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Newcastle University

Remarkable research for healthy ageing
THE DUNHILL MEDICAL TRUST

Making the extra years count

Inequalities in disability and dependency with increasing longevity

Advice
Inequalities
Health and care
Life expectancy
Immunisation
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Preface: Prevention in an ageing world

Around the globe, societies are getting older. People are living longer. And there is a growing shift towards encouraging longer working lives.

As countries age, it will be important to help people live healthier lives for longer. By doing so, we can not only improve wellbeing and enable people to remain active but also reduce dependency, bringing down the burdens on health systems.

There is already a consensus that, as well as being good for our health, preventing disease as well as limiting long-term impairment and the compounding impact of multiple diseases will play an important role in supporting the economic sustainability of health systems. But translating that consensus into sustained action can be challenging.

Making the extra years count was a research project by Newcastle University, supported by The Dunhill Medical Trust. It has addressed a critical gap in our understanding of the evolving trends in health expectancy measures. It also covers how these trends relate to long-term conditions and their relationship with socioeconomic inequalities in the UK. Given the Government's priority to reduce socioeconomic inequalities and the findings identified in the 10-year update of the Marmot Review, which suggest that inequalities and life expectancy trends are worsening, this report adds weight to the role of prevention in addressing inequality.

To explore the role of prevention in an ageing world, ILC has launched an international programme of work to:

- Influence and shape the discourse around prevention to promote preventative measures throughout people's lives
- Examine the health and economic burden of a number of communicable and non-communicable diseases that have potential for preventative interventions right across the life course
- Draw together examples of effective preventative interventions and activities among adults in mid and later life, evidencing the value of a range of primary, secondary and tertiary preventative interventions

The first phase of this work, *Prevention in an ageing world*, made the case for investing in prevention; it highlighted three recommendations for taking this agenda forward.[1] During 2021, we will be conducting further research and engaging with stakeholders around the world to identify what works and how to deliver these recommendations. This will form a second phase, *Delivering prevention in an ageing world*.[2]

[1]https://ilcuk.org.uk/prevention-in-an-ageing-world/

[2]https://ilcuk.org.uk/delivering-prevention-in-an-ageing-world/ The programme is made possible by charitable support or grants from Gilead Sciences, GSK, Home Instead, MSD, Pfizer, Sanofi and Seqirus. Programme content is being developed independently of the funders and ILC alone are responsible for the outputs.

Executive summary

The UK Government has set a target to add five additional healthy years to the average UK lifespan by 2035. Along with the goal to narrow the gap between the richest and poorest in our society, this represents the Grand Challenge of an Ageing Society as set out in the Industrial Strategy. There was already scepticism that these goals could be achieved – and they're now likely to be re-evaluated as a result of the COVID-19 pandemic.

The ambition for five extra healthy years recognises that the benefits of an ageing society can only be delivered if people live not only longer but healthier lives. And yet, ill health and disability have been increasing while the proportion of life spent in good health and free from disability has been declining. The gap between the richest and the poorest has also been widening, entrenching poorer outcomes for the least advantaged parts of society.

Making the extra years count, a research project led by Newcastle University, investigates the trends in longevity, disability, and dependence between 1991 and 2011. The research also explores how these trends relate to long-term conditions and socioeconomic inequalities.

The research has found key elements of these trends to be:

- Between 1991 and 2011, the proportion of life remaining at age 65 spent without disability has remained about the same for men but increased for women.
- Long-term conditions have become more prevalent, but people are spending more extra years disability-free than years with disability on average. In other words, more people are living with chronic illness, but this doesn't directly translate to disability.
- In terms of life expectancy without disability at age 65, the gap between the most and least deprived tripled between 1991 and 2011. This growing gap is mainly explained by the most advantaged people seeing a reduced incidence (onset) of and increased recovery from disability.

This new evidence adds weight to the findings of ILC's *Prevention in an ageing world* programme and our recommendations for action:

- Democratise access to prevention to alleviate health inequalities
- Inspire and engage policymakers, healthcare professionals and individuals to consider, support and access prevention
- Use technology effectively

Author: Dr Brian Beach

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Introduction

The UK Government has set a target to add five additional healthy years to the average UK lifespan by 2035. This was confirmed in the Conservative party manifesto ahead of the 2019 elections and in a speech by the Secretary of State for Health and Social Care in February 2020.[3] Along with the goal to narrow the gap between the richest and poorest in our society, this represents the mission of the Grand Challenge of an Ageing Society as set out in the Industrial Strategy.[4] It is unclear if or how this target will be affected by the COVID-19 pandemic; the Government response in March 2021 to the *Ageing: Science, Technology and Healthy Living* report from the House of Lords Science and Technology Committee suggests that such targets will have to be re-evaluated in light of the pandemic.[5]

As we move into the recovery phase following the pandemic, we need to ensure that we focus on improving health. We can't maximise the opportunities that may arise from an ageing society unless we help people to live not only longer but healthier lives. Action to ensure healthier longer lives will improve individuals' quality of life, provide stimulus to the economy, and generate broader social and societal benefits.

