Socioeconomic status and the expectation of disability in old age: estimates for England

The Medical Research Council Cognitive Function and Ageing Study (MRC CFAS) writing committee: David Melzer, Brenda McWilliams, Carol Brayne, Tony Johnson, John Bond

Abstract

***Objectives*—The longer life expectancy in old age of more privileged socioeconomic groups is well established, but less clear is whether the net effect of additional years of life is a lengthened, stable or reduced duration of disability. Estimates of healthy and disabled life expectancy (using definitions including dependency in activities of daily living and cognitive impairment) were made, contrasting occupational classes I and II (professional and managerial) with the rest.**

***Design*—Disability prevalence was estimated from the Medical Research Council Cognitive Function and Ageing study. Sullivan's method was used to calculate health expectancy.**

***Subjects*—10 377 people aged 65 years or over in Cambridgeshire, Newcastle, Nottingham and Oxford. Subjects were classified as disabled if they had evidence of dementia (using the Automated Geriatric Examination Computer Assisted Taxonomy) or scored 11 or more on the modified Townsend Disability scale, at baseline screen.**

***Results*—The prevalence of disability overall and need for "constant care" was lower in both men and women in social classes I and II compared with the rest. Men aged 65 to 69 in classes I and II can expect nearly 14 years of life free of disability compared with 11.5 years for those in classes III to V: for women the equivalent expectations are 15.5 and 13.8 years. Men aged 65 to 69 in classes I and II can also expect a shorter duration of disability: 1 year compared with 1.6 years for classes III to V. In women expectation of disability is higher overall, but shows little difference by occupational class.**

***Conclusions*—Relatively privileged socioeconomic groups in England, especially men, can expect fewer years of disability despite longer overall life expectancy. These findings lend weight to optimistic scenarios for the future numbers of older people with disability.**

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Department of Public Health and Primary Care, University of Cambridge
D Melzer
B McWilliams
C Brayne

Centre for Health Services Research, University of Newcastle upon Tyne
J Bond

Medical Research Council Biostatistics Unit, Cambridge
T Johnson

Correspondence to:
Dr Melzer, Institute of Public Health, Forvie Site, Robinson Way, Cambridge, CB2 2SR

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Socioeconomic differences are one of the key influences on health and their effect on mortality in old age is well established.[1] It is also clear from several studies that the prevalence of disability in relatively privileged sections of the older population is lower.[2] What is less clear, however, is whether the net effect of longer survival of privileged socioeconomic subgroups is lengthened, stable or diminished numbers of years lived with disability in old age.

Theories about the effect of rising life expectancy in populations over time vary from the pessimistic, which predict that additional years of life will be spent in a dependent state,[3] through to the optimistic, which envisage a compression of morbidity into an increasingly brief period before death.[4] Clearly, a similar range of possibilities might apply to longer lived subgroups within the current older population. As health, social and long term care service use is closely related to disability,[5] establishing the expectation of disability in longer lived subgroups is of considerable policy importance in efforts to prepare health and welfare institutions for an aging society.

The best measure combining disability and mortality data is disability free life expectancy,[6] which estimates the average number of years of life free of disability remaining at a given age to members of a particular population. This index is independent of the particular age structure of the study population and is therefore useful for comparing population health states and for monitoring and projecting future population health. Conventionally, only physical disabilities or limitations in activities of daily living are considered, although this may introduce biases by excluding cognitive impairments, which are a major element of disability especially at older ages.[7]

Estimates of disability free life expectancy for different socioeconomic groups have been provided for the USA[8 9] showing that subgroups who had more education have longer expectancy of life free of disability and a shorter proportion of their lives lived with disability, but a similar or longer actual duration of expected disability. Previous estimates of disability free life expectancy by socioeconomic group for the UK[10] have suggested that life expectancy without disability made up a larger proportion of total life expectancy in relatively privileged subgroups. However, these data are from the mid-eighties, measures of disability were relatively crude, and data on occupation were missing in 27% of those with disabilities.

