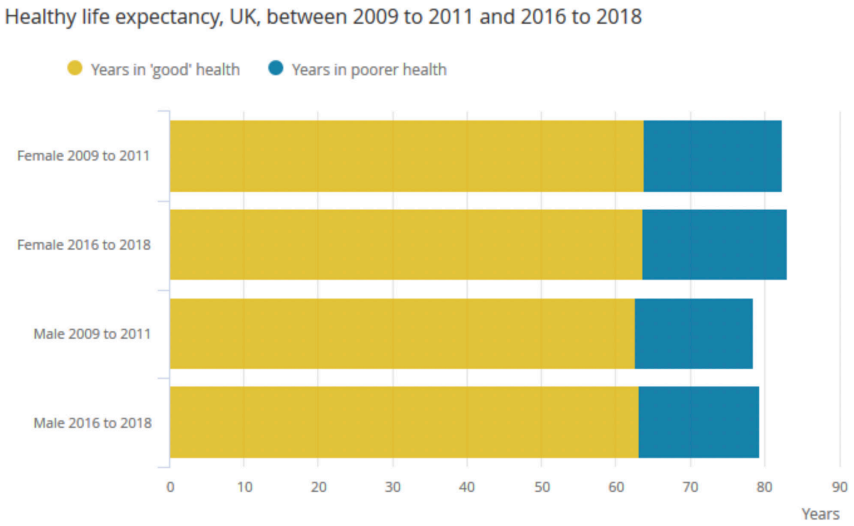
Mortality is adjusted to the European Standard Population 2013. Rates for other deciles are not shown for brevity, and lie monotonically between these values. MASI=mortality attributable to socioeconomic inequality. YLLI=mean premature years of life lost per person. *Change in values from 2003–06 to 2015–18. †Most deprived refers to the most deprived decile of the index of multiple deprivation 2015. ‡Least deprived refers to the least deprived decile.

Table 1: **Inequality over time**

were greatest for more deprived groups. However, relative reductions were greater for least deprived groups, leading to a widening gap between the less and most deprived.

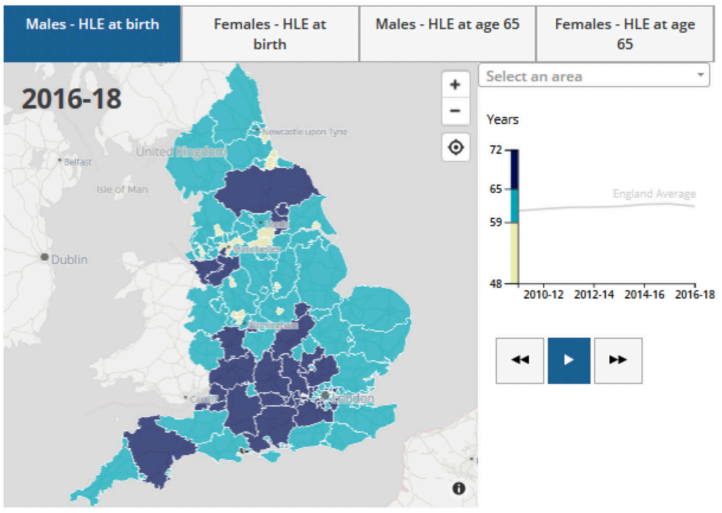
Trends in healthy life expectancy

The ONS has also produced recent data on trends in HLE and DFLE (ONS[4], 2019). The figure below shows that between 2009-11 and 2016-18 the proportion of life spent in good health in the UK has decreased from 79.9% to 79.5% for males, and from 77.4% to 76.7% for females, as improvements in HLE have not kept pace with (slowing) improvements in life expectancy.



The ONS provides online tools to analyse changes in HLE over time (from 2009-11 to 2016-18) by gender and area (see below). Of the eight local authorities (of 151) achieving a significant increase in male HLE over that period, five were London boroughs. There were significant falls

Figure 12: Healthy life expectancy at birth and age 65 by sex, upper tier local authorities in England, 2009 to 20011 and 2016 to 2018



Source: Office for National Statistics

Notes:

1. Local areas include upper tier local authorities (UTLAs) in England only.
2. Healthy life expectancy figures are not available for Isles of Scilly and City of London because of insufficient population size.
3. If you wish to more objectively compare the improvement in life expectancy across the time series between areas, you would need to take into account the confidence intervals provided in the pivot table.

in male HLE in Stockton-on-Tees and Darlington, both falling by about 6%. For females, four of the six areas with significant improvements in HLE were also in London, although Croydon was one of the areas with the steepest falls (falling by 9% to 59.5 years). Other areas with significant falls included Hillingdon, Walsall, Nottingham and Southampton.

The policy response to inequalities in health: some guiding principles

England's population experiences many forms of inequalities in health, from its determinants to outcomes including shorter, less healthy lives.

There is a moral argument to address this, if we believe that these are unfair, unjust and avoidable. Further, we know that the public is averse to inequalities in health, in many studies being prepared to 'trade-off' the health of the wider population for improved health for specific groups (McNamara et al., 2019), these effects tend be larger when focussed on socio-economic status, and for length of life as opposed to quality of life. Given the scale and seriousness of inequalities on this basis set out above, deepening public awareness and understanding of inequalities in health and what generates them is needed to exert pressure on politicians to take stronger action. Inequalities in health are also associated with high costs to public services. For example, Asaria et al (Asaria, Doran and Cookson, 2016) estimate that inequalities in health were responsible for an additional £4.8bn in inpatient hospital costs in 2011-12 and the Joseph Rowntree Foundation found that poverty costs the NHS £29bn overall in terms of excess demand (JRF, 2016).

The key question is, can we do anything about them? Or are we stuck with inequalities in health, seeking to mitigate their impact, but not able to affect their generation? In theory, there are many things that can be done to reduce inequalities in health, and intervention can take place right across the pathway or chain of policies that leads to them. Given the complexity of what drives inequalities in health, and the many ways they can be measured, it is unlikely that any single intervention, policy or approach will be a silver bullet. That means a mix of policies, approaches and interventions are needed, which in turn means national, regional and local strategies supported by some guiding principles drawn from what we know about health inequalities.

These are:

1. Have a theoretical framework to guide strategy and action;
2. Recognise that health risks combine which is what drives inequalities in health;
3. Addressing health inequalities requires action across a wide range of factors;
4. Be guided by what we already know works;
5. Recognise the power of action at local and regional level;
6. Aligned incentives, resources, leadership and accountability;

Conclusion

In conclusion, policy can make a different to health inequalities; in fact, it has done so in the recent past. Given the complexities of health inequalities, any policy needs to be guided by a higher level health inequalities strategy that itself draws on a coherent theoretical framework; recognises that risk factors combine to produce health inequalities; that action needs to address a wide range of factors not a silver bullet; learns from the successes and failures from the past; and last but not least aligns incentives, resources, leadership and accountability behind it.

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Key Paper C:
Making it easier to live well: addressing the behavioural and environmental drivers of ill health

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Hugo Harper - Head of Health, Behavioural Insights Team

Achieving 5 additional years of healthy life by 2035 will require a substantial shift towards prevention. In this note we prioritise the areas to focus on, and make specific recommendations in these areas.

Behavioural risk factors represent the largest opportunity to reduce health burdens across the population, making up more than 50% of the preventable DALYs as estimated by global burden of disease (Kyu et al., 2018). These risk factors also have a steep social gradient. The heaviest drinking, smoking and mental health issues are highly concentrated in the most vulnerable sections of society, with tobacco exposure being three times higher in the most deprived quintile compared to the least (ONS, 2019). The impact of this is stark. Between rich and poor, there is an 8-year gap in life expectancy, and an 18-year gap in years lived in good health.

However, all risk factors are not equally important. **In order to have the largest impact, we should be focussing on policy interventions that target tobacco, diet, stress, purpose and relationships**. Tobacco and diet clearly present the largest burden based on best current models. Models for causes of poor mental health are far less advanced than similar estimates for diseases like heart disease, stroke or lung cancer. Therefore, though the evidence is less certain, interventions in this area should still be prioritised as the gains could be large.

Table 1: Rough estimates for HLE achievable from addressing the primary known behavioural and environmental causes (Source: UK data, Behavioural Insights Team estimates[1])

Risk	Estimated years of lost HLE across UK population
Diet (incl. Indirect Effects)	2 – 4
Stress, Purpose & Relationships	0.5 – 2.5
Smoking	1 – 2
Alcohol	0.5 – 1
Physical Inactivity	0.25 – 0.5
Air Pollution	0.25 – 0.5
Total	4.5 – 10.5

This can be taken as encouraging – we have a good idea of what problems we need to solve to achieve our goal. However, it can be argued that recent governments have neither prioritised prevention nor had policies that could achieve ambitions. Unlike taking a pill, behavioural changes are often seen as less straightforward to achieve.

For example, we all know that it would be a good idea to eat less food high in sugar and fat, and eat more fresh fruit and vegetables. Yet faced with a delicious dessert, and perhaps a distracting TV, our good intentions are soon defeated. It is an open question how much of 'policy inertia' is a result of governments being uncertain about efficacy (in which case we

[1] These estimates are based on DALYS and YLD weightings from GBD scaled up to population to estimate HLE. We appreciate this is very rough but are unaware of any better existing estimates to prioritise action.

hope this paper will help) versus a judgement about political costs, such as the fear of being seen as the 'nanny state'. We must accept the importance of the environment in affecting health behaviours. Informational and educational campaigns will not be sufficient. We need to make healthy behaviours easier for people.

These behavioural interventions are often highly cost effective, costing well below the average £13,000 each QALY is estimated to cost the NHS – with some interventions at a cost of close to zero, or even revenue generating (Owen et al., 2011; Claxton et al., 2013). It is important that sufficient funding and political capital is given to these areas if we hope to achieve HLE+5 without drastic increases in funding. **Directing less than 1/10th of the additional funding agreed for the NHS to such interventions would almost certainly generate more QALYs than all the remaining 9/10ths spent on the NHS**.

Contemporary behavioural science, armed with recent policy successes, gives us good grounds to think that a sizable portion of these extra HLEs could be achieved – with political will. The section below gives a sense of the kinds of policies that could get us there. Whilst we do not discuss alcohol and physical activity in detail we believe similar interventions would be effective. There are also many high-impact, traditional public health measures that are well discussed elsewhere, and therefore we do not focus on these (Marteau et al., 2019).

We present ideas that we believe will have the largest impact for the smallest effort, considering both cost and political capital. Here the central idea is to reshape and harness market pressures and innovation to change the environments in which we live to offer easy, healthier choices.

1. Smoking

Given the massive and well-documented negative impact of smoking, its relatively focused nature, and its huge impact on health inequalities, we start with this as an area of focus. Smoking is increasingly concentrated amongst those in lower income groups, and those with mental health problems, so reducing it will also substantially reduce health inequalities. E-cigarettes are estimated to be 95% safer, so if all smokers switched it would save over 2 million DALYs per year.

Enhance techniques to quit with E-cigarettes

E-cigarettes are now the most popular route to quitting smoking, leading to 22,000 – 57,000 additional quits in 2016. Clinicians need to be recommending these safer alternatives. Adding e-cigs to traditional services makes them almost twice as effective. It is hard to justify why nicotine replacement therapy (NRT) is available on prescription but not e-cigs. Similarly, NIHR should fund the development and licencing of a prescription grade e-cig through the MHRA process, which could be a stronger dose version targeted at the most at-risk heavy smokers.

Expand smoking cessation

Smoking cessation interventions are also highly cost effective – typically 25-fold more cost effective than average NHS spend. Helping people quit smoking is the 'no brainer' of the public health world. However, such programs have been trimmed to the bone, with a halving in the number of smokers having been prompted to quit by their GP over the last decade.

Raise duty on hand-rolled tobacco

There is evidence of significant substitution to hand-rolled tobacco from more heavily taxed cigarettes. Addressing this slippage would be a worthwhile corrective at budget.

Reduce availability – Getting a smoke-free UK by 2030

As a first step to this, government could raise the legal age of purchase from 18 to 21, closing the window on a key age group from taking up smoking in the first place. Going further, the advent of e-cigs has opened the door to getting rid of smoking altogether. We could commit to banning conventional cigarettes by 2030, stating that e-cigs provide a safer alternative to tobacco.

2. Diet

Willpower alone is a very ineffective way of achieving mass change in diet. Evolution has led to us finding sweet and fatty foods hard to resist, and we will more-or-less gorge on auto-pilot when such food is available.

At the same time, markets have evolved to give us exactly what our revealed behaviour says we want. Against this background, by far our best strategy is to reshape our food environment as discussed in a recent CMO report (Davies, 2019). Using consumer shifts to drive changes in product formulation, size, and positioning will be central to the most effective ways in which we can change what we eat – i.e., a 'double nudge'. Innovative price and marketing interventions are also likely to be effective in reducing alcohol harm.

Price to change producer behaviour

If there is an alternative close substitute product or formula, then price differentiation can drive rapid and dramatic change. The UK's added-sugar levy is an excellent example. Sugar levels have fallen by 28% with no loss in sales, primarily through reformulation of existing products. Further action should look to extend the added-sugar levy to milk-based drinks and yogurts, extend VAT to a wider range of foods high in sugar, and consider a tax on added salt.

Marketing

There is a case for restricting the advertising of the unhealthiest foods. For example, the introduction of a 9pm junk food watershed represents a net present value of over £2 billion (*Further advertising restrictions for products high in fat, salt and sugar: impact assessment, 2019*). Restrictions should encourage reformulation of products and reductions in portion sizes.

Outlet differentiation

An alternative – and under-utilised – level to actively mobilise consumers is to sharpen competitive pressure between retailers (and out-of-home food outlets). Most UK consumers have multiple choices of where to buy food, and these retailers compete aggressively. Offering consumers more reliable information on which of their local retailers focus their special offers on healthier food will tilt the balance of competitive pressure in favour of healthier options.

3. Stress, Purpose & Relationships

There is convergent evidence that chronic stress (such as at work), lack of purposeful activity (such as unemployment), and social isolation have substantial health impacts. Social isolation, for example, has been estimated to broadly have the same impact on health as smoking 15 cigarettes a day, leading to around a decade of HLE lost.

Despite these effect sizes, there has been far less attention applied to addressing 'social' and relational causes of ill-health than other causes. Addressing this gap should be a high priority for health research. Promising interventions include:

Social prescribing

The NHS has recently made a commitment to employ 9,000 'social prescribers' or facilitators. Variations on the idea have existed since the 1930s: rather than prescribe a pill for a patient who is overweight or unhappy, instead prescribe an activity. The most important aspect of such prescribing for many people is likely to be their reintegration into meaningful social relationships and activities.

Facilitating local level social capital

A number of studies have shown that having more friends and people you can count on when you need help increases your well-being and longevity. Unfortunately, there is no such link between number of friends on Facebook and well-being. There is a major public health opportunity to stimulate the emergence of locally based social interaction and connection. Better designed cross-generational housing developments, lowering of barriers to social interaction and mutual support, making it easier to interact with others – but refraining from forcing such interaction.

Supporting people to stay in the labour market for longer

For many people, work is a major source of meaning, challenge and social support. As populations age and live longer, it is increasingly a health as much as an economic imperative to support more people to stay in meaningful work for longer. Such levers range from moving defaults away from automatic retirement at a given age to financial incentives for delaying retirement, late-career retraining, and Japanese-style later life work cooperatives.

Conclusion

Spending £13,000 on the NHS to deliver around one extra year of healthy life is not a bad return. Yet, it is a fraction of that achievable by pursuing policies that make it easier to live well, with many public health interventions providing ten-fold better value than this. If we were to set aside just 10% of the additional expenditure billions proposed for the NHS and deploy it to address the behavioural, lifestyle and environmental factors listed above, we could achieve significant increases in HLE.

It is essential that we focus on the behaviours that cause the greatest burden by making it as easy as possible for people to quit smoking, eat healthy, and feel connected within society. This points towards interventions designed to promote substitution and harm reduction across large numbers of people, rather than traditional informational and educational efforts.

The main point is to make it as easy as possible for people to live healthy and well. Much of the policy effort should be directed to nudging producers, retailers and workforces, not just towards individuals. Behavioural science provides evidence about which of these strategies are likely to have the largest impact and be most acceptable, but they will require strong political leadership to make them happen.

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Key Paper D:
National Leadership for Achieving HLE+5

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The goal to improve Healthy Life Expectancy (HLE) by five years by 2035 is ambitious. It would require HLE to rise significantly faster than it has over the past decade. Achieving this will require a major societal effort. It needs strong, visionary leadership at national level from government, voluntary and community organisations, and businesses.

The role of national leadership

National leadership is to drive two fundamental changes. First, long-term improvements in health need to be prioritised. Currently, too much policy, research, investment and action on health is driven by short-term political and financial considerations (Elwell-Sutton et al., 2019). Giving greater priority to long-term improvements in health would help to address chronic under-investment in prevention.

Secondly, health-in-all-policies needs to be made a reality. While the formal health sector has a vital role to play, much more is needed. Achieving HLE+5 means creating the right conditions for people to lead healthy lives. Improving health needs to be a shared value, something which everyone contributes to across the whole of government, business, charity sector and communities.

What is needed to provide national leadership?

The most fundamental change needed is one of mindset and culture. A national consensus needs to be formed around the goal of HLE+5 to ensure that it has support across sectors and political parties. Without this, there is a real danger that new structures and procedures will become token exercises which do not drive the major changes in priorities that are needed. With this in place, a range of measures can be taken.