Life expectancy – along with the related measure, health expectancy – is a key tool for assessing progress in longevity across a population. Yet we have known for several years that the UK sees significant inequalities in life expectancy between different socioeconomic groups.[6] Moreover, improvements in life expectancy have stalled in recent years, while the health gap between wealthy and deprived areas continues to grow.[7]

The Conservative 2019 manifesto commitment is not the first time that UK politicians have expressed an ambition to reduce

[3]https://www.conservatives.com/our-plan; https://www.gov.uk/government/speeches/adding-years-to-life-and-life-to-years-our-plan-to-increase-healthy-longevity
[4]https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/missions#healthy-lives
[5]https://committees.parliament.uk/work/1/ageing-science-technology-and-healthy-living/publications/
[6]The seminal work for this is the Marmot Review, *Fair Society, Healthy Lives*, published in 2010. http://www.instituteofhealthequity.org/resources-reports/fair-society-healthy-lives-the-marmot-review
[7]Marmot, M., Allen, J., Boyce, T., Goldblatt, P., & Morrison, J. (2020) *Health equity in England: The Marmot Review 10 years on*. London: Institute of Health Equity. https://www.health.org.uk/publications/reports/the-marmot-review-10-years-on

inequalities. As far back as 1997, New Labour's social exclusion agenda sought to address disadvantage and support communities. Some have assessed success on this agenda as "mixed", noting that disadvantaged groups continue to be excluded from decision-making processes.[8]

This means that we can't explain widening inequalities in life expectancy and health as the result of a lack of awareness or information. But increasing our knowledge of how these inequalities have emerged and changed over time still adds value as we look for solutions. *Making the extra years count*, a research project led by Newcastle University and funded by The Dunhill Medical Trust, has provided new insights on changing trends that encompass life expectancy, disability, long-term illness, and socioeconomic inequalities.

[8]McNeil, C. (2014) *The politics of disadvantage: New Labour, social exclusion and post-crash Britain*. London: Lankelly Chase. https://lankellychase.org.uk/resources/publications/the-politics-of-severe-and-multiple-disadvantage/

UK trends in measures of life expectancy

The ambition for five extra healthy years recognises that we will see the maximum benefit from increases in longevity if that extra life is spent in good health. There have been trends towards increases in life expectancy, healthy life expectancy (HLE), and disability-free life expectancy (DFLE) over the years. But the gains in HLE and DFLE haven't kept up with those for general life expectancy. In other words, ill health and disability have been increasing while **the proportion of life spent in good health and free from disability has been declining**.

The *Making the extra years count* project conducted a review of the evidence on UK trends in life expectancy measures.[9] With respect to **overall life expectancy**, it found:

- Gains in life expectancy over time were greater for men than for women. Estimated life expectancy at birth in 2017 was 79.2 years among UK men, an increase of 6.3 years since 1990.[10] For women, the increase was only 4.2 years: from 78.5 to 82.7.
- Life expectancy at age 65 increased from 1990 to 2016: the increase was 4.4 years for men and 3.0 years for women.[11]
- The difference between increases can be projected into the future, with an estimated 3.5-year increase for men and a 3.0-year increase for women between 2015 and 2035.[12]

In terms of **healthy life expectancy,** the trends broadly mirror those for overall life expectancy:

- While both genders have experienced increases in HLE, the gains have been larger for men. Between 1990 and 2017, HLE at birth grew by 4.4 years for men (to 68.5) and by 2.7 years for women (to 70.0).[13]

[9]Spiers, G., Kunonga, T.P., Beyer, F., Craig, D., Hanratty, B., & Jagger, C. (2021) "Trends in health expectancies: a systematic review of international evidence." *BMJ Open* (in press).
[10]Global Burden of Disease 2017 DALYs and Hale Collaborators. (2018) "Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017." *The Lancet*, 392(10159): 1859-1922.
[11]Global Burden of Disease 2016 DALYs and Hale Collaborators. (2017) "Global, regional, and national disability-adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2016: A systematic analysis for the Global Burden of Disease Study 2016." *The Lancet*, 390(10100): 1260-1344.
[12]Kingston, A., Comas-Herrera, A., & Jagger, C. (2018) "Forecasting the care needs of the older population in England over the next 20 years: estimates from the Population Ageing and Care Simulation (PACSim) modelling study." *Lancet Public Health*, 3(9): e447-e55.
[13]Global Burden of Disease 2017 DALYs and Hale Collaborators (2018)

- However, recent trends reported by the Office for National Statistics (ONS) for 2018 suggest that HLE for women actually reduced by 0.2 years between 2009/12 and 2015/17, compared to a 0.4-year increase for men.[14]
- In England, inequalities (based on area deprivation) in HLE at birth and at age 65 have widened for men but narrowed for women.[15] However, this narrowing appears to be related to declining HLE in the least deprived groups rather than an increase among the most deprived.

