Forecasted trends in disability and life expectancy in England and Wales up to 2025: a modelling study

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Summary

Background Reliable estimation of future trends in life expectancy and the burden of disability is crucial for ageing societies. Previous forecasts have not considered the potential impact of trends in disease incidence. The present prediction model combines population trends in cardiovascular disease, dementia, disability, and mortality to forecast trends in life expectancy and the burden of disability in England and Wales up to 2025.

Methods We developed and validated the IMPACT-Better Ageing Model—a probabilistic model that tracks the population aged 35–100 years through ten health states characterised by the presence or absence of cardiovascular disease, dementia, disability (difficulty with one or more activities of daily living) or death up to 2025, by use of evidence-based age-specific, sex-specific, and year-specific transition probabilities. As shown in the English Longitudinal Study of Ageing, we projected continuing declines in dementia incidence (2·7% per annum), cardiovascular incidence, and mortality. The model estimates disability prevalence and disabled and disability-free life expectancy by year.

Findings Between 2015 and 2025, the number of people aged 65 years and older will increase by 19·4% (95% uncertainty interval [UI] 17·7–20·9), from 10·4 million (10·37–10·41 million) to 12·4 million (12·23–12·57 million). The number living with disability will increase by 25·0% (95% UI 21·3–28·2), from 2·25 million (2·24–2·27 million) to 2·81 million (2·72–2·89 million). The age-standardised prevalence of disability among this population will remain constant, at 21·7% (95% UI 21·5–21·8) in 2015 and 21·6% (21·3–21·8) in 2025. Total life expectancy at age 65 years will increase by 1·7 years (95% UI 0·1–3·6), from 20·1 years (19·9–20·3) to 21·8 years (20·2–23·6). Disability-free life expectancy at age 65 years will increase by 1·0 years (95% UI 0·1–1·9), from 15·4 years (15·3–15·5) to 16·4 years (15·5–17·3). However, life expectancy with disability will increase more in relative terms, with an increase of roughly 15% from 2015 (4·7 years, 95% UI 4·6–4·8) to 2025 (5·4 years, 4·7–6·4).

Interpretation The number of older people with care needs will expand by 25% by 2025, mainly reflecting population ageing rather than an increase in prevalence of disability. Lifespans will increase further in the next decade, but a quarter of life expectancy at age 65 years will involve disability.

Funding British Heart Foundation.

Lancet Public Health 2017; 2: e307–13

Published Online May 23, 2017 http://dx.doi.org/10.1016/S2468-2667(17)30091-9

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Introduction

The substantial expansion in life expectancy and population ageing during the 20th century is continuing into the 21st century. Life expectancy at age 65 years among the 27 countries of the European Union has increased from 17·8 years in 2002, to 20·0 years in 2014.[1] Rapid ageing of populations in developed countries is set to continue; however, evidence about trends in morbidity and disability prevalence in the past few decades is inconsistent.[2,3]

Policy makers, service planners, and clinicians need reliable forecasts of future trends in life expectancy and the burden of disease and disability. Current projections involve simple extrapolations that fail to consider the combined effect that trends in disease incidence, particularly cardiovascular disease and dementia, will have on the health status of older people. In the UK, concerns exist regarding potential increases in age-related disability. Between 1991 and 2011, findings from the Cognitive Function and Ageing Study (CFAS)[4] showed that although total life expectancy and disability-free life expectancy increased, the proportion of life without disability decreased.

Trends in life expectancy and disability are shaped primarily by trends in the burden of cardiovascular disease and dementia.[5–7] Both conditions are important underlying causes of age-related disability, particularly in middle-income and high-income countries.[7] Cardiovascular disease morbidity and mortality have fallen greatly in the past few decades.[8,9] The associated prolongation of life expectancy has enlarged the pool of individuals surviving to old age and hence susceptible to dementia. Furthermore, because dementia and cardiovascular disease share behavioural and biomedical risk factors,[5,10] reduction in vascular risk might also reduce age-specific dementia incidence.[11–13] On the basis of these