1. Government leadership

Many of the most important levers for improving health sit with government. National government has a vital role to play both in acting itself and in empowering local government to lead on those issues which are best addressed at local or regional level. Making the bold changes that are needed to improve the nation's health will require action across the whole of government: a health-in-all-policies approach. An example of how this would look for transport policy is given below (Box 1).

Strong national leadership across government on HLE+5 also requires structures which embed health as a shared value (a common goal) for the whole of government and which hold government to account for its work to improve health. Measures needed include:

- Ministers re-affirming HLE+5 as a national priority;
- Adopting a legislative framework, along the lines of the Wellbeing of Future Generations (Wales) Act 2015 (Future Generations Commissioner for Wales, 2019), designed to ensure long-term decision-making in all aspects of government policy;
- Developing a national strategy to reduce health inequalities with clear targets for

health (e.g. healthy life expectancy), risk factors for health (see example below in Box 1), and broader social policy issues (e.g. child poverty);

- Requiring key parts of the public sector (including Public Health England, the NHS and the LGA) to be bound to contribute to the HLE+5 goal and health inequality targets;
- Changing the way success is measured, moving beyond GDP and evaluating policy based on health and wellbeing as a primary measure of successful government. The UK can learn from the Wellbeing Budget adopted in New Zealand in 2019;
- Establishing a new independent body to track and analyse the nation's health. This would provide expert advice to policymakers and regular reporting to parliament, on current trends in health and how health could be improved for future generations. This should be modelled on the Council for Climate Change.

2. Business leadership

"Business simply can't be a bystander in a system that gives it life in the first place."
Paul Polman, CEO of Unilever.

Businesses have a hugely important role in shaping the health of the nation. As employers they directly influence people's income, work-life balance, mental health and physical safety. The products they produce can treat or prevent illness, or be extremely harmful to human health. As a sector, businesses can use their influence to lobby for government policies which improve health or harm it. Large businesses can act as anchor institutions in their communities, so that the health and wellbeing of the community is inextricably tied to the institution.

Broadly, leadership is needed on two fronts:

1. Government has an important role in regulating the conduct of business, both its products and its other activities, to shape the impact which they have on health;
2. Business leaders need to affirm that health is a national asset which must be invested in and commit their businesses to doing this. This will require responsible business leaders to assess, track and actively work to improve the impact that their businesses have on health. A first step would be for business leaders and investors to work with health experts to develop the right metrics for measuring the impact of businesses.

3. Health charities

Health charities have a vital role to play in improving healthy life expectancy and reducing social inequalities, given their rich experience, great expertise and collective spend of £4 billion a year. At present, most focus on individual diseases, their detection, remediation and care rather than on primary prevention. There has been recent progress on organisations coming together to lobby for more effective prevention policies – e.g. the Obesity Health Alliance, Alcohol Health Alliance, and ASH. Health charities and Wellcome have pooled resources for another round of research funding on prevention through the UK Prevention Research Partnership.

Health charities can support achieving HLE+5 by working together, influencing policy on cross-cutting issues that promote health and reviewing what more they could do to promote prevention.

4. Cross-cutting leadership: a national champion for health

In addition to leadership within different sectors (government, business and charities), there is a role for a national champion who has a cross-cutting remit, with a mandate to challenge all sectors on their contribution to population health including the HLE+5 national target.

Better population health has at present no visible public champion who can play this role. The Secretary of State has some responsibility for population health and to promote change but will always be circumscribed in this. The CMO has a mandate to speak truth to Government but has limits as to how far he or she can go. Public Health England does not and cannot act as a vocal public champion for change, as it is part of the Department of Health and Social Care. Charities are not yet providing this role, neither individually nor collectively.

There is a need for a vocal, respected and influential champion. Such a body should act as an evidence-based voice for change to government, business, charities and the public. It would make the case that change is necessary, possible and affordable and that health inequality reduction should be a core goal. There is a need for a social movement to drive national change. An additional function of a national champion for health could be to help promote a social movement for change.

One network which could in future play the role of a national champion is the Collaboration for Wellbeing and Health, which is being supported by the Health Foundation and brings together ten major national bodies. Its aims are:

- To change the conversation on health;
- To promote national policies to support health;
- To support local actions to do so.

Box 1: A health in all policies approach to behavioural risk factors

Improving health and reducing inequalities requires action across government by many departments. Some of the most important departments including:

- *DEFRA for creating healthy environments and healthier food;*
- *DCLG for supporting local government's role in HLE+5 and for healthier homes;*
- *HMT for healthier taxation;*
- *DfT for healthier travel.*

Improving health is consistent with other priorities for these departments such as their role in tackling climate change.

Transport policy is an example of an area with important implications for health which needs to be addressed as part of a health-in-all-policies approach. See the paper by Andy Cope at Sustrans. There are two priority policy areas in transport that will need huge efforts to be made by all government departments, with the Department for Transport (DfT) taking a leading role:

Decarbonising our transport system

Make radical reduction of transport carbon emissions a key policy requirement of all national, sub-national and local transport policy and plans

Achieving better health outcomes through transport

Make outcomes on air quality, noise pollution, physical severance from places, and social exclusion priority areas for improvement including increasing active travel and focus on the role of transport in supporting a place to live, learning, employment and relationships

Officials and politicians, nationally and locally need to develop clear plans to improve health as part of addressing these major changes

Top level policy measures that will need to be implemented to achieve this are:

- *Changing transport economic appraisals so that health outcomes and carbon emissions become major determinants of scheme selection;*
- *Sustained investment in safe infrastructure; applying consistent, high quality design standards; making supportive changes to the planning framework; ensuring appropriate capital-revenue balance in investment in order to enable behaviour change initiatives that support wider engagement and participation in active travel;*
- *Supporting local town and transport planners, engineers and politicians recognising their contribution to health and climate change and actively promote a shift to healthier active modes of travel.*

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Key Paper E:
Local Systems and the Grand Ageing Challenge Goals

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Introduction

The Grand Ageing Challenge will only be met if local areas move to coherent population health systems which maximise the contribution of the four pillars of population health.

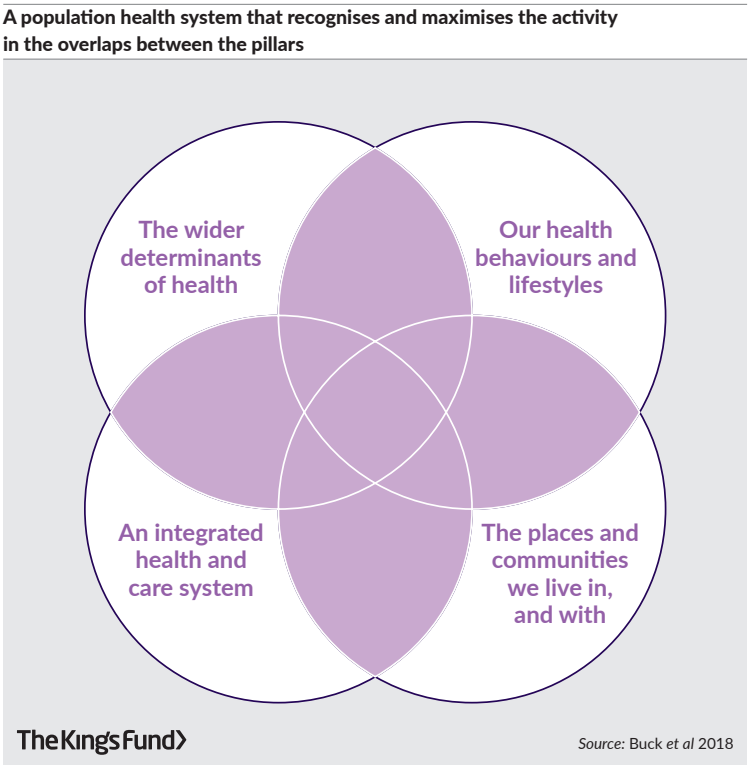
National government has a significant role, and the activities of each government department are crucial in shaping the environment in which communities can thrive and achieve the best possible health. Central government can (and does) set the rules and background infrastructure by which we make progress. It also sets the context against which norms and culture is set locally.

But we know from long experience and a lot of evidence that there is a hugely important role for local systems to both deliver services and set wider policies and 'place-shaping' that will improve health; in short, local systems must become local population health systems.

Local population health systems

Our definition of a local population health system

Figure 1: A population health system that recognises and maximises the activity in the overlaps between the pillars (source: Buck et al., 2018.)



A local population health system is how local areas arrange and resource activity in the four pillars of population health – the wider determinants, our health behaviours, an integrated health and care system, and the contribution of our communities – and how those areas identify, recognise, lead and support activity where these pillars intersect.

Doing this, and therefore achieving the goals of the Grand Ageing Challenge will depend on:

- Strong local system leadership;
- Meaningful involvement of the public;
- Ensuring health inequality reduction is a core system goal;
- Getting the underpinning enablers right;
- Enabling central government policy.

Local system leadership behaviours

Achieving the Grand Ageing Challenge requires leadership of a complex population health system, this in turn requires five key leadership behaviours from system leaders (Senge et al., 2015; Naylor and Buck, 2018):

1. 'Seeing the larger system' that influences population health locally – across to the other pillars of population health and the sectors that contribute to them;
2. Recognising that not all the solutions are to be found within their organisation, sector or 'pillar', and so actively supporting those who have solutions beyond their own source of power and responsibility;
3. A shift of focus from reactive problem solving to co-creating the system and designing strategies to get there;
4. Strong local political buy-in and support. The soft power of local political leadership (e.g. through city mayors) can cut across this complexity of local governance arrangement and appeal directly to communities;
5. Dedicated resources that can co-ordinate and help guide system-wide action. Experience suggests this need not be a large function, but it is critical to success.

Where leadership sits or rests is less important than the behaviours above. In some places this may be the Health and Wellbeing Board, in others NHS structure such as Integrated Care Systems, or as in many places a combination, this will depend on local contexts.

The public seen as partners in health by an enabling state

Investing in communities for health needs to be a critical part of any approach to population health and meeting the Grand Ageing Challenge goals.

There has been a welcome and growing recognition of the role and power of communities in health, as well as that of individuals (South, 2015; Lent and Studdart, 2019; Naylor and Wellings, 2019; Buck and Wenzel, 2018). The communities we are born, live, work and socialise in have a significant influence on how healthy we are. Strong communities are therefore good for health and local areas – often led by local government – are working in many ways to develop and support this (see case studies here: https://www.kingsfund.org.uk/events/community-best-medicine-leeds-event#presentations).

The ‘Wigan Deal’ (see Box) is one of the best known and documented approaches to working with the public and communities for health, but is not alone. The Deal has given public servants and others in Wigan a set of guiding principles that inform how they work with each other and with people using services and in the community more broadly.

Wigan does not offer a simple, ready-made solution that other areas can adopt overnight. However, it does provide a powerful example of what can be achieved when public services see communities as assets and commit to working in a different way that builds on people’s strengths.

Significantly, Wigan’s headline achievement in relation to healthy life expectancy (HLE) is impressive. The rate of improvement between 2009–11 to 2015–17 was faster in Wigan than in most of its 15 nearest ‘statistical neighbours’ (councils with a similar population and geography), with only three of these seeing similarly positive results (Public Health England, 2019), at a time when HLE across England was largely stagnant over the same period, narrowing the gap between Wigan and the national average.

Box 1: The Wigan Deal

Since 2011, Wigan Council has embarked on a major process of change involving moving towards asset-based working at scale, empowering communities through a ‘citizen-led’ approach to public health and creating a culture which permits staff to redesign how they work in response to the needs of individuals and communities. At the heart of this is an attempt to strike a new relationship between public services and local people that has become known as the ‘Wigan Deal’ between citizens and the council. In return for keeping council tax low, the council has asked citizens to work alongside it. Wigan’s approach has been based on four main components:

Asset-based working
There has been a major drive to work with local people in a different way that seeks to recognise and nurture the strengths of individuals, families and communities and to build independence and self-reliance. While asset-based working has been explored in many parts of England, Wigan is notable for the scale at which this approach has been adopted and for the consistency of implementation.

Permission to innovate
Leaders in Wigan Council have created a culture in which innovation is encouraged and frontline staff are permitted to take decisions for themselves and re-think how they work, based on their conversations with people using services. This has meant taking a different approach to risk – positive risk-taking is encouraged if the potential benefits for clients outweigh potential harms. It has also involved moving away from a ‘blame culture’ towards one that emphasises learning from what has not worked.

Investing in communities
Wigan Council has taken a three-fold approach. Firstly, investing directly in local voluntary sector organisations and community groups through a dedicated community investment fund. Secondly, the council commissions collaboratively where voluntary and community sector organisations are seen as partners and are actively supported to develop and improve. Finally, it has invested in citizen leadership roles at scale through roles such as community health champions (including young champions and alcohol champions), dementia friends, and autism friends.

Place-based neighbourhood working
As elsewhere, organisations are attempting to work together in a more integrated way. A distinctive feature of Wigan’s approach to this is the breadth of organisations involved – in addition to health and social care teams, multi-agency working within the borough’s seven ‘service delivery footprints’ involves the police, housing, employment, welfare services and others. This creates opportunities to tackle the broader determinants of health and wellbeing in a more coordinated and flexible way.

Source: (Naylor and Wellings, 2019)

Inequality reduction as a core goal

The Grand Ageing Strategy will not be achieved without tackling health inequalities as a core goal regionally and locally.

For example, at a regional level, the London Mayor is unique currently in having a statutory responsibility to have a Health Inequalities Strategy for London. The current strategy (Mayor of London, 2018) has a twin-track focus on: those things the mayor controls directly (e.g. spatial planning, transport, economic development, housing, environment and culture), and actions of wider partners (e.g. the NHS through London's Sustainability and Transformation Partnerships). The strategy is supported by a number of key indicators that are monitored over time. More major cities and regional areas need to adopt their own health inequalities strategies.

Good examples at local level include Sheffield and Coventry. In Sheffield the Health and Wellbeing Board has set itself the role of being the coordinator of the city's approach and work on health inequalities (Sheffield City Council, 2019). In Coventry, the new health and wellbeing strategy is the city's high-level plan for reducing health inequalities and improving health and wellbeing for Coventry residents (Coventry City Council, 2019). The local NHS also needs to take inequality reduction more seriously than it does (Buck 2018); the 2012 Health and Social Care Act introduced legislation on health inequalities which needs to be more actively used (Moore, 2019).

Six underpinning areas for regional and local reforms

Greater Manchester (GM) is on a journey towards a population health system covering 2.8 million people (Greater Manchester Health and Social Care Partnership, n.d.), adapting The King's Fund framework above to its own context. GM has set itself the task of reform in six core areas to help it achieve this as below; **local areas should set themselves the following six goals:**

1. Adopt a future generations and wellbeing policy

Local areas need to develop an approach to future generations policy, with wellbeing at the heart – this helps local systems focus on the long-term health of their populations, not simply meeting short-term healthcare demands. GM is exploring how a regional approach could learn from the Welsh experience with The Future Generations Act and New Zealand's approach to budgeting for 'wellbeing' (Charlton, 2019).

2. Have an investment strategy for prevention

All 'the headwinds' are to support acute treatment systems in semi-perpetual crisis due to tight budgets, this creates no headroom for non-immediate spending. GM is exploring the case for a prevention investment strategy with a focus on: payment and reward systems (e.g. risk-adjusted capitation); a prevention fund; and the feasibility of setting a prevention target as a proportion of overall spend (as has been suggested by PHE and CIPFA (CIPFA and Public Health England, 2019).

3. Use existing local powers optimally

Local areas need to use existing legal powers optimally. These lie in and outside the health care system. Regional and local areas need to be honest and ask themselves whether they are using the full powers available in the following areas: those that apply specifically to the NHS, including in relation to integrated care (NHS England, n.d.); powers over procurement through the Social Value Act (Fenton, 2016); the permissive powers under the Localism Act

(Department for Communities and Local Government, 2011) that provides a general power of competence for local authorities over improving local wellbeing; and finally the wide range of powers in other sectors (including transport, planning and education) in ways that are likely to improve the health the population and narrow inequalities in health.

4. Integrate governance, assurance and accountability

There are no easy solutions to accountability, given the complex nature of what drives population health – and as a key part of that health inequalities – but it is important to be as clear as possible about where governance and assurance lies locally, and what accountability means.

In Sheffield, the Health and Wellbeing Board fulfils this role around health inequalities challenging local partners to act and holding them to account for commitments made (Sheffield City Council, 2019); in Coventry, the Health and Wellbeing Board has been explicit about where the responsibilities for the strategy lie across the four pillars of population health (see Figure) (Coventry City Council, 2019).

5. Broaden population health leadership and use public health expertise optimally

Directors of Public Health play a critical role, but they cannot be the only leaders in place for population health. The role of specialist public health expertise is critical to local systems, as our work on international cities that do well on population health has shown (Naylor and Buck, 2018); there are fewer than 150 Directors of Public Health in England, each local system will therefore need to make the best use of this scarce resource in the way to maximise its impact for population health.

But there are many more people who can contribute, from those with the broadest roles to those with the most specialised. What works it what place and context will be different (for example, see Wigan's reimagining of the contribution and roles of council employees (Naylor and Wellings, 2019) and what firefighters are now doing in many places around England (Taylor, 2017) but every local place should have a local vision for the use of population health skills and roles in their workforce.