The review also covered other health-related life expectancy measures relating to **disability and dependency**. These findings are arguably more relevant for policy, as disability and dependency prevalence trends have direct implications for future health and care provision. The review found:

- DFLE and dependency-free life expectancy (DepFLE) at age 65 have increased over the period 1991-2011, with larger gains for men.[16] One study estimated that men gained 1.7 years of independent life, compared to 0.2 years for women.[17]
- Although the absolute number of years of DFLE and DepFLE increased over time, the proportion of life spent independent declined, more so for women than men.
- DFLE and DepFLE forecasts covering 2015 to 2025, and to 2035, suggest that gains at age 65 will persist.[18] Men are likely to gain 4.2 years (to 15.2) by 2035, while women should gain 0.9 years (to 11.6). Over this time, the proportion of life lived independently will increase for men but decline for women.

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[14]Office for National Statistics (2018) *Health state life expectancies,* UK: 2015 to 2017.
[15]Office for National Statistics (2019) *Health state life expectancies by national deprivation deciles, England and Wales*: 2015 to 2017.
[16]Jagger, C., Matthews, F., Wohland, P., Fouweather, T., Stephan, B., Robinson, L., Arthur, A., & Brayne, C. (2016) "A comparison of health expectancies over two decades in England: results of the Cognitive Function and Ageing Study I and II." The Lancet, 387(10020): 779-786.; Kingston, A., Wohland, P., Wittenberg, R., Robinson, L., Brayne, C., Matthews, F., & Jagger, C. (2017) "Is late-life dependency increasing or not? A comparison of the Cognitive Function and Ageing Studies (CFAS)." *The Lancet*, 390(10103): 1676-1684.
[17]Kingston et al. (2017)
[18]Guzman-Castillo, M., Ahmadi-Abhari, S., Bandosz, P., Capewell, S., Steptoe, A., Singh-Manoux, A., Kivimaki, M., Shipley, M. J., Brunner, E. J., & O'Flaherty, M. (2017) "Forecasted trends in disability and life expectancy in England and Wales up to 2025: a modelling study." *The Lancet Public Health,* 2(7): e307-e313.; Kingston et al. (2018)

Overall, the trends in HLE, DFLE, and DepFLE reflect smaller gains than for overall life expectancy, suggesting that not all the extra years added to life are spent healthy, independent, and free from disability. There is one exception: forecasts for independent life expectancy gains for men aged 65 exceed those for overall life expectancy, though these forecasts precede the COVID-19 pandemic.

This review underscores how the additional years gained from increased longevity are partially marked by poor health and disability in the UK. We need to make greater efforts to ensure that our longer lives are characterised by good health. Developing effective strategies to achieve this requires a more nuanced understanding of the drivers behind observed trends.

Measuring the extra years

Key findings:

- In the two decades since 1991, both men and women experienced an increase in the disability-free and independent years remaining to them at age 65, which resulted from a reduced risk of developing disability or dependency; for men, there was also a lower risk of death from a state without either disability or dependency.
- Women spend more years living with disability or dependency than men and reach the age where the remaining years with disability equal those without disability around 10 years earlier than men. Still, women have seen greater benefits over time, reflected in an increase in the proportion of years spent disability-free, although men still experience a higher proportion of later life spent independent and disability-free.
- There have also been improvements to the probability of developing disability or becoming dependent. The risk of developing disability declined by 20% over time for men and 30% for women, while the risk of becoming dependent also declined by 30% for women (though it remained unchanged for men).

Following on from the review conducted early in the project, the project team sought to make refined measures of health expectancy using the richness of the Cognitive Function and Ageing Studies (CFAS I and CFAS II) data and advances in methodological approaches.[19] Based on these analyses, the team found:

- For men, overall life expectancy at 65 increased by 4.6 years between the two CFAS studies (approximately 1991 to 2011).[20] DFLE increased by 3.7 years, while the number of years lived with a disability increased by 0.8 years.
- For women, overall life expectancy increased by 2.1 years, with 2.0 of these reflecting an increase in years free from disability.
- The proportion of life spent disability-free changed very little for men in this period (75.2% vs 76.8%). For women, it increased from 55.7% to 59.8%.

[19]See Appendix 2 for more information on CFAS and the methods used.
[20]We should note that, throughout this report, references to years associated with results generally correspond to the time periods of CFAS I and CFAS II, i.e. approximately 1991-1994 and 2008-2011.

The sampling used for CFAS allowed the project to specifically study life expectancies **at age 85**, providing a robust picture of experiences for those in the latest phase of life. The patterns of change were similar to those identified for those aged 65, with a 0.9-year increase in overall life expectancy for men and a 0.6-year increase for women. DFLE figures rose by 0.8 years for both men and women, while the proportion of life spent disability-free increased only for women.

Taking these figures together, the modelling shows that **the age at which the remaining years of life are evenly shared between those with and those without disability increased by about three years** for both men and women. In 1991, this was age 79 for men and 68 for women, increasing to 82 for men and 71 for women by 2011.