See Online for appendix

Research in context

Evidence before this study

Between Oct 1, and Oct 30, 2016, we searched PubMed for studies forecasting future trends in disability or dementia in the UK, with the search terms "disability", "dementia", "longevity", "life expectancy", "forecasting", "simulation", "model" and synonyms of "United Kingdom". The appendix (pp 12, 13) lists our complete PubMed search strings and shows results of our systematic review of the literature. We did additional hand searches with lists of references retrieved from relevant papers. We identified only two studies forecasting total life expectancy at age 65 years, neither of which investigated disability or disability-free life expectancies, and two studies reporting a future number of cases with disability in England and Wales. None of these studies modelled future trends in disability and life expectancy while explicitly including interactions between trends in cardiovascular disease and dementia.

Added value of this study

To our knowledge, this is the first study to model future trends in disability in the UK using empirical longitudinal data for England and Wales while also taking into account interactions over time between cardiovascular disease, dementia, and disability. Our findings show that people in England and Wales will live longer but, on average, a quarter of the extra years gained after age 65 years will involve disability. The overall burden of disability will grow primarily as a consequence of population ageing rather than an increase in the prevalence of disability. These predictions have profound individual and societal implications.

Implications of all available evidence

Changes in vascular risk factors are considered to be the primary drivers of trends in cardiovascular disease and dementia incidence; therefore, future forecasts of disability need to take into account the interaction of these conditions over time. Simulation modelling offers a platform to gain new insights to inform these projections and highlight opportunities for further refinement. Subsequent research should identify which prevention strategies might provide the biggest health and economic benefits in the future.

two opposing effects, forecasting of the projected prevalence of disability requires simultaneous modelling of both conditions.

Previous studies have not considered the complex synergies of life expectancy, cardiovascular disease, and dementia, nor the contribution of these chronic conditions to disability over time.[14] We therefore aimed to forecast trends in disability and life expectancy in England and Wales up to 2025, simultaneously accounting for time-varying trends in morbidity and mortality.

Methods

Model design

We developed and validated the IMPACT-Better Ageing Model (IMPACT-BAM)—a discrete-time probabilistic Markov model that follows the progression of a healthy population (aged 35–100 years) of England and Wales from 2006 to 2025 into eight different states characterised by the presence or absence of cardiovascular disease, cognitive impairment, and moderate-to-severe functional impairment (moderate-to-severe disability), and two states for death from cardiovascular disease and non-cardiovascular disease causes (appendix p 14). Movements of the population between these ten states are governed by 1 year age-specific, sex-specific, and year-specific probabilities of transition. IMPACT-BAM is a population model such that for each year in the simulation, a new cohort of 35-year-olds enters the system through the disease-free state.

Data sources

For the **Office of National Statistics** see https://www.ons.gov.uk

We combined age-specific and sex-specific population estimates from the Office for National Statistics with prevalence data from the English Longitudinal Study of Ageing (ELSA)[15] to populate all the states in the model at the start of the simulation. We used projections from the Office for National Statistics until 2025 to create the input population vector of 35-year-olds assumed to be disease-free at entry. Data for calculation of probabilities of transition were also from ELSA.[15]

Health states

We defined cardiovascular disease as a diagnosis of cardiovascular disease; myocardial infarction; or stroke or angina, or both. We defined cognitive impairment without dementia as impairment in two or more domains of cognitive function tests applied to ELSA participants (such as orientation to time, immediate and delayed memory, verbal fluency, and numeracy function). For individuals who were unable to take the cognitive function tests, the Informant Questionnaire on Cognitive Decline (IQCODE) was administered to a proxy informant (usually an immediate family member).[16] A score higher than 3·6 on the IQCODE was used to identify cognitive impairment without dementia. We defined functional impairment or disability as the inability to independently do one or more activities of daily living, which included getting in or out of bed, walking across a room, bathing or showering, using the toilet, dressing, cutting food, and eating. This definition of disability captures numbers of individuals who have difficulty maintaining self-care independence and require supportive care.

We defined dementia on the basis of the coexistence of cognitive impairment and functional impairment, or a report of a doctor diagnosis of dementia by the participant