6. Fix perverse incentives

There is a difficult incentive problem in acting on population health and health inequalities. The sectors that by investing resources are likely to have the biggest impact are often not able to capture the financial rewards from doing so. In the United States, some healthcare systems have directly invested in building and improving housing in the poorest areas (Pham and Green, 2018) since they know this is important for health and because it will pay off in lower demand for their patients for whom they are only reimbursed a set sum for care.

In England there is less incentive to do the same, since the NHS does not benefit financially from improving health and lowering demand for its services; local government also has less incentive to invest since any gains in terms of reduced demand will pay off to the NHS, and not local government directly. Budgets are jointly held and decisions made more jointly between the NHS and local government in some places which helps mitigate these incentive problems; in some places, the NHS is also acting more like an 'anchor institution' (Reed et al., 2019), 'looking beyond its own pillar' and supporting other sectors for health. However, both are less common than they need to be, and these are workarounds – in the longer term, the fundamental incentive and leadership problems need fixing.

Central government asks

Central government needs to make it much easier for local leaders, organisations and systems to 'do' all of the above. Central government needs to commit to a National Health Inequalities strategy, ensure the right resources are in the right place, and develop clearer accountability between the centre and localities (The King's Fund, 2019).

A national health inequalities strategy

The effort of local leaders, organisations and systems needs to be supported by a cross-government Health Inequalities Strategy. The last strategy (active until 2010) was successful in narrowing gaps in inequalities in life expectancy between deprived and less deprived areas (Barr et al., 2017). A new strategy needs to learn from this success, and develop further. The King's Fund has set out options for possible national 'binding ambitions' on both population health and inequality reduction and the reasons why in its Vision for Population Health (Buck et al., 2018).

The right resources, in the right sectors

We know that public health spending is good value for money – spending on the services supported through the public health grant is three to four times as cost-effective in terms of health gain as putting the same money into the NHS baseline (Martin et al., 2019), but central government has cut the grant. The King's Fund and Health Foundation have argued that at least £1 billion extra p.a. is needed to be put back into the public health grant (The King's Fund and The Health Foundation, 2019) but a more fundamental assessment is required of the optimal budget for local government public health.

Beyond the public health grant, overall local government real spending per head has dropped by 20% between 2009/10 – 2018/19. More deprived areas have faced larger cuts than least deprived areas; local government has been good at protecting social care services but at the expense of others which contribute to health (Harris and Phillips, 2019). Central government needs to put critical resources back into local government, and to reform the way it does so, so that more deprived areas and services that support population health and will contribute to meeting the Grand Ageing Challenge do not lose out.

The relationship between the centre and regional and local systems

There is a constant conundrum about 'what happens if what we want to happen doesn't look like it will' at the heart of national strategies which depend, in large part, on the actions of local systems. The Grand Ageing Challenge will need to address two challenges. Firstly, that different sectors – especially local government and the NHS – have very difficult accountability (and funding) relationships with the centre. Secondly (and subsidiary to this) that it is not clear that existing relationships currently is optimal for the Grand Ageing Challenge. We can – and should – learn from the strengths and weaknesses of previous regimes including those governing the previous National Health Inequalities and other strategies, governed through the Public Service Agreements process across government (Gay, 2005).

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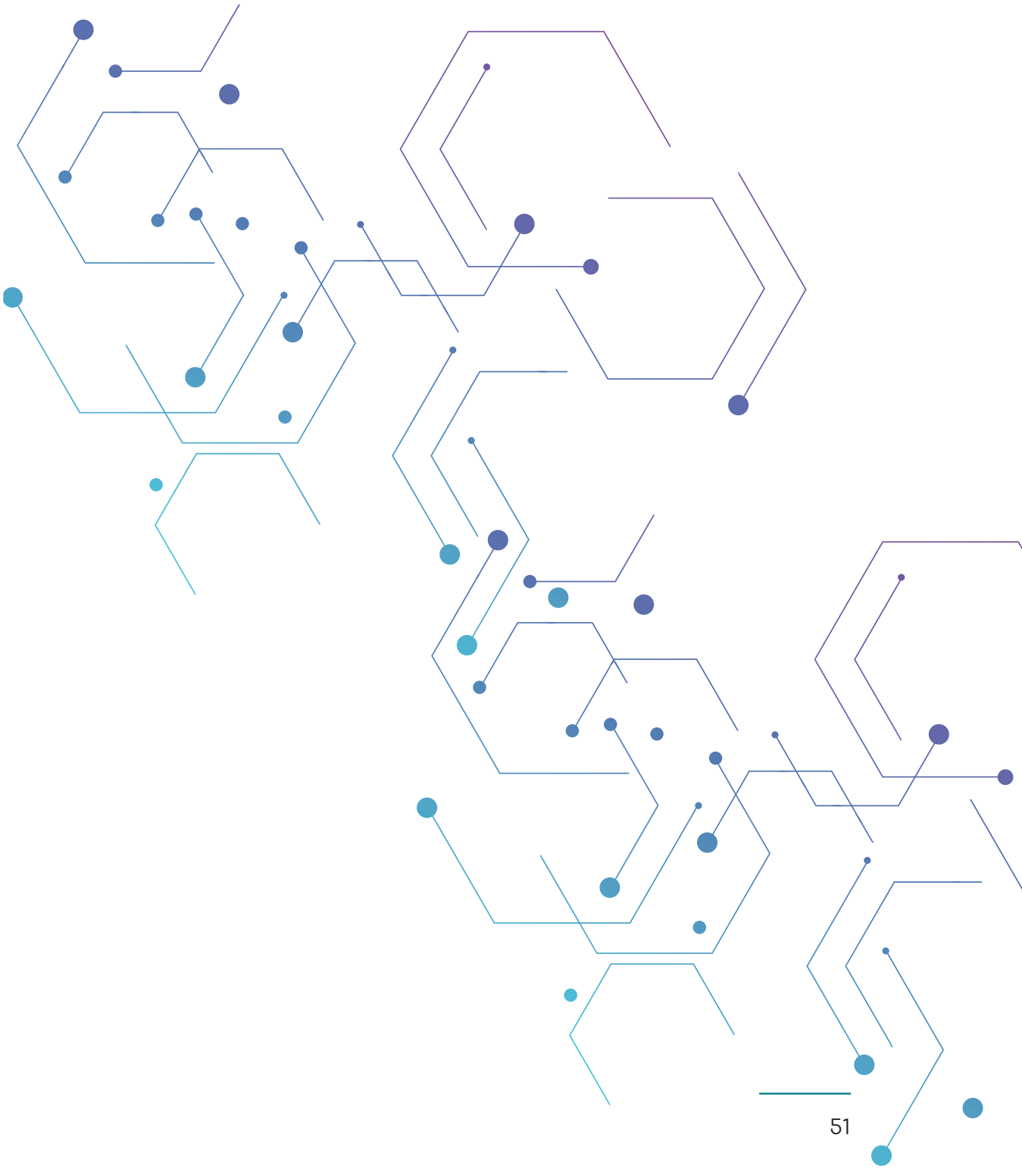


Key Paper F:
A Service for National Health - An NHS fit for 2035

Richard Barker - Health Innovation Network, New Medicine Partners
Charles Alessi - Public Health England, HIMSS

The National Health Service (NHS) is one of the most efficient health systems in the world and delivers more activity per unit of funding than many other similar systems. However, it has never truly embraced prevention as a primary goal, and so its metrics and the preoccupation of its leadership focus on the delivery of care to sick patients, rather than the maintenance of health across the population, including the economically and socially disadvantaged. This paper describes how this needs to change, in terms of the focus of the health and social care system, the metrics by which we measure performance and the nature of the leadership we need.

Shift the Focus towards Prevention

The NHS is a product of its age. Ideated in the late 1940s and having been through countless reorganisations, it remains an institution whose focus is the curing or amelioration of illness.

As we move to a health and care system which is based more on personalised interventions that encompass wellness and more active personal involvement, let us describe what the NHS would look like in this new world and how it would differ from the 'old' NHS. While hospitals, primary care and local government are all driven to achieve the same aims, the financial metrics would differ. The emergence of Integrated Health & Care Systems, managed and measured on overall outcomes rather than activity, should in principle facilitate this.

The NHS today is managed, measured and assessed on the things that are considered to be important. Primarily, this is on adherence to budgets and performance against operational targets, such as time to referral for major diseases, or waiting times in Accident and Emergency (A&E). In the case of hospitals, activity levels and case mix – as well as various care quality metrics assessed by the Care Quality Commission – are routinely collected and often appear prominently in the press, especially where there is evidence of adverse variance. The drivers to ensure breaches in targets are avoided are thus very high in the minds of both administrators and staff that drive the system. Persistent or serious overspend against annual budget results in the Trust being placed in Special Measures and often in the Chief Executive being dismissed.

Not surprisingly, therefore, the focus of today's NHS is predominantly on how to survive today's demands for treatment within allocated budgets, rather than 'looking down the road' to enhance the wellness of the population and thereby reduce the demand for costly, late stage interventions in the medium and long term.

The future NHS may well look the same in terms of the institutions delivering care and to some extent their staffing, however the focus of care will be different. Prevention of ill health and incorporation of wellness will form part of what an NHS would be expected to deliver to satisfy the new financial metrics driving the system, and the activities of the service would progressively mirror this. The activities within primary care and secondary care would also be more similar rather than different, and the focus and emphasis around prevention of disease and maintenance of wellness would be very similar. Integrated care systems (ICSs) would identify how each arm of the service (and the relevant aspects of social care) can best anticipate the risk of future disease (or readmission for the same disease) and put preventative measures in place. Specifically, in the case of cardio-metabolic, non-communicable diseases, the importance of risk reduction would be highlighted, and the need for patients to self-manage would be considered to be as important as the treatment of disease once it emerges or worsens.

Let us look at some specific examples of the changes needed between the present day and 2035. Prevention strategies and investments must be targeted to reverse completely avoidable surges in chronic disease resulting from shifts in the population's lifestyle. There are already 3.8 million UK citizens diagnosed with **diabetes** and an estimated 1 million undiagnosed but living with diabetes. At current course and speed the total is estimated to rise to 5.5 million in just the next 10 years. Actions targeted at childhood and adult obesity can help prevent today's and tomorrow's pre-diabetics developing the disease.

As well as causing complications such as blindness and foot and leg amputations, Type 2 diabetes is also the most common gateway to other chronic conditions such as cardiovascular disease, depression and chronic pain, as shown by recent analysis of the population of Lambeth in London. So, effectively tackling diabetes could prevent millions of people joining the growing ranks of the multi-morbid, frail middle-aged and elderly.

Despite the widespread availability of inexpensive generic drugs, untreated or poorly treated **hypertension** also remains a major threat. Avoidable heart attacks and fatal or debilitating strokes are the result. An estimated 1 in 4 of the UK population has raised blood pressure. An estimated 4 million people have untreated hypertension, according to the British Heart Foundation, and this is particularly common in middle-aged men.

These facts, of course, are not lost on today's NHS. Monitoring and management of diabetes and hypertension and the prevention of diabetes are already explicit priorities, with programmes and primary care Quality and Outcomes Framework (QOF) incentives around them. However, these are a continuation of what we call 'medicine by body part' rather than a more holistic 'precision health' approach around the individual and his or her life course. This approach – focused on outcomes in terms of health maintenance rather than treatment of conditions when they arise – needs to be supported by digital tools, appropriate metrics and adequate funding. And there are clear synergies with the policy initiatives to 'make it easier to live healthily' described elsewhere in our strategy.

Therefore, the focus will increasingly be on achieving health status outcomes, rather than the cost-effective management of disease. Aligned financial drivers in primary and secondary care would help ensure that different parts of the health and care system adopt a more collegiate approach towards achieving the same goals.

The new NHS will adopt a life-course approach to health and wellness and concentrate on encouraging wellbeing, managing inequalities with the same weighting it adopts around managing ill health. The fact that new unified financial metrics (see below) will govern the way it operates will encourage cooperation between primary, secondary and social care, recognising their interdependence in effectively managing a citizen's overall health life course. Interoperability and access to medical records by patients as well as their involvement in their own health and care will be essential aims for the system to encourage, since both of these factors drive better health and wellness outcomes.

The 2035 patient would have access to their customised care and wellness record. This would be populated by their unified Electronic Medical Record as well as their own health and wellness data and other pertinent data. They would be in contact with the NHS on a regular basis specifically around assessment of biomarkers which they would be using to assess their wellness and better manage their risk factors. The NHS would be working – in concert with local government – offering citizens curated personalised support, and be utilising digital tools and incentives as well as behavioural drivers such as gamification, to better motivate behavioural change in citizens.

The factors that will drive and accelerate healthy productive ageing are multifactorial and lie within as well as beyond the health and care systems. Thus, programmes to tackle the social determinants of health (as described elsewhere) are of vital importance.

The transformation of the current NHS is further fuelled by an increased understanding that health and care need to deliver service with measurable improvements in outcomes, rather than solely in activity, for citizens, with outcomes rather than activity becoming the numerator in assessing the productivity with which the NHS uses its resources. Furthermore, they are driven by increasing recognition of the long-term unaffordability of the present models of delivery, exacerbated by ageing and multi-morbidity of citizens.

To accomplish this reimagined new health and care system, a holistic view of the individual, including the non-health determinants, needs to be captured in the design of patient-centred care delivery. The fact that the only real option for delivering this is via digital transformation offers real opportunity to generate and capture appropriate data points to drive and monitor the new system.

There is emerging consensus internationally that new health and care systems need to be capitated, personalised, and value- and population-based. From Europe to the Americas to the Middle and Far East, systems are in transition to new models of care. These new capitated models are favoured by payers in that they seem to offer better financial control over time, as well as offering advantages over the existing activity-based models, as they tend to value long term individual outcome above units of activity as well as truly incentivise the prevention of ill health and the promotion of well-being.

Increasingly measure NHS performance on Outcome rather than Activity

The challenge to deliver five extra years of healthy productive life in England is far more likely to succeed if the financial metrics that drive health and care are also aligned in mainstream practice.

Managing health and care systems is particularly complex. As live, complex, adaptive systems, they are made up of a myriad of moving parts. Thus, as the probability of producing unintended and unexpected consequences through tinkering of a few sentinel metrics is high, so the design of the new metrics needs to be done with great care. For example, outcome metrics are not an exact science and we are in the foothills of our understanding of how best to drive them. There is no simple formula and the fact that one outcome (such as weight loss) inevitably affects another (such as a diagnosis of diabetes) makes the design of metrics particularly challenging. Also, using financial metrics to encourage the health care system to shift its emphasis from activity to outcome cannot occur in a single step without significantly increasing the already considerable pressure on delivery systems. However, we believe it is achievable by a more nuanced and staged approach.

We propose a transition to a more preventative, population health-based system to be phased in over a number of years. Whilst there should be debate around the pace of this change, the most pressing action now is a clear statement that this will be the direction of travel the NHS will be taking as part of its long-term plan, and describing the optimal end state as one which would encompass both activity and outcome.

With such a complex delivery system made up of a multitude of players, financial predictability is important, enabling payments to be normalised on a year to year basis. The optimal approach will encompass the capitated, personalised, value and population-based systems we aspire to deliver in the pursuit of universal healthcare provision, and thus include both personalised outcome measures as well as activity and progress indicators.

The NHS by 2035 will serve a population which will differ in important respects from the one we have today. It will have become older and with the advent of a more personalised customised public health offering to individuals via precision health and enabled digital connectivity, the citizen will be much more activated.

It is not that prevention and health maintenance is a new concept for the NHS. However, when the NHS five-year view was published in October 2014, what was presented was a vision, not a plan to integrate prevention into care. The same could be said for the NHS Long Term Plan published in January 2019, where there is promise, but no timescales for how the payment systems are to be altered and at what pace.

We propose that what is achievable, without destabilising existing provision, is a cumulative substitution of a meaningful percentage of metrics and financial allocation over the next three years. For example, in the case of the total core income for NHS hospitals, allocating 5% in year one, a further 7.5% in year 2 and an additional 12.5% change in year 3, oriented to outcome measures, would achieve the first major step by having a quarter of all the financial drivers pointing towards prevention in three years' time. As regards primary care, the similar (or perhaps greater) pace and methodology would apply. The adoption of primary care networks and the emergence of ICSs, with their populations makes this more achievable. Some measure of autonomy could be allowed to ICSs on how precisely responsibilities and financial allocations are distributed across primary, secondary and social care.

The new outcome-based metrics to drive prevention and better outcomes could be developed over a period of years in an iterative process. The ones proposed below are all ones where the data is already available and collected, and the metrics could encompass the following parameters:

Optimising health and risk reduction

1. Sentinel metrics for Optimising health:
    - Disability-free life expectancy at the age of 65;
2. Sentinel metrics for risk reduction:
    - Smoking prevalence in adults (over 18);
    - Percentage of physically active adults (over 18);
    - Admission episodes for alcohol related conditions;
    - Percentage of adults classified as overweight or obese

Improving Wellbeing and activation and the wider determinants of health

1. Sentinel metrics wellbeing/activation:
    - Self-reported wellbeing scores percentage;
    - Warwick-Edinburgh Mental Well-being Scale (WEMWBS) scores in target populations;
    - Activation scores;
2. Sentinel metrics in Social isolation:
    - Social isolation percentage metrics;
    - Access to healthy assets.