Similar patterns emerged for dependency:

- Between 1991 and 2011, men aged 65 gained 3.5 years and women gained 2.5 years of living independently.
- Men also gained 1.1 years lived with dependency, which means there was little change in the proportion of life after 65 spent without dependency (around 70%). Women, however, did experience an increase in the proportion of remaining years spent living independently, from around 45% to 54%.
- The age at which remaining life is equally split between dependent and independent states also increased, from age 75 to 79 for men and from 65 to 67 for women.

At age 85, there was a small increase in the number of years spent living independently between 1991 and 2011: 0.8 years for men and 0.5 years for women. This means a 10.5% increase in the proportion of life without dependency for men and one of 7.6% for women.

Overall, both women and men have seen important gains over time. Women have experienced a greater benefit, reflected particularly in the increase in the proportion of disability-free years remaining at age 65. Yet men have also witnessed benefits, with growth in the proportion of remaining years spent disability-free and independent.

Transitions between independence, disability, and death

These findings set out the number of years spent in different states in the later part of life, improving our understanding of how disability

and dependency characterise later years and how this has changed over time. However, a key benefit of the longitudinal approach used here is that we can model how people move between these states, providing answers as to whether the gains in disability-free years are due to lower mortality from a disability-free state or a real decline in disability incidence.

The project calculated the probability of transitions between states of no disability, disability, and death, looking at men and women within five-year age groups (65-69, 75-79, and 85-89) separately for CFAS I and CFAS II. The findings show that **the probability of developing disability increased with age and was higher for women than for men** consistently in both studies. The probability of death (whether from a disability or disability-free state) also increased with age but was consistently higher for men than women in both studies.

Looking at differences between CFAS I and CFAS II, modelling found that both **men and women were less likely to develop disability in the more recent study** than in the earlier one: men had a 20% lower risk, while women had a 30% lower risk. Men also experienced a decrease in the risk of death, while most notably the risk from a disability-free state was reduced by 50%.

Transitions between states of dependency were also modelled. **The probability of becoming dependent remained relatively stable over time for men but declined by around 30% for women**. The probability of death decreased to a greater extent among men, with a 60% lower risk of death from a dependent state in CFAS II compared to CFAS I.

Taken together, the results on disability and dependency show some important gains over time. The risk of developing disability has declined for all, and the risk of becoming dependent has also declined for women (though it remains unchanged for men).

The role of specific conditions in later-life disability and dependency trends

Key findings:

- While, between 1991 and 2011, many long-term conditions have become more prevalent for both men and women, we see larger increases in disability-free years at age 65 than in years living with disability. The increase in prevalence cannot be explained solely by the ageing of the population.
- The exception to the trend for prevalence to increase is cognitive impairment, which has declined over time. It's linked to equal gains in years with disability and disability-free among men but gains only in years with disability for women. Cognitive impairment's negative impact on life expectancy is thus higher in more recent years.
- Within the same timeframe, men with multiple long-term conditions at age 65 gained 3.9 years overall (2.9 of these years disability-free), likely resulting from an overall lower risk of death. Women gained 1.9 years overall, but with 1.6 disability-free years.

The previous section showed that, as longevity increases, men and women have both gained more disability-free years than years with disability at age 65. Women reach the age at which remaining years are equally shared between disability and disability-free states around 10 years before men. To investigate the drivers for these additional disability-free years and the differences between genders, *Making the extra years count* explored the role of long-term conditions.

Prevalence of long-term conditions

Long-term conditions are the major drivers of disability, and their prevalence has been increasing faster than what we would expect from population ageing alone.[21] The CFAS data identifies a range of long-term conditions using self-reported assessments based on

[21]Stuck, A.E., Walthert, J.M., Nikolaus, T., Büla, C.J., Hohmann, C., & Beck, J.C. (1999) "Risk factors for functional status decline in community-living elderly people: a systematic literature review." *Social Science & Medicine*, 48(4): 445-469.; van Oostrom, S.H., Gijsen, R., Stirbu, I., Korevaar, J.C., Schellevis, F.G., Picavet, H.S., & Hoeymans, N. (2016) "Time Trends in Prevalence of Chronic Diseases and Multimorbidity Not Only due to Aging: Data from General Practices and Health Surveys." *PLoS One*, 11(8): e0160264.

diagnoses from doctors (except for cognitive impairment, which used an examination included in the CFAS interview).[22] Co- or multi-morbidity, where individuals have multiple long-term conditions (MLTCs) at once, is of growing interest for health policy in the context of an ageing population. This research defined MLTCs as the presence of two or more long-term conditions; if any were not reported, MLTCs were based on a percentage of the total conditions present.

The prevalence of long-term conditions and MLTCs is presented in Table 1, covering different age groups and the two components of CFAS. Key insights include:

- The prevalence of all long-term conditions, except for cognitive impairment, increased over time for the 65+ (all ages) group.
- The prevalence of arthritis and stroke only increased in the 85+ age group, while increases for coronary heart disease, diabetes, and peripheral vascular disease were seen in all age groups examined (i.e. 65-74, 75-84, and 85+).
- The overall prevalence of respiratory problems was similar in the two studies, but increases were found for the 75-84 age group and decreases in the 85+ group.