Reversing or living well with a long term non communicable disease

Sentinel metrics selected would be around biomedical indicators similar to QOF comprising cardiovascular disease, chronic obstructive pulmonary disease, early cancer diagnosis, musculoskeletal long-term problems, sensory and communication-related conditions, mental health and dementia.

Whatever the metrics selected, the overriding factors to be taken into consideration are the life-course approach as well as adoption of newer concepts like HealthSpan.

Provide Strong Leadership to Drive Change

The shift we are describing will not occur without strong messages and symbolic actions from the top. This needs to go well beyond occasional references to the prevention agenda in speeches; it could include:

- Regular publication of atlases of variation in health status, highlighting strong and poor performance;
- Well-publicised performance against targets on, for example, diabetes prevention, blood pressure and lipid control, alongside (and increasingly instead of) the current operational targets for treatment;
- National coverage of, and awards for, local programmes (such as those we have seen in Wigan and Torbay) that have harnessed local leadership and entrepreneurship to achieve substantial improvements in population health status;
- Progressive education of ministers and other leaders that the touchstone for an NHS to be proud of is not the number or size of its hospitals, but the avoidance of hospitalisation by more effective preventative measures (as we have seen in the Swedish example of being proud to **close** hospitals)

The following vignette describes how the new system will look and feel different from the perspective of a doctor in the NHS:

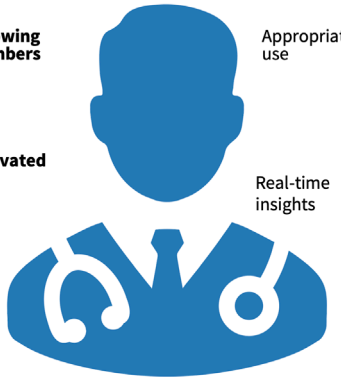
Figure 1: A 'New NHS'

"By accessing appropriate information, this allows me to offer more tailored recommendations to not only cure but also assist people better manage their risk factors for disease. It also allows me to better partner with primary care as well as address patient's concerns much more effectively"

Patients arrive at consultations having done the basics so little time is wasted.

Patients are activated and more willing to engage and make better choices about their own health

"The limited time I have with a patient can be utilized more effectively – focusing on empathy, care, and behavioural change because the data is there and the system is aligned"



Patients access care appropriately and only when they really need it.

Clinicians are able to observe how patients are doing between appointments for patients and cooperate with primary care as both driven to achieve the same outcomes

Clinicians are able to offer genuinely personalized care plan considering environmental, genetic, lifestyle and medical history data available

Key Paper G:
Measuring National Healthy Lifespan Using Objectively Recorded Health and Care Data

Rupert Dunbar-Rees - Chief Executive, Outcomes Based Healthcare
Ellie Bragan Turner - Senior Health Outcomes Analyst, Outcomes Based Healthcare

Summary of key national findings and implications of new evidence of the health of the nation:

1. For the first time, we now have an objective and current measure of our national health – how long we live in good health, our healthy lifespan, or "HealthSpan" (Outcomes Based Healthcare, 2019). This is based on analysis of NHS data for the average age when people are diagnosed with their first significant long-term health condition[1], from the work done in partnership with NHS England/Improvement, Public Health England, and Arden and GEM Commissioning Support Unit, by Dr Rupert Dunbar-Rees, and his team at Outcomes Based Healthcare (OBH) in 2019.

2. This suggests we may be much less healthy than we thought. Previously the estimate for how healthy we were was our Healthy Life Expectancy (HLE) and was based on self-reported subjective assessment from a sample population, whether we described ourselves as being in good health or not. In England (2016-2018) it indicated a woman would on average expect to live 64 years in good health, over a lifetime. Now we know from initial pilot work on objective national NHS data that, on average, women are being clinically diagnosed with a significant illness at 55 – nearly 9 years sooner. Women living in our most deprived areas are being diagnosed with a significant long-term condition when they are only 47 years old, on average.

	HLE (2016-18)	HealthSpan (2018/19) median (yrs.)
MEN	63.4	56
WOMEN	63.9	55

3. The clinical commissioning group areas in England with the highest and lowest average HealthSpans nationally are 61 years and 41 years respectively. This represents a 20 year "HealthSpan Gap" across the country, where people spend a greater proportion of already shortened lifespans in poor health.

4. This new evidence allows us to very promptly track, within only a few months instead of years (as previously), if the health of the nation is getting objectively better or worse. We can also compare how healthy different counties, cities and localities are, and measure the changes taking place, as they occur.

5. The potential implications of this are major; it signals that the demand increases that are being experienced now in the NHS, and continuing as our society ages, are likely to be even greater than had previously been expected. More people are being diagnosed with significant long-term conditions earlier in their lives, and living with them for longer than we had previously thought. In the case of women this amounts to up to 9.7 extra years (or up to 50% longer) in poor health, on average, than health and care systems have previously allowed for, based on self-reported data[2]. We can also expect additional increases in demand because people with one long-term condition often progress to multiple long-term conditions over time.

[1] There are 26 major or significant long-term conditions used for this measure as listed later, in Appendix 2.

[2] See technical note #1 at the end of this document.

6. This also has large implications for local authorities, as people developing long-term conditions earlier in their lives will mean increased demand for social care.

7. For individuals, this evidence is worrying. If we do nothing, many of us risk of spending a higher proportion of our lives in ill-health and a higher risk of falling out of work because of ill-health. **The positive news is that this future is largely avoidable.**

8. But for politicians and policy makers it is a wake-up call to get serious about prevention. Of the 1.4 million such new cases of the same significant (first) long-term conditions diagnosed in England in 2018/19, a high proportion were of illnesses that could have been prevented if society and politicians had been serious about doing so.

9. This deterioration in our national health can be slowed down or even reversed if we focus our efforts on where we can have most impact. For example, by greatly increasing identification and treatment of high blood pressure, and obesity, coupled with more vigorous measures to help people quit smoking and adopt healthier behaviours. But these must be underpinned by creating environments and life circumstances that fully support them to do so.

10. The analysis in this report also shows that action to prevent or delay such illnesses, as well as offering great personal benefits, would also, over time, mean that the increases in NHS demand and cost that will continue as our society ages will be lower than would otherwise have been the case if left unchecked. Since, in most cases, the resulting improvements to our HealthSpan will be greater than increases in how long we will live. For the country as a whole, the cohort 'leaving' the Healthy / Well cohort each year could expect, on average, to incur additional acute healthcare costs alone in excess of £1 billion per annum, greater than they would have incurred if they had remained in the 'Healthy / Well' cohort for an additional year.

B. Methodology – Background / Context

Understanding potential changes in healthcare demand and expenditure associated with increases in healthy lifespan ideally requires an objective approach to measuring individual health status, covering an entire population. The approach described here generally uses routinely collected, population-level, linked longitudinal health and care (i.e., 'real world') data, spanning multiple care settings. It measures the significant long-term conditions which lead to someone 'moving from' the healthy / generally well cohort, to any other 'non-healthy / well' state (see Figure 1 below). Further detailed methodology, and specific outcome measures to monitor these flows between health states are available on the link in the references below (Human Health Span, 2019).

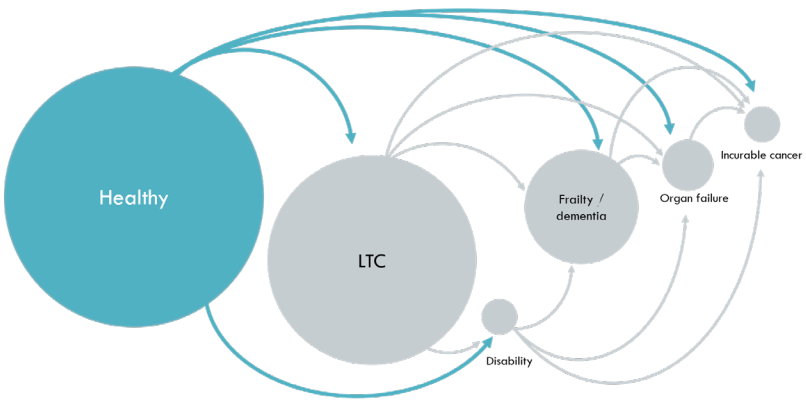
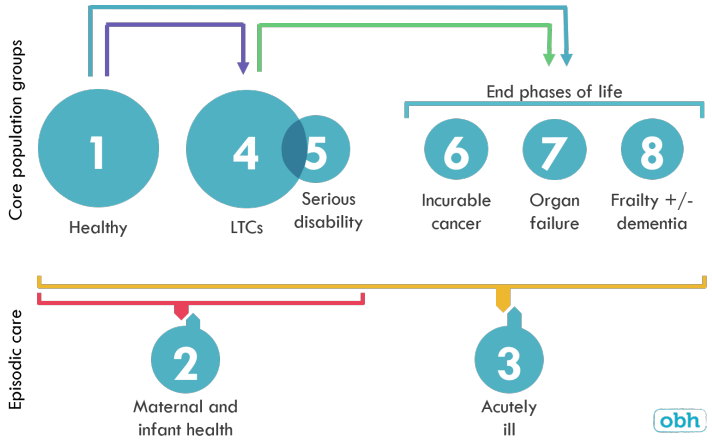


Figure 1: HealthSpan™ / Healthy Lifespan® measures the age of first movement out of the 'Healthy / Generally well' segment to any other segment (or death), and are signified by the green arrows.

Daily movements occur in both directions at a population level, and are routinely picked up in linked, longitudinal, population-level health and care data. However, net movements are generally from 'left to right', when viewed over a life course. The base segmentation approach which Outcomes Based Healthcare have built their UK data model on is the 'Bridges to Health' model, described originally by Joanne Lynn (Lynn et al., 2007; see Figure 2).

Figure 2: OBH Segmentation Model, underpinning these analyses, adapted from 'Bridges to Health' (Lynn et al., 2007).



Source: OBH, adapted from the Bridges to Health model. Lynn J, Straube BM, Bell KM, Jencks SF, Kambic, RT. (2007). *Using population segmentation to provide better health for all: the 'bridges to health' model.* The Milbank Quarterly: 85(2): 185-208.

C. Insights from using this segmentation model,

on objective, linked, longitudinal health and care data (including primary care data):

- The current size and nature of the 'healthy / generally well' population;
- The main conditions which are the 'first' conditions to be experienced when 'leaving' that cohort;
- The aggregate / net effect of these 'first' conditions, in terms of HealthSpan / Healthy Lifespan;
- The health and care expenditure associated with those population movements 'out of' the 'healthy / generally well' population segment, to a variety of other health states.

These are set out as a series of steps set out in Appendix 1. In addition, work is currently being undertaken with central NHS bodies, on nationally held, linked datasets of a broadly similar kind (but excluding primary care data). Early indications suggest that the outputs from the national work appear to be broadly comparable with the outputs from the specific examples below, and the current key findings are summarised above.

Healthy Lifespan / 'HealthSpan' analysis using objective, longitudinal, whole population, morbidity data differs to corresponding self-reported HLE and DFLE survey-based measures (which generally tend to report less than good health later in the life course). However, it objectively represents the 26 significant long-term conditions that principally impact HLE, represents entire populations rather than a sample, and uses routinely recorded, current data. It is also possible to associate this insight with health and care expenditure data and wider determinants data, to build up a comprehensive, population-level picture of healthy lifespan.

Some anonymised / illustrative examples from Outcomes Based Healthcare's work with local areas to measure population level Healthy Lifespan / HealthSpan using routinely collected, objective health and care data are shown in Appendix 1.

Appendix 1

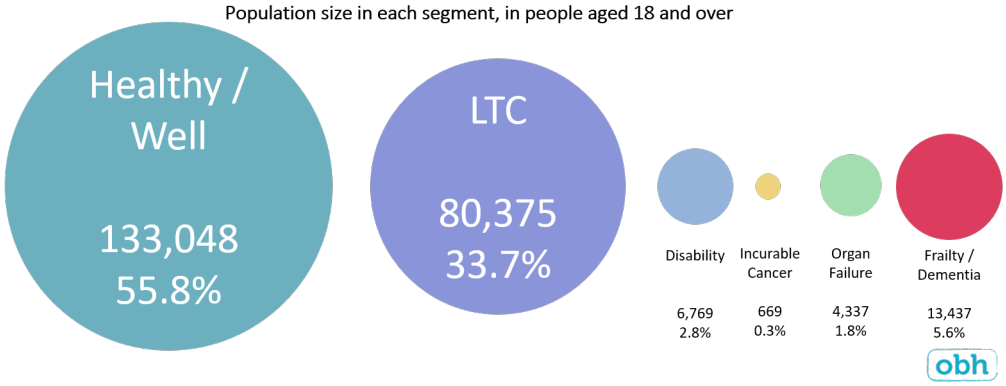
Local Examples of selected HealthSpan Insights:

Examples listed below represent relatively small, local authority borough-based population sizes (of approximately 250-300,000 people), but corresponding national work with central NHS bodies appear to be demonstrating broadly similar values to those set out in some of the examples below.

Step 1: Understanding the approximate proportion of the population who are currently Healthy / Well

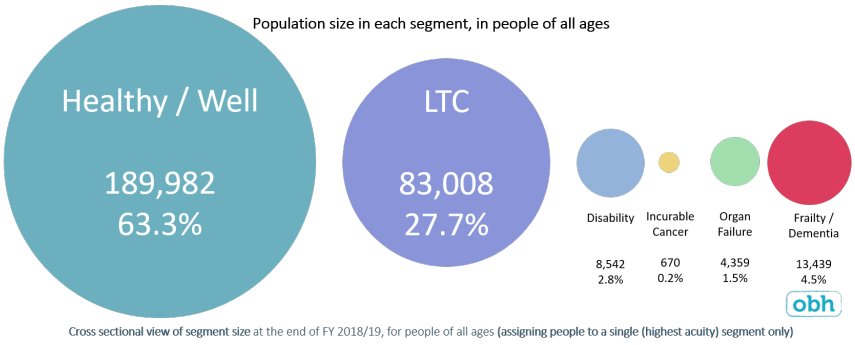
Figures 3 & 4: A typical population distribution between each of the segments identified above, standardised to a typical clinical commissioning group (CCG) / Local Authority area population of 300,000 people. This also depends on the precise input variables and configuration used (typical configuration set out in Appendix 2), as well as local disease prevalence.

People 18+:



Cross sectional view of segment size at the end of FY 2018/19, for people aged 18+ (assigning people to a single (highest acuity) segment only)

All ages:

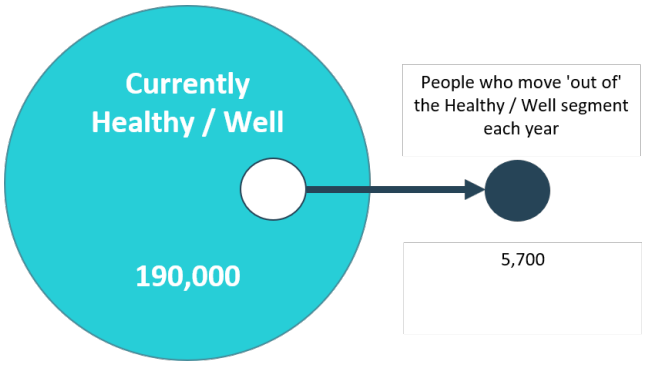


Cross sectional view of segment size at the end of FY 2018/19, for people of all ages (assigning people to a single (highest acuity) segment only)

Note: the Currently Healthy/Well segment is dependent upon the definition and precise local configuration of other segments. It includes people who may be likely to soon 'move into' another segment, including people with undiagnosed conditions, people with no diagnosed conditions but with known risk factors (e.g. smoking, obesity), as well as a small number of people with isolated rare conditions not included elsewhere in the segmentation model.

Step 2: Understanding how many people develop significant long-term conditions (LTC) which cause them to 'leave' the Healthy / Well segment with for the first time, in a given time period (e.g. each year)

Figure 5: Of the approximately 190,000 currently healthy / well people in the local example given above, approximately 3.0% (5,700 people) left the 'healthy / well' cohort in FY2018/19 (approximate range over last five years 3.0-3.6% per annum, or 5,700-6,800 people per annum). Average annual per person health expenditure typically increases significantly on leaving the healthy / well cohort (see Figure 11 for acute expenditure element). So, each of these movements are associated with significantly higher health and care expenditure, on average.

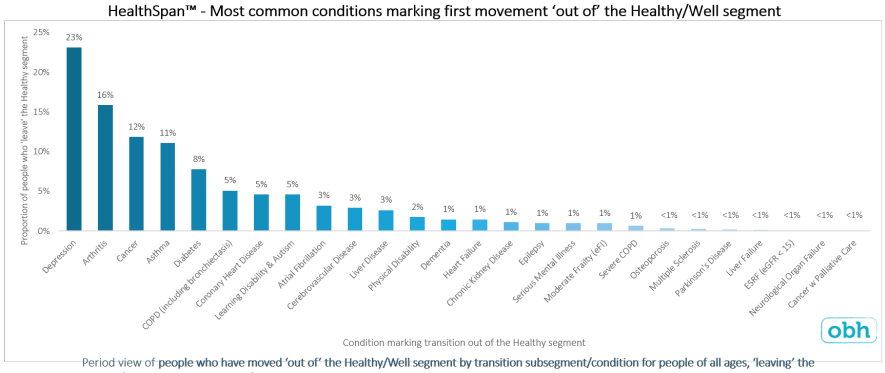


Step 3: Understanding the main conditions marking 'first movement' out of the Healthy/Well segment

Figures 6 & 7: Typical local examples of 'first condition' movements (potential "Gateway conditions" – see technical note below), out of the Healthy / Well segment (i.e., as opposed to overall condition incidence or prevalence). The resulting ranking is a combination of high incidence conditions, and younger / earlier ages of onset. Subsequent long-term health conditions are excluded from these figures, which only show the first significant condition experienced for each individual.

Example 1

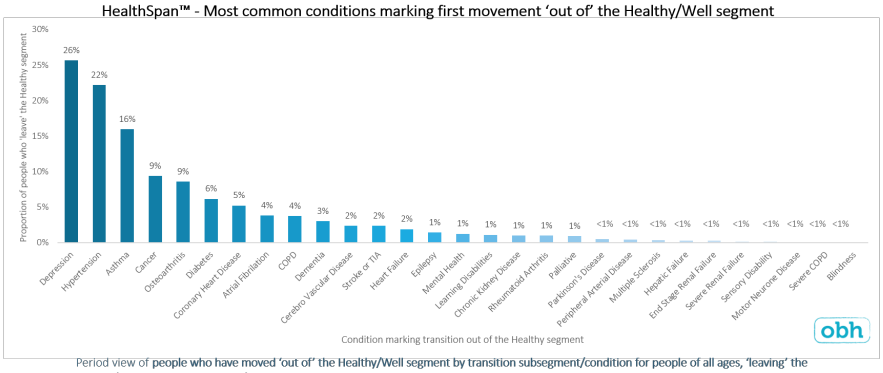
HealthSpan™ - Most common conditions marking first movement 'out of' the Healthy/Well segment



Period view of **people who have moved 'out of' the Healthy/Well segment by transition subsegment/condition for people of all ages, 'leaving' the Healthy/Well segment in FY 2018/19**. The high frequency conditions represent a combination of both high incidence and younger ages of onset.

Example 2

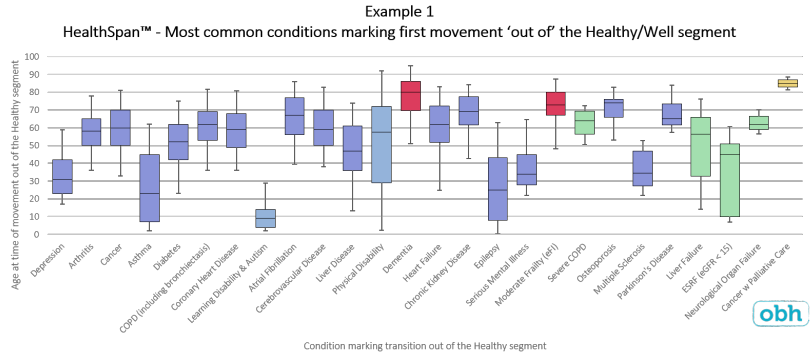
HealthSpan™ - Most common conditions marking first movement 'out of' the Healthy/Well segment



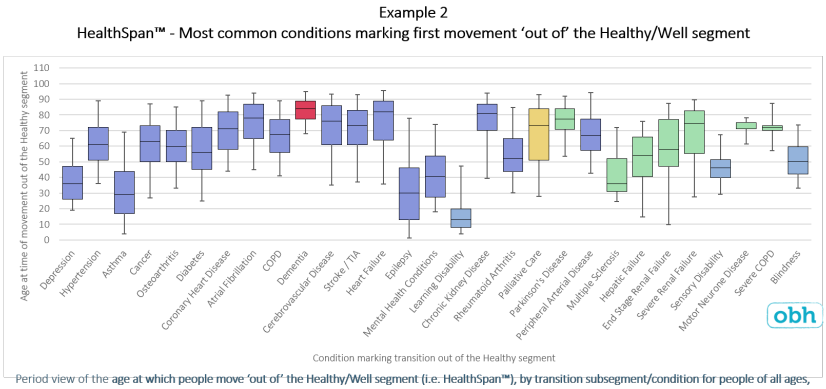
Period view of **people who have moved 'out of' the Healthy/Well segment by transition subsegment/condition for people of all ages, 'leaving' the Healthy/Well segment in FY 2015/16**. The high frequency conditions represent a combination of both high incidence and younger ages of onset.

Step 4: Understanding ages of onset of each of the main conditions marking 'first movement' out of the Healthy / Well segment

Figures 8 & 9: Range of ages of onset of each of the conditions listed in Figures 6 & 7, respectively. Some of the conditions listed are potentially modifiable (i.e., through prevention and / or delaying onset, or in some cases resolution and / or cure), while some conditions listed remain currently unmodifiable.



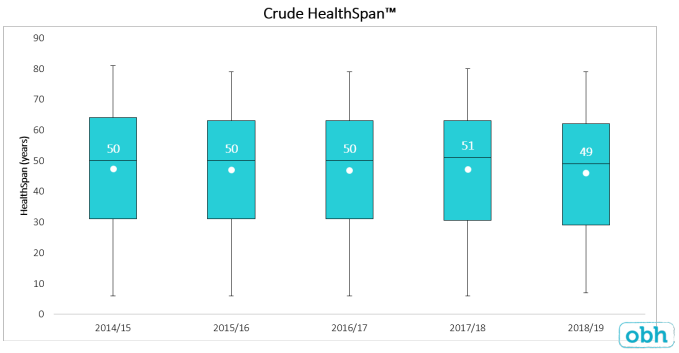
Period view of the **age at which people move 'out of' the Healthy/Well segment (i.e. HealthSpan™), by transition subsegment/condition for people of all ages, 'leaving' the Healthy/Well segment in FY 2018/19** (boxplots show median HealthSpan, interquartile range, and 5th and 95th percentiles). Subsegments/conditions ranked in order on previous image.



Period view of the **age at which people move 'out of' the Healthy/Well segment (i.e. HealthSpan™), by transition subsegment/condition for people of all ages, 'leaving' the Healthy/Well segment in FY 2015/16** (boxplots show median HealthSpan, interquartile range, and 5th and 95th percentiles). Subsegments/conditions ranked in order on previous image.

Step 5: Understanding the combined, longitudinal effect of the onset of the conditions listed above on HealthSpan / Healthy Lifespan

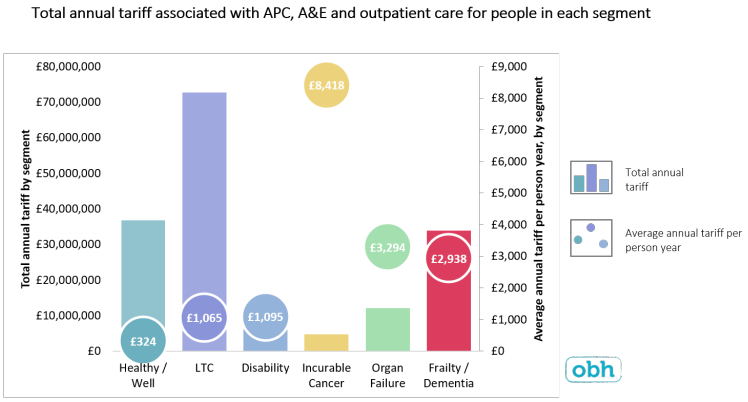
Figure 10: Demonstrates the aggregate effect of these 'first' conditions, in terms of median and mean HealthSpan / Healthy Lifespan for people moving out of the Healthy / Well segment, in a typical local example (male and female combined). Note that this objective / whole population measure of onset of significant morbidity is approximately 8-10 years earlier than the corresponding self-reported HLE / DFLE estimates.



Longitudinal period view of **crude HealthSpan™ for people of all ages, 'leaving' the Healthy/Well segment each year** (boxplots show median HealthSpan, interquartile range, and 5th and 95th percentiles, white dots show mean HealthSpan value)

Step 6: Understanding changes in segment / cohort-specific health and care expenditure with progression of significant morbidity

Figure 11: Shows a typical example of segment-specific annual acute expenditure FY 2018/19, spanning admitted patient care, A&E and outpatient care nationally, for all people registered with a GP practice in the relevant area. Note this view does not for example include wider expenditure on community, primary care or social care, for example, so these costs below will only be a subset of the 'true' wider health and care expenditure (depending on the precise definition of that). There are a range of secondary research sources for broader (but less easily quantified) health expenditures, also including community services, primary care, prescribing, social care (https://humanhealthspan.com/healthspan-calculator/).



Period view of **total and average (per person-year*) tariff for admissions in FY 2018/19 (for admitted patient care, A&E and outpatient care),** for people aged 18+ (assigning people to a single (highest acuity) segment only)
***Note**: this is an average annual tariff per person-year, rather than an average tariff per admission.

Step 7: Conclusions: bringing it all together to estimate the additional cost of each extra year lived in poor health, as opposed to being generally Healthy / Well

The step-wise combination of the segmentation approach, combined with condition-specific 'movements' data, and existing healthcare utilisation and expenditure data enables an understanding at a 'macro' level of the current expenditure associated with each health state / segment. Figure 11 represents an 'actual expenditure directly incurred' example of the acute element alone, given this is where expenditure is most significantly felt, and where potential savings are often most easily realised (or not incurred). So, this should broadly represent a minimum expenditure not-incurred from progression from a 'healthy / well' state, to other health states, if HLE +1 or +5 were successful.

There is a wide distribution of costs within the segment-specific averages presented above. However, in Outcomes Based Healthcare's work, typically average annual acute expenditure on people in the 'Healthy / Well' segment is in the region of approximately £300-400 per annum per person, and around £1,350-1,500 per annum per person for all other health states combined.

> *For the country as a whole, the cohort 'leaving' the Healthy / Well group each year could expect, on average, to incur additional acute healthcare costs alone in excess of £1 billion per annum, greater than they would have incurred if they had remained in the 'Healthy / Well' cohort for an additional year.*

Note that potential expenditure 'savings' can only be established relative to what would have happened without each extra 'healthy year' at population level, rather than in absolute terms. This analysis does not allow for any costs of intervention, or prevention to achieve each extra 'healthy year', which would need to be deducted from any potential relative expenditure 'savings' set out above.

Appendix 2

Significant long-term conditions included in the national HealthSpan™ pilot analysis::

- Asthma;
- Atrial fibrillation;
- Bronchiectasis;
- Cancer;
- Cerebrovascular disease (including stroke, transient ischaemic attack);
- Chronic kidney disease (including renal failure);
- Chronic liver disease (including liver failure);
- Chronic obstructive pulmonary disease (including respiratory failure);
- Coronary heart disease (including angina, myocardial infarction);
- Dementia;
- Depression;
- Diabetes;
- Epilepsy;
- Frailty;
- Heart Failure;
- Hypertension;
- Inflammatory bowel disease;
- Learning disability and / or autism;
- Neurological organ failure (including motor neurone disease, Parkinson's disease, multiple sclerosis);
- Osteoarthritis;
- Osteoporosis;
- Parkinson's disease;
- Physical disability;
- Peripheral vascular disease (including peripheral arterial disease);
- Rheumatoid arthritis;
- Serious mental illness.

Technical notes #1:

More people are being diagnosed with significant long-term conditions earlier in their lives, and living with them for longer than we had previously thought. In the case of women this amounts to up to 9.7 extra years (or up to 50% longer) in poor health, on average, than health and care systems have previously allowed for, based on self-reported data.

This is calculated based on the national 2016-18 ONS life expectancy and health state life expectancy figures, compared to national 2018 / 19 HealthSpan™ and Lifespan figures:

- *Life Expectancy for England in 2016-2018 was 83.2 years, and Healthy Life Expectancy was 63.9 years. This equates to 19.3 years spent in poor health, or 23.2% of total Life Expectancy;*
- *OBH Lifespan in 2018 / 19 was 84 years, and HealthSpan was 55 years. This equates to 29 years spent in poor health, or 34.5% of total Lifespan;*
- *The difference between the two (19.3 years compared to 29 years) is 9.7 years. HealthSpan indicates that 9.7 additional years are spent in poor health, or approximately 50% more than suggested by Healthy Life Expectancy figures.*

[5]*Hypertension is frequently classified as a potentially modifiable 'risk factor'. However, a number of significant national and international sources also classify hypertension as fulfilling the requirements to be regarded as a long-term, or chronic condition.*

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Key Paper H:
Business as a key stakeholder in health

John Godfrey - Corporate Affairs Director, Legal & General;
Tina Woods - CEO, Longevity International, APPG for Longevity Secretariat Director

Here we examine both some of the upside opportunities, and the downside risks, for business.

Their marketing expertise, understanding of consumer behaviour, distribution power – and role as employers, investors, innovators and buyers – equip businesses to be key stakeholders to achieve the goal of 5 extra years of healthy life expectancy (HLE+5) while minimising health inequalities. As with the challenge of addressing climate change, doing this well can deliver economic rewards, but failing to respond risks financial and reputational damage.

There are 5 main ways that business can have the most impact on living longer well:

1. Creating a healthy longevity industry

Globally, those aged 50 and over own nearly three-quarters of all financial assets, and spending by age 60+ adults will reach $15 trillion by 2020 (Irving et al., 2018). The 50+ market is the third largest market in the world by population, behind only the US and China, but its development is hampered by 'market failures' (click here to read the paper on *Longevity Market Failures - Summary of the APPG Business Boards*).

These include the erroneous public assumption that all healthy ageing products and services should be covered by the state, and a seeming inability or unwillingness to conduct the same level of market research and segmentation for older as for younger people, with consequently poor choice and quality of available options. Products and services for older consumers are too often badly designed for their markets and sold in ways which fall short of the rising expectations of consumers, especially the baby boomers. Available markets are therefore under-estimated and the cycle continues.

Businesses therefore need to be incentivised, 'nudged' and then rewarded in key areas where better product and service development is needed that will deliver our goal, including:

1. Creating healthy active places;
2. Designing age friendly homes;
3. Maintaining health at work;
4. Sustaining physical activity;
5. Supporting social connections;
6. Providing support for cognitive impairment;
7. Managing common complaints of ageing.

A greater focus on the built environment (public spaces, communities and individual homes) is essential. As part of this, we need a radical rethink of the way we fund and build new homes to broaden choice and, including for example, more specialist and 'all-age homes' suitable for multi-generational living and old age. New models of social housing are being pioneered for 'all-age housing' to drive inclusivity and age-related diversity across a community (click here to read the paper *Business Model Innovation in Social Housing* by Alistair Wickens).

The majority of current housing schemes by mainstream house builders, local authorities and registered providers are delivered on a planning and business model which encourages standardisation, leaving little room for innovation and incorporation of design features or technology. While there are new businesses starting to emerge that are combining the best design and technology to meet increased aspirations and needs, we need better models, enhanced incentives and supportive regulation to open up innovation and investment in new built environments and healthy communities, much in the same way as what has happened in other sectors, like healthtech.

UK-based innovative start-ups struggle to both experiment and scale due to risk-averse providers, planners and regulators, while larger providers also find more secure and better margins are earned for tried and tested models which do not take account of the ageing demographic. The UK therefore needs to create safe spaces which encourage innovators and entrepreneurs to take risks and build evidence of the case for novel solutions (click here to read the case study on *Technology as a tool to inform and connect older people* by Dr Louise McCabe). This requires work across multiple sectors incorporating private, public and third sectors to test models and share the evidence and data created.

While change is needed to promote HLE+5 in new housing, this only addresses the 'flow' issue: to improve and retro-fit 'stock' of existing housing is equally important, both to improve HLE and to address climate impacts from housing.

Beyond the built environment, more funding is required to support the scaling of ageing-focused ventures, to grow from early-stage to 'investment ready' ventures of sufficient scale and maturity to be operationally sound, commercially viable and proven to achieve impact. While the Ageing Society Grand Challenge will be able to pump-prime this sector, and some industries including the tech sector is beginning to see applications among older groups (e.g. in voice activation), research by the Centre for Ageing Better and Big Society Capital demonstrated that investment at the early growth and scale-up stage is challenging (click here to read the paper *Investing for Social Impact* by Stephen Muers).

Achieving scale is a particular challenge for products and services that aim to achieve significant social as well as economic impact. Despite the Social Value Act, positive social outcomes lack commonly agreed metrics and are not recognised in the prices paid for goods and services, particularly in statutory commissioning. The prevailing venture capital business model also relies on supporting companies with the potential to achieve very large scale very quickly. The answer may in part be specialist funds with a commercial rationale focused on supporting ageing innovations to achieve scale over a longer term. Such funds will require investors willing to take a longer perspective and to value positive social outcomes rather than only focusing on rapid VC-style returns.

The Government could also consider an environment where tax credits and other targeted concessions can support institutional investment. Government funding to support initiatives outside the traditional local authority and third sector pathways should also be considered, to release capital for innovation whether technological, educational, social, or built. A framework allowing Pension Funds to invest directly into innovation should also be developed.

2. Aligning with responsible investment

Consumers and employees increasingly want to deal with businesses which are socially responsible. Investors likewise increasingly consider Environmental, Social and Governance (ESG) factors in portfolio selection and capital allocation, and Regulators are also taking a more active role (click here to read the paper *The Rise of EGS and Responsible Investing* by Hiral Patel). As investors drive business model change both as part of risk management and capital allocation models, there are clear implications for the HLE+5 agenda.

According to the Global Sustainable Investment Alliance, sustainable investing assets in the five major markets (Europe, US, Japan, Canada and Australia / New Zealand) stood at $31tn at the start of 2018, a +34% increase in two years (2018 Global Sustainable Investment Review, 2018).