[22]Cognitive impairment was defined as a score of less than 26 on the Mini-Mental State Examination. Folstein, M.F., Folstein, S.E., & McHugh, P.R. (1975) ""Mini-Mental State". A practical method for grading the cognitive state of patients for the clinician." *Journal of Psychiatry Research*, 12(3): 189-198.

Table 1: Prevalence of long-term conditions by age and study[23]

	65-74		75-84		85+		All ages	
	CFAS I %	CFAS II %	CFAS I %	CFAS II %	CFAS I %	CFAS II %	CFAS I %	CFAS II %
Arthritis	50.0	50.1	55.3	57.1	57.0	64.2	52.9	55.0
Coronary heart disease	15.7	16.3	19.7	24.9	19.7	26.3	17.7	21.0
Cognitive impairment	23.4	15.9	44.4	30.6	72.6	50.6	37.5	26.8
Diabetes	5.3	14.1	7.6	16.1	5.5	11.6	6.2	14.5
Hearing difficulties	15.2	19.6	24.4	28.6	45.4	43.5	22.5	26.9
Peripheral vascular disease	4.0	10.2	4.6	11.3	4.0	10.8	4.3	10.7
Respiratory problems	20.0	19.8	18.3	20.5	19.2	16.4	19.2	19.5
Stroke	5.6	6.2	10.1	10.4	10.6	13.2	8.0	8.9
Visual impairment	7.1	11.4	15.9	15.1	32.7	26.8	13.6	15.2
MLTCs	42.8	47.1	61.1	63.9	77.6	75.4	54.3	58.1

With respect to MLTCs, prevalence increased overall between the two studies, but there was a decline for the 85+ group specifically; the increase in the prevalence of MLTCs was most pronounced for the youngest age group, aged 65-74. Further analysis looked at the relationship between being classified with MLTCs and each of the long-term conditions, particularly to explore if this had an impact on observed differences between the studies. In general, the proportion of people with each condition who also had MLTCs was high across both genders and both studies (i.e. over 70% for arthritis and over 80% for all other conditions). The prevalence of MLTCs between CFAS I and CFAS II also increased a few percentage points for those with many of the single long-term conditions.

[23]Taken from a report prepared for the National Institute for Health Research Policy Research Unit in Older People and Frailty: Bennett, H., Matthews, F., Kingston, A., Robinson, L., Knapp, M., & Jagger, C. (2020) *Project 1: The contribution of single and multiple chronic conditions to the deteriorating time trends in later-life disability – Part 2: Single and multiple conditions.*

Measuring the extra years with long-term conditions

As noted earlier, the majority of extra years that men gained between CFAS I and CFAS II were disability-free. This trend was also the case **for those with most long-term conditions, as the proportion of remaining years at age 65 spent disability-free stayed fairly stable over time**. Men with respiratory problems or stroke saw the largest increase in DFLE: 4.5 and 4.3 years, respectively. The smallest increase in DFLE was found for those with cognitive impairment (1.4 years), although this was matched by a similar increase in life expectancy with disability.

The presence of a long-term condition doesn't necessarily equate to disability, yet different conditions may have different impacts on developing disability. The analysis looked at the disabling effect of different conditions, finding:

- Stroke had the biggest impact: DFLE at 65 for men who had had a stroke was 6.0 years lower than for men who hadn't in CFAS I. This figure was reduced slightly, to 4.6, in CFAS II, but cognitive impairment demonstrated a comparable effect, reducing DFLE by 4.8 years in CFAS II.
- Arthritis had a bigger impact on reducing DFLE in CFAS II (by 2.4 years) than in CFAS I (by 0.7 years).
- In contrast, the loss of years (total or disability-free) due to respiratory problems was lower in CFAS II than in CFAS I.
- The other conditions demonstrated little change between the study periods.

The situation was similar for women in many respects. **Like men, the gains in years at 65 for women with each long-term condition have mostly been disability-free.** But in contrast to men, for certain conditions in women, there was a reduction in the number of years lived **with disability** between CFAS I and CFAS II: arthritis, coronary heart disease, diabetes, hearing difficulties and respiratory problems. Turning to DFLE, the largest gains of 3.5 years were found for women who had had a stroke. Findings on cognitive impairment were also notable, with an increase in the number of years lived with disability between CFAS I and CFAS II but no increase in those disability-free. Consequently, the proportion of remaining years with disability increased from 47.8% to 51.7% for women with cognitive impairment.

Comparing the effect of different conditions for women:

- Stroke also had the biggest impact among women in CFAS I, with DFLE at 65 reduced by 4.6 years compared to women who hadn't had a stroke. Diabetes was a close second, reducing DFLE at 65 by 4.5 years.
- By CFAS II, the decrease in DFLE at age 65 due to cognitive impairment (4.2 years) exceeded that due to diabetes (3.8 years) or stroke (3.2 years).
- Coronary heart disease was associated with a smaller difference in DFLE from CFAS I to CFAS II. In contrast, however, the difference in total years lived between women with and without coronary heart disease increased.