Based on the ESG mandates today, topics of particular interest include: climate change and board composition/governance and employee diversity, manifested for example through mandatory Gender Pay Gap reporting. Demographic issues, including the impact of ageing, are now beginning to join this list of concerns. Moreover, ESG investors increasingly seek alignment with the UN Sustainable Development Goals, which include population health imperatives.

In the parallel case of climate change, the reasons to shift practices (apart from being 'the right thing to do') are basically threefold:

1. As regulation, policy and consumer attitudes change, business models may become obsolete, leaving investors with worthless 'stranded assets' (e.g. coal mines);

2. Conversely, aspects of climate transition now make clear economic sense. For example, clean renewable energies like offshore wind can also be cheap, which makes it investable on its own terms;

3. Emergent technologies like hydrogen and nuclear fusion can offer big potential upside gains.

There are some direct links between the climate agenda and healthy living solutions (active travel, less car use, more green spaces, better nutrition, better air quality) and Healthy Life Expectancy fits well with the principles of sustainable investment.

The parallels are even more striking, though. Just as addressing climate creates technical and scientific progress and investment opportunities, so investing in healthy life expectancy will also create further potential opportunities to 'unlock the silver pound' and access a growing consumer base with disposable income. These investment opportunities will not just be in obvious areas like cruises or healthcare, but also in food (e.g. supermarkets, supplements), leisure (e.g. restaurants, hotels, gyms) and retail (e.g. well-designed, 'desirable' products for the consumer). There are also significant developments in science to extend healthy life expectancy with high commercial potential (see Key Paper by Lynne Cox).

3. Accelerating data-driven innovation

The government's Industrial Strategy Grand Challenges programme aims to harness Britain's unique strengths, including in AI, life sciences, genomics, fintech, agetech and healthtech. Data is a cross-cutting theme which applies as much to health and later living as to climate change and the built environment. However, far more can be done to harness data-driven innovation in the development of a healthy longevity marketplace.

We can take lessons from Open Banking (a collaborative model in which banking data is shared between unaffiliated parties to deliver enhanced capabilities to the marketplace), which has stimulated the fintech ecosystem. Healthtech is more complex than fintech but is still amenable to open innovation and the significant opportunities to harness datasets across the life course to develop new products and services. An open data approach will maximise federated open market innovation, competition and efficiency. Taking a user-centric design approach and ensuring common interoperability will drive up rates of adoption and inclusion, while reducing friction and confusion for the end customer. Given the pace of change, now is

the time to create foundational principles, practice and regulation to experiment and develop products and services that will deliver our goal for five extra years of healthy life expectancy while minimising health inequalities. Click here to read the paper *Taking Open Banking to Open Life* by Gavin Starks.

An open innovation framework will provide a way for innovators to experiment with different ethical data models and stimulate social and business model innovation to develop and scale market-led solutions specifically geared to deliver HLE+5 while minimising health inequalities. Place-based innovation hubs could be supported to facilitate discussion between major public buyers, NHS, public health, social enterprises, civic & community leaders, and with customer-facing businesses, on how to keep us healthier and how to help us live longer better. Local innovation initiatives could also support lifelong learning and multi-generational enterprise, bringing older and younger entrepreneurs together, supporting employment, providing purpose, and harnessing the right combination of skills and life experience. 'Knowledge for equity' could be a currency to trade.

An evaluation methodology capturing 'what works' against key performance metrics tied in with healthy life expectancy (e.g. increased social engagement and reduction in frailty, falls and social isolation) would drive further cycles of investment and experimentation. A centralised co-ordination body would facilitate the adoption of meaningful output from the projects.

One data model that could be tested, for example, is a network of civic data cooperatives (click here to read the paper *National Grid of Civic Data Cooperatives for Health* by Iain Buchan), that allows value-chains of care to self-organise around a person's digital-self (Future Care Capital, 2017). The UK's civic systems already share the relevant data to a greater or lesser extent and are well-placed to involve their communities in creating a network of civic data co-operatives for open healthtech innovation while addressing public concerns over private sector data monopolies (Future Care Capital, 2019).

The model for data cooperatives is different than the Hub and Spoke model currently adopted by Health Data Research Hubs of Health Data Research UK (HDR UK) – which presently are focused on treatment of disease, clinical trials and real-world evidence – but learnings can be shared across both models.

4. Business as healthy employers

Employers must help people keep in work in their 50s by adopting age-diverse practices (and challenging ageism at work), ensuring people can refresh their skills and provide the in-work health support to keep in work. This will increase our labour supply, raise our economic activity rate and be good for individuals, our economy and public finances. The ONS estimates that if the employment rate of people aged 50 to 64 matched that of those aged 35 to 49, it would add more than 5% to UK GDP, or £88 billion (Storey et al., 2018).

Lifelong learning and re-skilling will be essential to the future of an ageing workforce. Benefits to lifelong learning include fuller working lives, with positive outcomes for individuals, the economy and wider society (many of which are non-financial, including improved life satisfaction, mental stimulation and well-being). In order for the benefits of lifelong learning to be fully realised, however, the government and employers need to address the current barriers to later life learning.

Reskilling and upskilling will be increasingly important, especially with the rise in workplace automation and flexible working. Employers need to consider workplace design and their current working practices, in addition to considering the means by which lifelong learning will be delivered (Barclays, 2019).

Business can also play a major role in helping to reduce demand on the NHS & Social Care system. The 'care gap' (gap between what people need and what is being provided), is growing and in the last 4 years alone has grown by 60%. The UK now has 1.4 million people whose care needs are not adequately addressed (Age UK, 2019). Business can help to close this gap by helping people keep healthy and in work, but also by supporting the growing numbers of middle-aged people balancing caring for elderly relatives with their work responsibilities. While solutions to keep people healthy and independent for longer will achieve big savings for the state through compressing morbidity and reducing acute care needs, the balance of informal care will change too, as more will be expected from families and partners as a result of heightened informal care requirements.

Larger businesses and organisations are now required to report on gender and diversity aspects of their employment practice; this is an input for ESG investment, and there is a good case to extend this to incorporate age-related diversity. It should be noted that the majority of the UK's workforce is employed by Small and Medium Enterprises (SMEs), which may be less well-equipped to respond to additional reporting requirements.

Most businesses form part of a supply chain trading with other businesses. At the top of the supply chain, larger businesses acting as healthy buyers could have significant potential to support health including as purchasers of goods and services who support and drive higher standards and best practice through purchasing and investment decisions. This is the case already with modern slavery issues, though for HLE+5 and age-related diversity, an index or kitemarking system could be developed to show how well a business is contributing to the health of the nation, and become a source of competitive advantage for participating businesses in exchange.

5. Business as a champion for living longer well

Customers, investors and broader society increasingly expect business to be part of the solution for better health, not the problem. Business leaders need to both advocate and provide solutions to avoid criticism for the harm that some products and behaviours cause to health. They could form a coalition to promote healthier behaviours through their products, services, marketing and practices.

As a starting point they should agree the key questions and then focus on the four giants of smoking, excess drinking, harmful diets and physical inactivity. The dialogue should clarify how business can support the following:

- Reducing smoking further, especially in poor neighbourhoods;
- Reducing harmful drinking or shifting to less harmful forms;
- Making homes safe from falls and hypothermia as we reduce carbon emissions;
- Helping us shift to healthier diets;
- Engraining physical activity in all our habits from youth to older age.

Where business does not adapt to help change consumption patterns, government should stand ready to use the "sticks and carrots" of regulation and taxation. This has long been uncontested for smoking, and disappointing tax receipts from sugar levies in many jurisdictions suggest soft-drink manufacturers can adapt recipes without long-term damage to profit.

The great merit of business is the ability to adapt, and the best businesses are getting ahead of the HLE+5 agenda. There is good evidence that the potential gains for business are considerable. Recent research from Nielsen shows the tenfold growth in the non-and low-alcohol drinks market, now worth almost £100m, since 2009. Food producers and retailers, including notably, Greggs, are leaning into the growing agenda for healthier eating and reduced

meat consumption. Similarly, research from RAND Europe and Vitality shows the significant economic benefits that could be realised through very modest increases in physical activity – an extra 15 minutes of walking every day could potentially add $100 billion to the global economy every year, with 2.5 extra years of life and 5 more productive days a year in work. Incentivising activity could be a significant opportunity for gyms and the leisure industry. Business can step up to the HLE+5 challenge – and those that do so will be winners.

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Key Paper I:
The Economic and Scientific Case for Therapeutic Intervention in Ageing

Lynne S Cox - Department of Biochemistry and Oriel College, University of Oxford

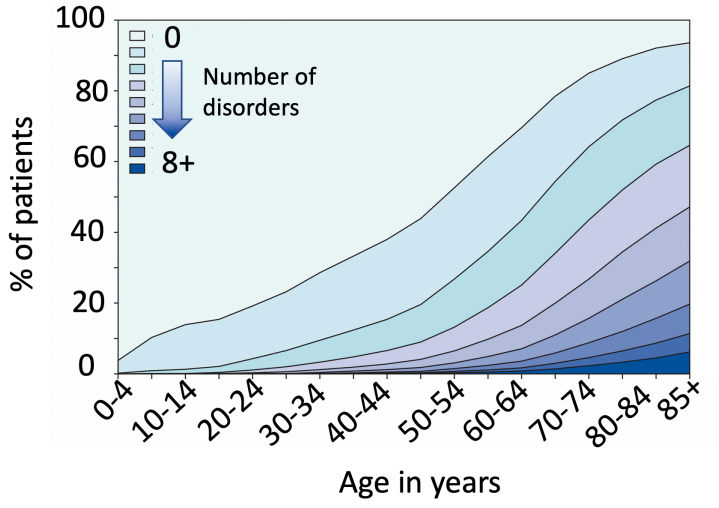
Summary

- Ageing leads to age-related disease and frailty
- Costs of health care for older people are 7-8 times higher than for younger people
- Improving healthy life expectancy provides a large net financial gain: increased workforce, increased productivity, increased spending power, decreased cost of care (including hidden costs of unpaid care) and social good
- Ageing and age-related diseases are malleable
- New advances in the science of the biology of ageing have identified interventions to prevent, delay or even reverse age-related diseases; early stage human clinical trials report health benefits

What is Ageing? (a biological definition)

Ageing can be defined in biological terms as the gradual loss of physiological function with increasing chronological age, until death; it is observed in all mammals and is a process with underlying biological drivers – it is not a social construct, though socioeconomic factors can exacerbate or ameliorate the severity of age-related decline. Ageing impacts on every cell type, tissue and organ in the human body, resulting in multiple diseases. Such diseases cluster, suggesting common patterns of causation, and resulting in many older people suffering multiple age-related diseases at the same time-termed multimorbidity[1](Figure 1).

Figure 1:
Multimorbidity increases with age. Increasing chronological age is associated with greatly increased incidence of multiple different age-related diseases in the same individual. (Figure from The Lancet (2012) 380, 37-43) – such diseases cluster into groups e.g. diabetes, cardiovascular disease and dementia often occur together in the same patient.



The Current Cost of Ageing

Age-related diseases account for a major proportion of total health care costs in the UK; health spending on those aged over 85 years is >8 times greater than for a person of 20-30 years[2]. On average, British men spend the last 16 years of life in poor health (a period of morbidity), with women suffering an even longer morbid period of up to 21 years[3]. The gap between life expectancy (LE) and healthy life expectancy (HLE) widens with increasing socioeconomic deprivation. This is dealt with in more detail elsewhere in this Strategy document.

Escalating Costs of 'Doing Nothing'

Healthcare costs increase in concert with:

- **The numbers of people requiring treatment:** Demographic changes mean the treatment population is rapidly rising; moreover, the obesity epidemic is driving diabetes[4] and premature ageing in a large proportion of the population.
- **The extent and type of illness being treated:** With ageing comes multimorbidity and increased complexity of treating these multiple diseases, with risk of polypharmacy and adverse drug reactions/events (currently estimated at £98.5 million pa[5]).
- **The underlying cost of treatment:** Technological and pharmacological advances provide ever more sophisticated but also costly interventions; people are surviving previously fatal conditions and living longer with chronic disease[2].

The goal of any strategy aimed at improving national wellbeing (and coincidentally reducing health care costs) must therefore be the improvement of healthy life expectancy across the population, including in those approaching or already at old age.

Healthy Life Expectancy can be Increased

The increased burden of illness, disability and frailty associated with long lifespan is not inevitable, as seen in the greatly decreased morbid period in older people in Sweden compared with the UK (Figure 2), following the Swedish implementation of wide-reaching interventions to reduce socioeconomic inequalities and improve population health.

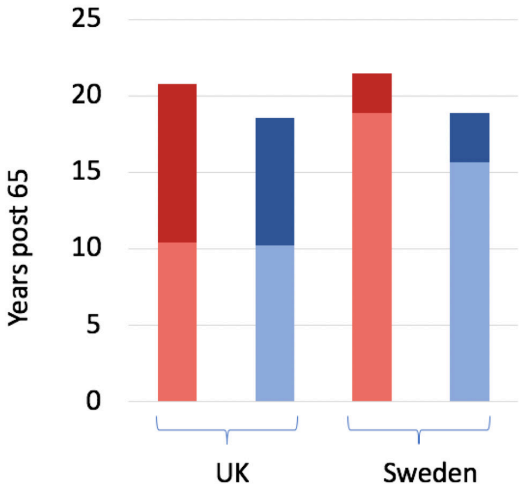


Figure 2:
Decreases in human age-related morbidity are possible. Additional years of life after the age of 65 spent in good health (lighter bars) versus ill health (darker bars) for men (blue) and women (red) in the UK and Sweden. Data for year 2015 from[6]).

[1] *https://bmcgeriatr.biomedcentral.com/articles/10.1186/s12877-018-0705-7*

[2] *https://obr.uk/docs/dlm_uploads/Health-FSAP.pdf*

[3] *https://www.kingsfund.org.uk/publications/whats-happening-life-expectancy-uk; https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/bulletins/healthstatelifeexpectanciesuk/2015to2017*

[4] *https://www.nhs.uk/news/obesity/latest-obesity-stats-for-england-are-alarming/*

[5] *http://www.eepru.org.uk/wp-content/uploads/2018/02/eepru-report-medication-error-feb-2018.pdf*

[6] *https://ec.europa.eu/eurostat/databrowser/view/tepsr_sp320/default/table?lang=en*

While such interventions provide marked improvement in health in older people, there is still a high incidence of disease in the oldest members of the population, who therefore require an alternative approach for improving health and quality of life, as well as minimising costs of disease treatment. Different interventions need to be adopted for different age groups within the UK population in order to achieve additional years in good health for all (Figure 3).

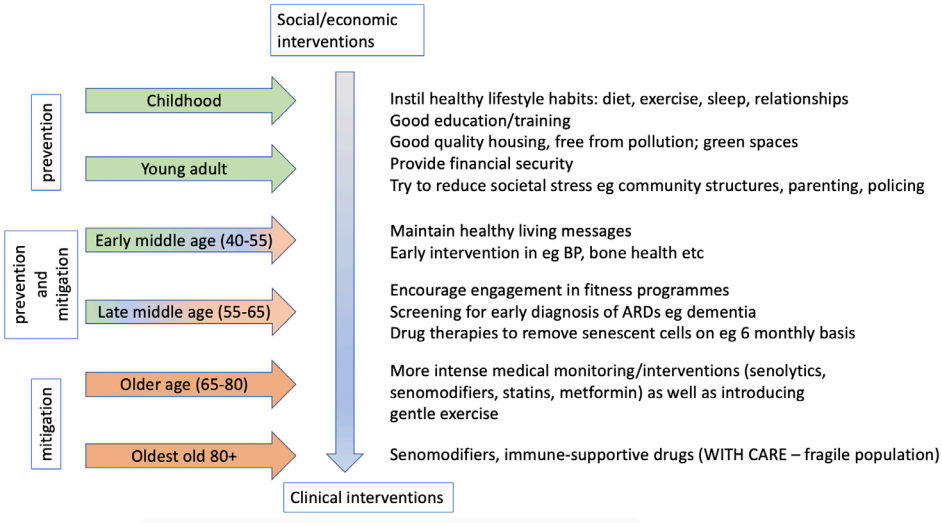


Figure 3: Different interventions to improve health are required at different stages of the lifecourse. Socioeconomic interventions are required early in life, with the aim of preventing disease. In middle age, this shifts to a combination of public health and clinical approaches including screening for early signs of age-related diseases to permit early intervention. Intermittent use of emerging therapeutics that can prevent the onset of age-related disease through removal of harmful senescent cells should be beneficial for those in late middle age, while more intense drug treatments to mitigate the effects of age-related disease are required for those already in the older age categories.

Other Key Papers in this strategy document address socioeconomic, public health, behavioural, business and technological interventions; here we present scientific evidence demonstrating that it is possible to improve health even in later life through clinical interventions, underpinned by rigorous scientific research. We then outline a series of approaches needed to place the UK at the forefront in advances in prevention and early treatment of age-related diseases.

Increasing Healthy Life Expectancy is Highly Cost-Effective

Modelling of costs of improving healthy life expectancy versus benefits of a healthier older population is complex[7]. However, economic modelling commissioned by the American Federation for Ageing Research (AFAR) in association with the Glenn Foundation of Medical Research (based on the US population), demonstrates that the predicted $3 trillion cost is far outweighed by a $7.1 trillion benefit (Figure 4): by comparison, delaying cancer resulted in no net benefit (in terms of cost)[8], and adding only 1m to the projected baseline of 75.5m able-bodied people in the US aged over 65, while improving healthspan increases the active able-bodied population to 87.2m – an increase above baseline of 11.7m people.