Between the studies, additional years gained at age 65 for both men and women with MLTCs were largely disability-free. The gains in DFLE for women were similar to the total years gained (1.6 versus 1.9 years), reflecting a small increase in the proportion of years without disability. The age at which half of the remaining years are disability-free changed very little for men and women with MLTCs, reaching 78 and 65 respectively. However, the increase among those without MLTCs meant that between studies there was a 7-year increase for men and a 6-year increase for women.

Transitions between states by long-term condition

Among men, the probability of dying from a disability-free state decreased over time. This played a significant role in driving changes in DFLE for those with a number of conditions. Only men with coronary heart disease saw the probability of developing a disability significantly reduced.

The risk of developing disability was reduced for women with a number of separate conditions: arthritis, coronary heart disease, hearing difficulties, respiratory problems, and visual impairment. Peripheral vascular disease was the only condition associated with a lower probability of death with disability for women, with a 50% reduction in risk.

Comparing those with a long-term condition to those without, both men and women who had had a stroke were significantly more likely to develop disability in each of the CFAS study periods. For men, the risk of developing disability increased with cognitive

impairment or arthritis in CFAS II but not in CFAS I. Among women, diabetes was associated with higher risk of developing disability in both studies. Cognitive impairment among women was linked to increased risk of developing disability in CFAS II only, whereas the risk of dying from a disability state was higher in both studies.

Regarding MLTCs, men with MLTCs were 40% less likely to die from a disability-free state and 20% less likely from a disability state in CFAS II compared to CFAS I. This partly explains why overall life expectancy saw a greater increase than DFLE. This situation was reversed for women with MLTCs, likely resulting from a reduced probability of developing disability in CFAS II, which was 30%. When comparing people with MLTCs to those without, men and women with MLTCs were more likely to develop disability in both studies. Men with MLTCs were more likely to die with disability in CFAS I, while women with MLTCs were less likely to experience recovery (i.e. moving from a disability to a disability-free state) and more likely to die with disability in CFAS II.

Exploring the role of socioeconomic inequalities

A great deal of work on life expectancy – including the research featured in this paper – has rightly looked at trends among men and women separately, given significant differences between these groups. *Making the extra years count* also explored the role of different long-term conditions in shaping life and health expectancies, as such conditions are considered important drivers for disability and mortality. We also know that these trends are linked to socioeconomic status and deprivation: this project investigated these links.

It has long been recognised that there are inequalities in life expectancy in the UK and that these inequalities are growing.[24] The picture is even starker for health expectancies, with a difference of 18.3 years for men and 18.8 years for women between socioeconomic groups.[25] Lower socioeconomic status is also linked to earlier onset of long-term conditions, which can lead to earlier disability and dependency.[26] Earlier onset of individual conditions can also lead to the earlier development of multiple long-term conditions (MLTCs).[27]

Making the extra years count looked at the difference in disability-free life expectancy (DFLE) at age 65 across socioeconomic groups (measured using the Townsend deprivation index for area-level deprivation) and the role of MLTCs.

Key findings include:

- The difference in DFLE across socioeconomic groups tripled between 1991 and 2011.
- The different gains in DFLE across socioeconomic groups were due to the most advantaged men and women seeing improvements in positive transitions (i.e. reduced incidence

[24]Marmot, M., Allen, J., Boyce, T., Goldblatt, P., & Morrison, J. (2020) H*ealth equity in England: The Marmot Review 10 years on*. London: Institute of Health Equity.
[25]Office for National Statistics (2020) *Health state life expectancies by national deprivation deciles, England: 2016 to 2018*
[26]Barnett, K., Mercer, S.W., Norbury, M., Watt, G., Wyke, S., & Guthrie, B. (2012) "Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *The Lancet*, 380: 37-43.
[27]Townsend, P., Phillimore, P., & Beattie, A. (1988) *Health and Deprivation: Inequality and the North*. London: Routledge

of and increased recovery from disability), which was not experienced by the least advantaged men and women.

- The difference across socioeconomic groups for people without MLTCs was similar in size to those with MLTCs, suggesting that MTLCs play a limited role in driving socioeconomic inequalities.

The widening socioeconomic inequalities in DFLE at age 65 in people without MLTCs could not be explained by the least advantaged having a greater prevalence of disability or acquiring MLTCs in the two-year follow-up for each study.

Among those without MLTCs, there was little change in any transitions for the least advantaged men and women, the only exception being a lower risk of incidence of disability for men. The most advantaged men and women without MLTCs also saw a reduction in incidence, while men experienced a lower risk of death from a disability-free state and women saw a lower risk of death from disability.

This means that MLTCs are unlikely to be a key driver of socioeconomic inequalities in DFLE measures. We can't rule out MLTCs from playing a part, but they cannot explain widening inequalities for those without MLTCs. The substantial growth in inequalities in DFLE at age 65 demonstrates that policy ambitions to reduce such inequalities have failed, while our findings underscore that it is not solely a matter of reducing the prevalence of illness. We need broader solutions that address the social determinants of health.