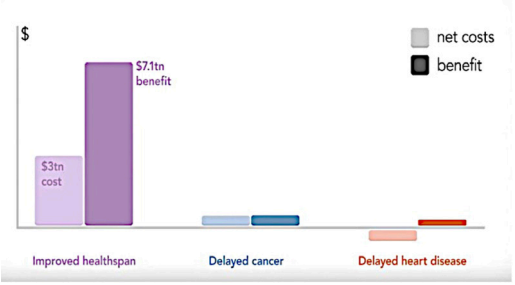


Figure 4:
Cost benefits analysis of intervening in ageing (USA data). Improving healthspan i.e. lifespan free of serious ill-health (purple) is compared with scenarios of delaying all cancers (blue) or delaying heart disease (red). Cost is shown in pale shading, benefit in darker shading. Data and figure from AFAR[9].

[7] *https://onlinelibrary.wiley.com/doi/full/10.1002/hec.1599*
[8] *https://www.youtube.com/watch?v=X-qlo9eVd3c*
[9] *https://www.youtube.com/watch?v=X-qlo9eVd3*

Prevention is usually far cheaper than treatment – a recent Merseyside measles outbreak cost £4.4 million for 2,458 reported cases, while complete immunisation would have come in at only 4% of that figure (£182k) . Similarly, in adults, disease prevention strategies such as use of PrEP to prevent HIV infection have been shown to be cost effective: for a PrEP treatment population of 400,000 over 15 years, savings of £1 billion are projected with 40,000 discounted Quality Adjusted Life Years (QUALYs) gained over an 80-year period (lifetime)[11].

Such examples are useful in that they show the huge savings of taking preventative measures to avoid disease onset. Strategies that prevent the onset of age-related diseases are therefore also likely to prove highly cost-effective. However, it is also critically important to remember that a large cohort of the population already suffer from age-related diseases, for whom new treatments that actually address core underlying causes - rather than simply providing symptomatic relief - are urgently required. The distinction between 'prevention' and 'mitigation' is also somewhat artificial and misleading: early intervention can mitigate early disease processes before symptoms develop, so it looks like prevention: senolytic drugs (see below) may be preventative in middle age but curative in older age; vaccination is preventative, but in older people it is necessary to boost immune response to vaccination using senescence-modifying drugs, hence a combination of mitigation and prevention is required.

How Can We Increase Healthy Life Expectancy Though Scientific Interventions?

Since ageing is a biological process, with age-related disease a consequence of that process, it should be possible to treat or even prevent age-related disease by modifying the underlying biological causes of ageing. There is strong scientific evidence to support the idea that age-related diseases arise from a small number of factors, including: physical and psychosocial stress (arising e.g. from age, poverty, pollution, smoking, and/or trauma) leading to cell senescence and stem cell exhaustion; inflammation; immune system malfunction; and extra-cellular effects on structural components of the body (especially those driven by high blood sugar).

Removing Senescent Cells Improves Health

Scientific research on the biology of human ageing has identified changes to cells (building blocks of our bodies) that result in altered behaviour and a state known as **cell senescence**; senescent cells change shape and lose their normal function; they no longer participate in repair after damage, but instead send out inflammatory signals and secrete enzymes that damage the surrounding tissues. In much the same way that cancer cells are simply the body's normal cells that have undergone a deleterious change, so it is with senescent cells – stress or damage results in normal body cells becoming senescent and deleterious to the body. Implanting senescent cells into young mice results in early onset of a range of age-related diseases, showing that senescent cells are causative in multiple morbidities of ageing. Notably, obesity, which is of epidemic proportions in the west and driving early onset of a number of age-related diseases, mechanistically induces cell senescence and leads to depression, a serious health condition seen in many older people. Senescent cells in the body can drive other cells into senescence – either through local or systemic communication – an aspect that is likely to be amenable to therapeutic intervention. In particular, suppression of the pro-inflammatory and tissue-degrading senescence-associated secretory phenotype (SASP) has great health-promoting potential[15].

[10] *https://www.ncbi.nlm.nih.gov/pubmed/26944712*

[11] *https://www.thelancet.com/action/showPdf?pii=S1473-3099%2817%2930540-6*

[12] *https://www.ncbi.nlm.nih.gov/pubmed/29988130*

Importantly, multiple preclinical studies in mice have demonstrated that removal of senescent cells using agents termed 'senolytics' can greatly improve health even in later life [16](and see Figure 5). The beneficial effects of senescent cell removal can be seen in the heart, muscles, bone (including arthritic joints), fat, liver, kidney and even the brain, with animals showing improved cognitive performance and 'younger' behavioural traits such as inquisitiveness and exploration. It is the removal of senescent cells, rather than the particular drug or combination that is used, that has overall benefit, clearly showing that the senescent cells themselves are the key therapeutic target. Lifespan is also extended as a consequence of better health (Figure 5C). Notably, removal of senescent cells has been reported to prevent onset of and even boost efficacy of therapies against cancer[17].

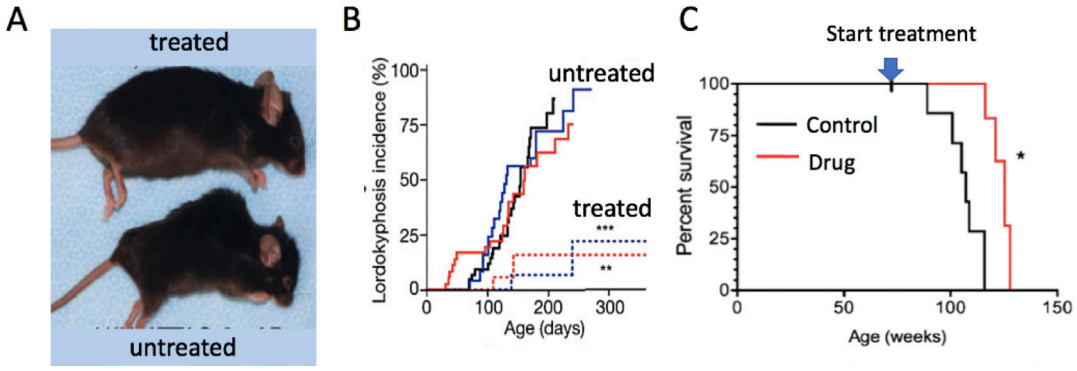


Figure 5: Senescent cells cause age-related diseases; removal improves health and increases lifespan. (A) Senescent cells accumulate with age; untreated ageing mice suffer many age-related diseases including kyphosis, seen as 'hunchback'; treated littermates are protected from kyphosis. (B) Incidence of kyphosis over time in male (blue) and female (red) treated and untreated mice. Intermittent removal of senescent cells in ageing mice using senolytic treatment prevents onset of serious diseases such as osteoporosis and bone fracture. (Data in A, B from Baker et al 2011 Nature 479(7372):232-6). (C) Senolytic drug treatment (fisetin) increases mouse lifespan even when started late in life, with accompanying improvements in health. (Data from Yousefzadeh et al 2018 EBioMedicine. 36:18-28. doi: 10.1016/j.ebiom.2018.09.015.)

Based on positive outcomes in these preclinical studies, senolytic therapies have now been taken into human clinical trials, with promising results reported for idiopathic lung fibrosis and diabetic kidney disease[18] (ClinicalTrials.gov Identifier NCT02874989; NCT02848131); trials are also ongoing in osteoarthritis of the knee (NCT03513016), and are planned for age-related macular degeneration, diabetic retinopathy, and even Alzheimer's disease (NCT04063124).

Other Promising Therapeutics

While senolytic drugs have shown great efficacy in preclinical models, with some promise in very small scale clinical trials[18], they may not provide a complete solution to addressing the diseases of ageing. In some instances, it may be deleterious to kill senescent cells entirely – particularly as it is not yet known what the senescent cell burden is in any individual or tissue, as the field still lacks reliable and robust senescence biomarkers. Hence senescence-specific biomarker development should be a major research priority.

[13] *https://www.ncbi.nlm.nih.gov/pubmed/30612898*

[14] *https://www.ncbi.nlm.nih.gov/pubmed/30462359*

[15] *https://link.springer.com/article/10.1007%2Fs10522-015-9610-z*

[16] *https://www.ncbi.nlm.nih.gov/pubmed/22048312; https://www.ncbi.nlm.nih.gov/pubmed/26840489; https://www.ncbi.nlm.nih.gov/pubmed/28340339; https://www.ncbi.nlm.nih.gov/pubmed/30936558*

[17] *https://www.ncbi.nlm.nih.gov/pubmed/30737084*

[18] *https://www.thelancet.com/article/S2352-3964(18)30629-7/fulltext; https://www.thelancet.com/journals/ebiom/article/PIIS2352-3964(19)30591-2/fulltext*

mTOR Inhibitors

A key molecular target that has attracted much attention and significant pharma investment is a regulatory enzyme complex called mTOR. This can be inhibited using the drug rapamycin (a macrolide antibiotic). In cancer, mTOR is often overactive; in senescence, mTOR is also found to be hyperactivated[19]. Rapamycin-mediated inhibition of mTOR (and potentially other as yet uncharacterised targets) leads to increased lifespan and improved health in a number of organisms ranging from nematode worms, through to mice[20], including better cognitive performance and lower amyloid levels in a mouse model of Alzheimer's disease[21]. Based on a small early stage trial showing cardiovascular benefit of rapamycin treatment in ageing dogs[22], a large-scale trial has just begun[23]; dogs share the same living environment and behavioural patterns of their owners, making this particularly interesting as a pre-clinical ageing study. We review the use of rapamycin and other mTOR inhibitors in the treatment of age-related disease elsewhere[24].

Contrary to historical medical opinion (based on high dosing in kidney transplant patients), mTOR inhibitors also support the ageing immune system. A further mTOR inhibitor, RTB101, (currently in clinical trials for Parkinson's disease) showed great promise in enhancing the immune response of older adults to influenza vaccination , findings which were recapitulated and extended in phase 2 clinical trials of vulnerable elderly adults including those with COPD and asthma, reducing incidence and severity of respiratory infections . However, phase 3 trials did not meet primary endpoint – whether this is an issue with trial design rather than the drug per se is still a matter of investigation.

Though much earlier in development, we have generated data suggesting that low level blockade of mTOR through an alternative mechanism to that of rapamycin (i.e. using an ATP-mimetic drug) not only delays the onset of human cell senescence but also suppresses key phenotypes, including high levels of damaging reactive oxygen species and the pro-inflammatory senescence-associated secretory phenotype (SASP) . Other similar drug modalities, particularly those with SASP-suppressing activity, are also being tested.

Metformin

A widely accepted and prescribed anti-diabetic drug, metformin is about to be tested for its ability to delay the onset of age-related diseases, potentially with compression of morbidity (decreased time in ill-health). This is based on many years of clinical data showing that diabetic patients taking metformin had better health outcomes not only compared with other diabetics but also with otherwise healthy people not on metformin[28]. The 'Treating ageing with metformin' (TAME) trial is ground-breaking in that it has gained FDA approval for a mixed endpoint of ageing i.e. delayed progression to any one of a number of age-related diseases[29].

[19] *https://www.nature.com/articles/s41580-019-0199-y?platform=oscar&draft=collection*

[20] *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2786175/*

[21] *https://translationalneurodegeneration.biomedcentral.com/articles/10.1186/s40035-018-0133-9; https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0009979*

[22] *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5411365/*

[23] *http://dogagingproject.com*

[24] *https://www.ncbi.nlm.nih.gov/pubmed/30096787*

[25] *https://stm.sciencemag.org/content/10/449/eaaq1564*

[26] *https://ir.restorbio.com/static-files/328a7bb4-1c5a-4c35-a8d5-7c1ea6ce995f (see especially slide 22)*

[27] *https://www.ncbi.nlm.nih.gov/pubmed/26851731*

[28] *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5943638/*

[29] *https://www.fightaging.org/archives/2019/09/tame-trial-for-the-effects-of-metformin-in-humans-to-proceed-this-year/*

[30] *https://www.ncbi.nlm.nih.gov/pubmed/30669119*

In combination with human growth hormone and a further antidiabetic DHEA, metformin appeared to 'turn back' ageing (measured using the GrimAge methylation clock[30]) in a small number of middle-aged men[31], showing that it is possible not only to delay age-related diseases but potentially to improve health outcomes.

Additional Research Approaches to Developing New Therapies

It is still early days in the field of biogerontology in terms of fully understanding underlying drivers of cell and organismal ageing, and thence designing effective rational new therapies for age-related diseases. A number of approaches deserve attention. These include:

- Reversing rigid crosslinks that reduce tissue elasticity (e.g. in blood vessel walls) [32]; such changes often arise from non-enzymatic glycation in the presence of high blood sugar, generating age-associated advanced glycation end products (AGEs); AGE signalling exacerbates senescence and inflammation hence is a target for new therapeutics[33]. Farnesyl transferase inhibitors may also improve aged blood vessel health[34].

- Gene therapy to replace factors that deplete on 'normal' ageing (caution is urged with telomerase reactivation[35]).

- Metabolic modification, particularly through NAD+ supplementation[36].

- Stem cell therapies to aid tissue regeneration, either by reactivating endogenous stem cells or adding in exogenous lab-grown cells[37], or by ex vivo tissue engineering to generate 'replacement parts'.[37]

- Strategies to increase autophagy – either through dietary modification (e.g. 5+2, fast mimicking diets[38]) or via drug interventions; this is supported by a large body of evidence showing that caloric restriction in mice and rhesus monkeys greatly extends health span[39]. (Notably both mTOR inhibitors and metformin – two of the most promising anti-ageing drugs - impact on nutrient sensing) [40]

- Alternative therapies for dementia e.g. examining antiviral drugs[41], as well as gingipain inhibitors[42] in diseased brains may be symptomatic rather than a cause, and multiple different drivers may result in the same overall gross morphological and functional changes currently considered one disease entity – Alzheimer's. In the way that cancer research showed clearly that there is no one disease called cancer, dementia research is likely to highlight multiple different modes of dementia requiring different treatment regimens. This also suggests that prevention of dementia may be possible – a much sought-after goal, and one that would have far-reaching economic and wellbeing consequences.

- AI-driven drug design: using adversarial neural networks to design novel drugs and 'test' them in silico[43] should vastly shorten the time from biological target discovery through to drug development.

- Tech and AI: Improvements in technology have led to major advances in health care, providing the ability to treat previously untreatable conditions, allowing earlier intervention before disease states become critical (e.g. imaging-enhanced stenting for CVD), with the effect of increasing lifespan. Recovery of physiological function after strokes may require advanced electronics (e.g. brain implants, new materials with sensory properties for prosthetics etc). The promise of AI and new technologies in ameliorating age-related ill health are covered in more detail in other Key Papers within this strategy document.

[31] *https://www.nature.com/articles/d41586-019-02638-w*

[32] *https://www.revelpharmaceuticals.com/news/glucosepane-crosslink-breaker-graduates-from-top-yale-lab*

[33] *https://onlinelibrary.wiley.com/doi/full/10.1111/acel.12850*

[34] *https://www.ncbi.nlm.nih.gov/pubmed/20458013; https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0196232*

Why Now is the Time for Change

Cost-benefit analyses show that we cannot afford not to do something now:

- An ageing population in poor health is costly, while a productive healthy older population brings an economic dividend; as both the proportion and number of older people (65+) in the UK population increases, we need to act now to find effective measures to prevent and treat age-related diseases.
- New scientific advances, now including human clinical trial data, show that it is possible to intervene to alleviate age-related disease by treating the underlying cause, and hence to improve health in later life.
- There is a serious opportunity cost if we do not act now - the UK risks being left behind by more agile competitors developing novel anti-ageing therapeutics
- The UK is now positioned to develop new regulatory and funding frameworks in academia, pharma, biotech and AI, that could expedite creative research and development of new anti-ageing treatments; this will feed into building a strong post-Brexit economy as well as encouraging inward investment into the Life Sciences industries in the UK.

Strategic Approaches To Improving Healthy Life Expectancy in the UK

Below, I suggest four key points to achieve the goal of improved healthy life expectancy; these approaches are consistent with the current Life Sciences Industrial strategy, climate change urgency, and provide strong opportunities for economic growth and investment. I term these points 'the 4 As' (see also):

Awareness:

It is essential to overcome lack of awareness - even in the medical profession - that it is possible to improve health across the lifecourse and to treat age-related diseases at their cause even in older people, rather than simply providing symptomatic relief. To do this, education and training are needed for professionals and the public alike. Ageing biology and therapies should be taught in the GCSE biology curriculum (as monoclonal antibodies and stem cells already are). Training for medical professionals is needed, with introduction of courses on the new science of ageing (geroscience/biogerontology) at preclinical and higher levels. Research scientists should provide briefings to public officials, and be encouraged to engage actively with the public. Media can play a huge role by presenting ageing health stories in a responsible and factually-based manner.