Final reflections

The research of *Making the extra years* count has addressed a critical gap in our understanding of the evolving trends in measures of health expectancy, how these relate to long-term conditions, and the relationship with socioeconomic inequalities in the UK. Given the Government's targets to add five additional healthy years to the average UK lifespan by 2035 and to reduce inequalities across socioeconomic groups, these findings should play an important role in working out how to achieve these goals. This is all the more important given the findings identified in the 10-year update of the Marmot Review, which suggest inequalities and life expectancy trends are worsening.

We must acknowledge that the COVID-19 pandemic may affect trends in health and life expectancy, socioeconomic inequalities, and broader resource allocation for health and care. This introduces further uncertainty about what the future will hold. However, the experience of the pandemic has underscored the importance of making headway in reducing inequality and ensuring equity in the delivery of healthcare.

Demands on the health and care services will only increase, as our ageing population means that complex health needs will become more prevalent. Further progress must accommodate the complex health needs that result from MLTCs and multi-morbidity. Such efforts must also ensure that delivering complex care does not further entrench socioeconomic equalities due to lack of access or other barriers.

Policy must also consider broader solutions to stimulate health. Preventative health services are key for encouraging a life course approach to health. Further investment in prevention has the potential to generate cost-effective, positive outcomes, reducing further long-term pressures on the health and care systems.[28]

The significant role of prevention

This new evidence adds weight to the findings of ILC's *Prevention in an ageing world* programme and our recommendations for action:

- Democratise access to prevention to alleviate health inequalities

[28]For more information on ILC's *Delivering prevention in an ageing world programme*, visit https://ilcuk.org.uk/delivering-prevention-in-an-ageing-world/

- Inspire and engage policymakers, healthcare professionals, and individuals on the prevention agenda to consider, support and access prevention
- Use technology effectively

Democratising access

To make prevention efforts effective, healthcare systems must ensure equal access to preventative interventions for all. But the reality is that for too long, cultural, economic and geographic divides have led to deep-running inequalities in access, which have been further exposed during the pandemic. To address health inequalities, we need urgent action to:

- Make prevention convenient
- Ensure that cost is no barrier, such as minimising out-of-pocket charges
- Tailor prevention to ensure that services fully cater to the growing diversity of our older population
- Improve health literacy through co-production, so that individuals can understand and use healthcare information to better self-manage their long-term conditions
- Address ageism among policymakers and healthcare professionals, as well as older people themselves, to ensure that people receive the best care to prevent or manage conditions, regardless of age

Inspiring and engaging

Change is driven by people. During the pandemic we have seen that, when people come together, systems can respond quickly to protect and promote population health. We need to sustain this urgency to inspire and engage policymakers, healthcare professionals and individuals by:

- Communicating the importance of prevention using a wide range of robust evidence to demonstrate the wider social and economic benefits, using language that resonates with political and policy-making audiences, in healthcare and beyond
- Changing the message to shift the prevention conversation from stopping people becoming unwell to helping them be healthy, independent and productive

- Training and equipping healthcare professionals to give the right advice, work together from community to hospital settings, and help people achieve and sustain healthy lifestyles.

Using technology effectively

Technology undoubtedly has a crucial role to play in promoting the prevention agenda and helping people stay healthier for longer. The pandemic has led to health systems around the world quickly integrating new technologies, from telehealth to drive-through clinics. While we mustn't treat technology as a magic bullet, it has significant potential to improve health outcomes by:

- Improving take-up of preventative interventions, such as investing in technologies that monitor vaccination uptake in real time so that primary healthcare providers can target those in need
- Empowering patients to take control of their own health and wellbeing
- Reducing barriers to use, through improved healthcare access for those in hard-to-reach communities, while improving health outcomes for all through collaboration between healthcare and allied professionals, enabling individuals to adopt health-promoting behaviours

Further resources

A number of publications and reports have incorporated research from the *Making the extra years count* project; some of these are currently in progress and being prepared for public dissemination. The project team also contributes to the work of the Older People and Frailty Policy Research Unit (PRU) at the National Institute for Health Research (NIHR), which aims to produce timely, high-quality evidence for policymakers. The PRU reflects a collaboration of researchers from the Newcastle University, the University of Manchester, and the London School of Economics.

Further details on the NIHR Older People and Frailty PRU can be found at https://www.opfpru.nihr.ac.uk/, where links to project outputs will be updated over time.

The following articles from the project are already available:

- Bennett, H., Kingston, A., Spiers, G., Robinson, L., Corner, L., Bambra, C., Brayne, C., Matthews, F., & Jagger, C. (2021) "Healthy ageing for all? Comparison of socioeconomic inequalities in health expectancies over two decades in the Cognitive Function and Ageing Studies I and II." *International Journal of Epidemiology*, 1-11. https://doi.org/10.1093/ije/dyaa271
- Spiers, G., Kunonga, T.P., Beyer, F., Craig, D., Hanratty, B., & Jagger, C. (2021) "Trends in health expectancies: a systematic review of international evidence." *BMJ Open* (in press).

The Office for National Statistics (ONS) provides a wide range of figures related to measures of life expectancy. Links to key collections on the ONS website include:

- *Life expectancies* https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies
- *Health and life expectancies* https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies

Appendix 1: Life expectancy – Defining and measuring longevity

Measures of life expectancy are key indicators for understanding the health and longevity of a population. Put simply, life expectancy provides an estimate of how long people can be expected to live on average. There are, however, a range of details that factor into life expectancy measures that influence how we might interpret them.

Life expectancy is expressed with reference to a specific age. Common approaches use important reference points such as birth or age 65; the former reflects a lifelong perspective and the latter puts an emphasis on later life.

Calculating life expectancy may also take a period or cohort perspective. Period measures look at life expectancy across a population for a given time, while cohort measures attempt to assess life expectancy for a specific group of people. Cohort measures account for changes in mortality rates; they can be more appropriate for thinking about a given individual of a specific age and how long they can expect to live.[29]

Life expectancy provides a general picture on the status of longevity in society. But such general measures can't tell us about the quality of these additional years. There's increasing interest in the extent to which longevity is characterised by good or poor health, leading to refined measures of health expectancy.

Such measures include healthy life expectancy (HLE), disability-free life expectancy (DFLE), and dependency-

Definitions of health expectancies

Healthy life expectancy estimates the number of years people live in good health, drawn from individuals' self-reported assessment of their health.

Disability-free life expectancy reflects the number of years people are expected to live without needing help with certain daily activities.

Dependency-free life expectancy is similar to DFLE but uses a wider set of activities and cognitive impairment to reflect the extent to which a person can live independently.

[29]https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/methodologies/periodandcohortlifeexpectancyexplained

free life expectancy (DepFLE).[30] These measures have conceptual similarities, but each reflects a particular nuance of interest for researchers and policymakers interested in older people's health and capacity.

It may also be worth noting that, in technical terms, life expectancy measures are synthetic population-level statistics – that is, they are created by applying assumptions across populations and groups of interest, since we don't know precisely when people in a cohort will die in the future. They are essential tools in understanding public health but yield only limited insights into how an individual's life will progress.

[30]Some research has opted to frame dependency-free life expectancy as independent life expectancy, abbreviated as IndLE. As measurements, DepFLE and IndLE are conceptually the same

Appendix 2: A note on methods and definitions

The *Making the extra years count* project explored some of the underlying drivers for inequalities in life expectancy measures, assessing the extent to which they play a role in observed trends. The project used the Cognitive Function and Ageing Studies (CFAS) to create new models around transitions between different life states, i.e. disability-free, disability, and death, and their impact on life expectancy measures.[31] The nature of the CFAS datasets allowed us to address shortcomings and gaps in previous research on these topics by providing longitudinal data (following the same people over time) in two comparable samples.

The Cognitive Function and Ageing Studies

The Cognitive Function and Ageing Studies (CFAS I and CFAS II) are population-based studies of people aged 65 and over that used random samples from three areas: Cambridgeshire, Newcastle, and Nottingham. CFAS I held interviews that began in 1991, while CFAS II held interviews in 2008; both studies conducted follow-up interviews with participants after two years.

The studies oversampled people aged 75 and over to ensure good coverage and sufficient numbers to conduct robust analyses. They covered the full range of the older population, including those in care homes, nursing homes, and semi-dependent housing. Where appropriate, e.g. where participants were cognitively frail, informant interviews were held with a friend, family member, or carer.

Definitions of disability and dependency

For the analyses conducted as part of *Making the extra years count*, we used specific definitions of disability and dependency.

Disability was grouped as either severe or mild/moderate. Severe disability was defined as involving limitations in activities of daily living (ADLs) and instrumental activities of daily living (IADLs), which indicated that respondents were housebound or required help with at least one of the following: washing all over,

[31]Cognitive Function and Ageing Studies. *CFAS*. 2020 Available from: http://www.cfas.ac.uk.

preparing and cooking a hot meal, and putting on shoes and socks. Mild/moderate disability was defined as involving limitations in IADLs, such as needing help with heavy housework or shopping, and carrying heavy bags. Those with no disability did not need help with any of the above and could get around outside the house.

Dependency was grouped as high, medium, or low; otherwise, people were classed as independent. High dependency involved needing help with toileting or feeding, being chair- or bedbound, or having severe cognitive impairment. Medium dependency involved needing help with either preparing and cooking a hot meal or putting on shoes and socks. Low dependency included those needing help with cutting their toenails, shopping, doing light or heavy housework, or washing/bathing.

About the ILC

The International Longevity Centre UK (ILC) is the UK's specialist think tank on the impact of longevity on society. The ILC was established in 1997, as one of the founder members of the International Longevity Centre Global Alliance, an international network on longevity.

We have unrivalled expertise in demographic change, ageing and longevity. We use this expertise to highlight the impact of ageing on society, working with experts, policy makers and practitioners to provoke conversations and pioneer solutions for a society where everyone can thrive, regardless of age.

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International
Longevity Centre UK

Vintage House
36-37 Albert Embankment
London SE1 7TL
Tel : +44 (0) 203 242 0530
www.ilcuk.org.uk