[35] *https://www.ncbi.nlm.nih.gov/pubmed/21226558*

[36] *https://www.sciencedirect.com/science/article/pii/S2468501118300063*

[37] *https://www.nhsbt.nhs.uk/how-we-help/advanced-therapies/*

[38] *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6816332/*

[39] *https://science.sciencemag.org/content/325/5937/201; https://www.nature.com/articles/ncomms14063*

[40] *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5144999/*

[41] *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4128394/*

[42] *https://advances.sciencemag.org/content/5/1/eaau3333*

[43] *https://insilico.com*

Acceptance:

Ageing is perceived as 'normal' and hence interfering in the ageing process is seen as unnatural and even abhorrent. However, public audiences are highly receptive to a conceptual reworking when senescent cells are equated with cancer cells – the body's own cells have gone rogue, with therapies to treat/prevent that. A trusted public figurehead (for example, David Attenborough on climate change and plastics) would help to educate and reassure the public and can drive societal change. Media engagement is vital – print, broadcast and online media, chat-shows, theatre, films, drama and documentaries all have a part to play; science journalism[45] and popular science books[46] have already started to make a difference, as have biotech finance[47] and investors[48].

Affordability:

While new drugs are often extremely expensive, some promising senolytics are repurposed anti-cancer drugs (e.g. dasatinib, mTOR inhibitors) or natural products (e.g. fisetin, quercetin), while some immune-supportive drugs that look promising as senomodifiers (e.g. statins[49]) are cheap and already widely used within the NHS. New drugs arising from charity or publicly-funded science in UK universities should be developed through low-cost manufacturing instead of being tied by patents owned by big pharma. Stem cells and gene therapies will be expensive, but risk/cost could be shared through public-private partnerships; public-based manufacturing facilities (e.g. extending the current model using the National Blood Transfusion Service[50]) should also help cut costs. AI (e.g. adversarial neural networks[51]) can speed up rational drug design.

Application:

Getting drugs to the clinic requires the streamlining of clinical trials including basket and umbrella trials within the NHS[52](these spread risk and cost, and increase positive hit rates). Long-term funding for biobank, cohort and longitudinal studies, as well as seed-corn and visionary funding for high-risk but potentially high pay-out research, is needed, as is innovative new scientific thinking (e.g. in dementia research). A large ring-fenced budget (e.g. 0.2% of annual NHS healthcare costs, c.f. 1 year HLE = 0.39% GDP), administered by a new National Institute of Ageing, would foster co-operation and creativity in discovery and development of novel anti-ageing medicines, and break down artificial silos of research disciplines. Such investment would also flag the UK as a country serious about ageing research, attracting inward investment into biotech and pharma.

> *Modifying ageing health outcomes by understanding and treating the underlying biological causes of ageing and age-related disease is now a reality, and one that we should grasp in order to achieve the goal of better health for all.*

[44] *http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/science-and-technology-committee-lords/ageing-science-technology-and-healthy-living/written/105595.html; https://parliamentlive.tv/Event/Index/1c0e8f76-2e8a-4e27-a297-4b4f2e9cb5f3*

[45] *https://www.newscientist.com/article/mg24232270-100-anti-ageing-drugs-are-coming-that-could-keep-you-healthier-for-longer/*

[46] *https://www.bloomsbury.com/uk/borrowed-time-9781472936066/*

[47] *https://www.longevity.technology*

[48] *https://www.juvenescence-book.com*

[49] *https://www.ncbi.nlm.nih.gov/pubmed/12676819*

[50] *https://www.nhsbt.nhs.uk/how-we-help/advanced-therapies/*

[51] *https://insilico.com*

[52] *https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-019-3664-1; https://www.kennedy.ox.ac.uk/news/showcasing-a-new-approach-to-arthritis-research*

Key Paper J:
Leveraging Developments in Science and Technology

James O'Shaughnessy - Chair, APPG for Longevity Science, Genomics & Technology Advisory Board
Tina Woods - CEO, Longevity International, APPG for Longevity Secretariat Director

Addressing the R&D value chain

Longevity is the most important single issue for society in the next 30 years, according to Sir John Bell, Regius Professor of Medicine at Oxford University and Life Science's Champion. Presently, however, 'longevity' is seen through the negative lens of the 'ageing challenge' – an inevitable process, the main impact of which is to place immense pressure on the NHS and wider health and care systems. Consequently, there is a sense of fatalism about the policy responses that are proposed. It is too often seen as an issue to be accommodated rather than a set of problems that can be solved. Equally, there has been little consideration of the potential opportunities from greater longevity in overall population health, wellbeing and prosperity.

In truth, the reality of an ageing society is both a tractable challenge and the source of rich economic and social potential. In order to mitigate the risks and exploit the opportunities, we need to maximise the ability of science and wider R&D value chain to contribute to achieving HLE+5. This will require a change in attitude, away from fatalism towards a hard-headed empirical approach, and this change must come quickly. As it stands, there is not enough long-term research funding and policy focus for prevention and mitigation of age-related disease and disability, especially compared with the spend on care for the already sick and the treatment of disease. As a result, exciting developments in science and technology are under-exploited, and the goal of working towards HLE+5 – and the corresponding reduction in health inequalities that entails if executed properly – is not yet seen as a major mobilising force for the science community.

This is perverse as a small increase in research spend is likely to have enormous cost and QALY benefits with increased HLE. Age-related diseases account for more than 80% of total healthcare costs. With demographic shifts towards an increasing elderly population – in 2017, more than a fifth of the European population was aged over 65 (Eurostat, 2019) – the disease burden is rising rapidly, with healthcare costs estimated at £35-60 billion p.a. in the UK alone for age-related disease. Please refer to the Key Paper G by Lynne Cox, on the economic and scientific case for therapeutic intervention in ageing.

There are positive signs of policy change: the creation by government of the Ageing Grand challenge, and its translation into the Industrial Strategy, is good news, as is the high priority that the Department for Health and Care (DHSC) has placed on prevention in the NHS Long Term Plan. However, there needs to be a significant re-orientation of the R&D value chain towards the achievement of the goal of HLE+5 if we are to generate the ideas, products, services and companies that will help the UK achieve this goal.

Compounding the current inefficiency of the value cycle, the UK has a general structural problem in that, while it is relatively effective in early R&D across all sectors – including health and the life sciences – it fares less well in translation, adoption, scale up and commercialisation. This is amplified by the role of the funding bodies, which 'double down' on early stage science and research but do little to support spread of innovation, as below.

The combination of these three factors – scepticism about the solvability of the problem, the absence of a unified goal, and the lack of focus on scaling up effective interventions – leads to a significant gap in funding to support the scaling of ageing-focused ventures, especially

those products and services that aim to achieve significant social as well as economic impact (positive social outcomes are also not recognised in the prices paid for goods and services, particularly in statutory commissioning which tends to focus on payments for processes rather than outcomes).

Harnessing the potential of data

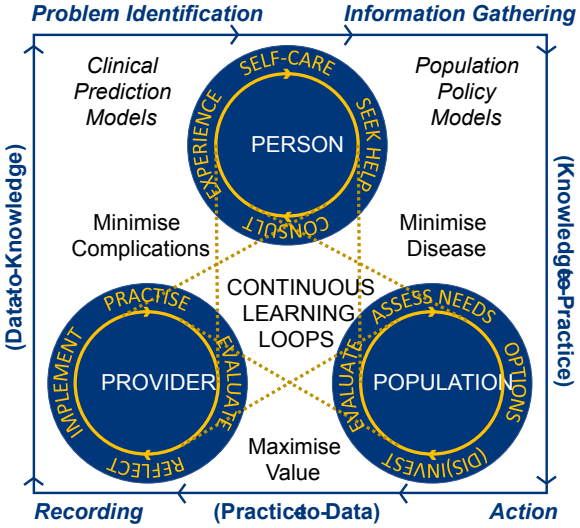
Data should be considered a precious national asset which if harnessed safely and ethically can drive new capabilities, industries, jobs and prosperity. The UK has rich and diverse data sets, for example within our NHS, and these have the potential to bring significant societal and economic benefits by enhancing and maintaining the nation's health. Presently, however, there is too much focus on sickness data (i.e., NHS data) when healthcare comprises only 10-15% of the overall determinants of health. We need to broaden the data view to encompass the wider determinants of health (Donkin et al., 2019) -with 60% behavioural, social and psychological and 30% biological / genomic- and leverage insights and solutions from data science across the life course to deliver HLE+5 while minimising health inequalities,as illustrated from the government Foresight report, Future of an Ageing Population (Government Office for Science, 2016).

With approximately 30% of our health determined by our genes, more attention and funding are needed on the role of genomics and epigenetics in reducing premature ill-health rather than treating diseases. Up until now Genomics England has focussed in the 100,000 Genomes Project on how genomics can transform healthcare in the diagnosis and treatment of cancer, infection and rare diseases. As a result, of the Chief Medical Officer's Report "Generation Genome", a National Genomics Board chaired by Baroness Blackwood has been formed. This Board has set an ambitious National Genomic Healthcare Strategy focussed on how genomics can aid diagnosis and personalised medicine and in particular exploring the potential of genomics in prevention. Central to this is the Accelerating Detection of Disease programme, the platform for developing effective diagnostics for early, asymptomatic chronic disease, carrying out up to 5 million polygenic risk score assessments on volunteers. Click here to read the paper *The impact of the 100,000 Genomes Project on NHS Transformation* by Mark Caulfield.

To leverage the true potential of these initiatives, however, will require harnessing insights using multimodal AI from multiple datasets outside healthcare within an open data ecosystem geared to identifying solutions to keep people healthy and well across the life course. This is the rationale for the 'Open Life' data framework described in the Key Paper on business by John Godfrey and Tina Woods.

As AI- and data-driven health and care develops, and as Integrated Care Systems (ICS) evolve, we also need to move the R&D cycle away from a linear model to a learning system that continuously provokes pull-through of relevant R&D of solutions that improve outcomes (e.g. not just fixed solutions like drugs but algorithms that get better the more they are used).

The race is on to create the world's first AI / digital 'brain' for an integrated care system (ICS). The UK has fewer barriers than the US to collecting the relevant data across care-provider, civic-administrative and consumer sources and the export potential is large for AI-driven health. A blueprint of algorithms to drive continuous improvement in an ICS is effectively an 'operating system' integrating three levels of learning loop as illustrated in this diagram, as described by Professor Iain Buchan of the University of Manchester (Buchan, 2019):



Many data-driven companies, small and large, that are in our homes right now have their sights on becoming our health coaches and healthcare providers, and since 2012 have invested most heavily in data management & analytics, wellness, and genomics (CB Insights, 2019). These companies see commercial opportunities in the UK's rich 'birth to death' dataset, creating healthcare apps or medical devices that could be sold to health providers or exported across the world. NHSX, a new joint unit set up in July 2019 to drive the digital transformation of the health service, is aiming to provide guidance on commercial contracts and data sharing agreements to create channels for fair revenue sharing with the public sector amid concerns that leveraging NHS data will benefit tech giants at the expense of the taxpayers whose data is being used.

Getting this right could not be more important – the creation and distribution of value by data-driven companies must be done fairly, and seen to be fair by the public, or else they will withdraw their trust and the health gains will be lost. NHSX recently produced a report, Artificial Intelligence: How to Get it Right (Joshi and Morley, 2019), which provides an overview of how they are putting policy into practice for safe data-driven innovation in health and care. In its quest to be a global leader in AI-driven health, the UK should weigh up the pros and cons of national versus networked solutions to drive data innovation or a mixed economy of trusted vehicles to leverage individual and corporate buy-in (e.g. data trusts, data cooperatives, data communities, data collaboratives). An argument to move from a national hub-spoke model to a network of civic data cooperatives is made in the paper by Iain Buchan (Buchan, 2019).

Embedding longevity as an organising principle

We need to support the development of a longevity industry that aims to achieve healthy life expectancy while minimising health inequalities as an organising principle and strategic priority. Healthy longevity should be seen as a cross-cutting theme as important as climate change within the research community (e.g. UKRI, NIHR, Wellcome Trust, HDRUK; click here to read the paper on *Democratising Healthcare AI* by Corri Black) – using the appropriate mix of government incentives (e.g. R&D tax credits) and private sector investment to stimulate the market (as described in the the Key Paper H: Business as a Key Stakeholder in Health - John Godfrey and Tina Woods). Critically, investment needs to be as focused on the development and implementation of preventative strategies that delay the onset of ill health as it is therapeutic ones that deal with the consequences of ill health. This change in mindset and funding strategies is the most important change of all.

Specific actions to develop the longevity value cycle include:

Enhance investment in R & D

More investment, especially long term grant funding, is needed in deep preventative technologies and mitigation strategies, including:

1. Understanding the causes of ageing well and ageing poorly including omics research (genomics, epigenomics, nutrigenomics, pharmacogenomics) and investment in cohorts (whether preclinical models: e.g. ageing mouse colonies, cell banks, tissue banks or patients);
2. Developing digital and biological markers of ageing (that can predict functional capacity at some later age better than will chronological age);
3. Researching effects of environmental, social and economic factors (e.g. sleep / pollution / stress / social factors) in the 'exposome' (this encompasses the totality of human environmental exposures from conception onwards, complementing the genome). (Cox, 2019).

Significant, ring-fenced, long-term and stable financial support via an umbrella 'agnostic' organisation – similar to the US National Institute for Ageing (i.e., 'NIA-UK') that is not tied to specific disciplines – could foster collaboration for all interested parties, integrate new findings and provide quality oversight. New ventures such as the Longevity AI Consortium in preventative health and new research initiatives like UK Prevention Research Partnership (UKPRP) could also contribute to this end.

Legislation to support R&D in regenerative medicine should also be explored; for example, providing a temporary marketing license to facilitate phase 3 trials with stem cell therapies that are safe in phase 1 and 2 trials has opened up significant markets in Japan.

Facilitate adoption and scale

We need to encourage investment to address funding needed to enable organisations to grow from early-stage to 'investment ready' ventures of sufficient scale and maturity to be operationally sound, commercially viable and proven to achieve impact, including specialist funds focused to achieve scale over a longer term.

As part of this, we need to prioritise actions and investment to achieve social impact, including initiatives outside the traditional local authority and third sector pathways, and to release capital for innovation whether scientific, technological, educational, social, or built environments.

An accelerated and standardised framework for individual digital tools will help accelerate adoption and scale. As part of this, NHSX needs to prioritise activity, and disease-specific tools that will deliver improvements in healthy life expectancy – facilitating their adoption across the NHS population by supporting start-up companies developing them, who currently lack the resources to engage with the very large number of decision-makers and influencers that act as gatekeepers to NHS use and reimbursement.

Leverage 'Data that Cares'

We need to espouse a high-definition view of health and care and leverage mass-participation in generating and sharing the longitudinal data needed to realise our goal of HLE+5. Existing longitudinal datasets from NHS, Local Authority and national administrative sources can be linked provided there is enough social license from the public to support this. Such linkages already happen, at least in part, in local health and care systems (e.g. to support commissioning of health and social care services). We need a fit-for-purpose transparent agreement between

individuals, civil society, businesses and the state about how data can and should be leveraged to promote autonomy and benefit the health of the nation. That includes an understanding of what data could drive the development of new / improved treatments and technologies in a data-driven ecosystem designed to augment and subsequently supersede the 20th Century sickness model with a 21st Century 'National Service for Health'. Note Future Care Capital's Care Covenant concept and click here to read the paper *Harnessing the Potential of Data to Deliver a Longevity Dividend* by Annemarie Naylor (Naylor, 2019).

Overall, there is a need for much more education and awareness in the general public- including schools - on how the latest developments in science and technology can improve their lives; this will help communicate concepts like the importance of civic data sharing too.

Data can be harnessed in an 'Open Life' data ecosystem but will require not only permission but also active participation of individuals and communities. The #DataSavesLives campaign showed that chains of health and care systems can gain public support for R&D with such data. Other top-down approaches to do the same (e.g. Care.Data), failed. An 'Open Life' data innovation ecosystem harnessing citizen data will help to bring in representative populations and encourage civic and direct-to-citizen digital-self enablement. Healthy life expectancy while minimising health inequalities could be seen as a social responsibility metric - and through the right incentives encourage and reward businesses and investors.

Box 1: The Future

What might a moon-shot look like where harnessing the potential of data from everyone today could be undertaken in the service of delivering a longevity dividend tomorrow and for generations to come? What types of public sector projects could be supported via an 'Open Life' data ecosystem? Below are two examples.

NHS Precision Health Platform - Richard Barker (click here to read the full paper)

A 'through life' precision health digital platform that connects with activity / condition-specific tools and supports individuals managing their health through the life course, via a 'digital twin' or avatar approach. The NHS provides an accelerated, standardised process for the development, regulation and NHS adoption of these tools to avoid, delay and better manage the chronic conditions that contribute to unhealthy longevity. The most appropriate incentives (financial and non-financial) would be employed in enabling individuals using such tools to improve their healthy lifespan.

Red Book for Life - Eric Kihlstrom (click here to read the full paper)

A wellness decision framework, acting as a trusted tool for citizens to help contextualise health advice, leveraging well-established World Health Organization research, the UK's leading role in health data and data ethics (noting that social determinants of health are mostly outside of NHS health data sets), the Centre for Data Ethics and Innovation work on data stewardship models, existing successful health data tools, and people's recognition of the trusted NHS Red Book. It is one thing for people to hear about eating healthy, getting more exercise and drinking less alcohol but it is another thing for people to realise that the information applies to them and that they must act for their own benefit.

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Older.

Resolution Foundation

what works wellbeing

Open Age life's just begun

The Big Middle

sustrans

Voice

Ogilvy

UK active More people More active More often

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