The study presented here aimed to estimate the disability free life expectancy, and the expectancy of life with physical disability or cognitive impairment by socioeconomic groups in England using the UK occupationally defined social class. The Medical Research

Council Cognitive Function and Ageing Study[11] provides a large and recent source of data to explore this issue. This paper presents prevalence data for a range of measures of disability by social class and estimates of the expectation of health and disability in a range of age groups for men and women. The implications of the patterns of healthy and disabled life expectancy reported here are then explored by contrasting traditional projections with social class based short-term projections of future numbers of older people with disability in England.

Method

THE SAMPLE

The Cognitive Function and Ageing Study (CFAS) was set up in 1991 as a two stage population prevalence survey with longitudinal follow up. Full details of the study can be found elsewhere.[11] Stratified random population samples of people in their 65th year and above were selected from Family Health Service Authority lists to provide equal numbers in the two age groups 65 to 74 years and 75 years and over, and included people living in institutions. Initially each person in the sample was interviewed in their home by a trained fieldworker using a computerised interview. At this prevalence screening interview, data were collected covering basic demographic details (including years of full time education and social class), activities of daily living, help provided with certain activities, social networks, health, cognitive functioning and the presence of organic psychiatric disorder (assessed by diagnostic interview). Data from the initial prevalence screen (Version 4.0) for Cambridgeshire, Newcastle, Nottingham and Oxford were used in this analysis, plus death notifications from the National Health Service Central Register. Prevalence screening information was available on 10 377 people from these sites and data were pooled as there were no important differences between the sites in demographic structure or cognitive impairment.[11]

Social class was coded according to OPCS standard occupational codes using CASOC,[12] coding each person's main occupation for most of their working life and the occupation of their most recent husband for married, widowed, divorced or separated women. Class I and II includes all those who had professional and managerial occupations; class III to V includes class IIIN (skilled non-manual, for example, clerical and secretarial), class IIIM (skilled manual, for example, craft and related occupations and foremen), class IV (partly skilled occupations, for example, street traders and scaffolders) and class V (unskilled occupations, for example, cleaners and farm labourers).

Table 1 Number of people in the study sample by age, sex and social class

	Men		*Women*		
Age groups (years)	*Social class I+II*	*Social class III–V*	*Social class I+II*	*Social class III–V*	*Total*
65–74	620	1638	762	1996	5 106
75–84	428	1075	684	1856	4 043
85+	75	228	251	628	1 182
Total	1 123	2 941	1 697	4 480	10 241

Those who were unclassified by social class (2.7%) have been randomly allocated in age/sex specific proportions to the two social class groups and those in the armed forces (1.3%) have been excluded.

DEFINITIONS OF DISABILITY AND NEED FOR CARE

People in the sample were identified as disabled if they were mentally impaired, physically disabled or both. Mental impairment (possible dementia) was measured at screen by the Automated Geriatric Examination Computer Assisted Taxonomy (AGECAT).[13] If the AGECAT organic syndrome level was 3 or more (identifying possible dementia), people were classified as mentally impaired. They were identified as physically disabled if they scored 11 or more on the modified Townsend Disability Scale.[14] This scale covers nine activities of daily living (washing all over, cutting toenails, getting on a bus, going up and down stairs, doing heavy housework, going shopping and carrying heavy bags, preparing and cooking hot meals, reaching an overhead shelf and tying a good knot in a piece of string). Each activity scores 0 (no difficulty), 1 (can do but with difficulty) or 2 (not able) and the scores are summed to give a total, which is subdivided into five groups: 0 (no incapacity), 1–2 (slight incapacity), 3–6 (some incapacity), 7–10 (appreciable incapacity) and 11 or more (severe incapacity). A person who is classified as physically disabled (scoring 11 or more) would need help with at least two of the specified activities and have some difficulty with some or all of the rest.

People were also classified as needing constant care or supervision, based on the "critical interval of need for care". The two dimensions in this classification[14] are functional incapacity (self care, house care and mobility) and mental state. People were first allocated to a category on the basis of their daily living functioning (from the Townsend disability scale plus a further three activities) and their degree of mobility (from a specific question asked at screening), and then on their degree of mental impairment, as measured by the Mini Mental State Examination.[15] All those with severe mental impairment (MMSE score less than 10) are classified here as needing constant care regardless of their physical state. Typically, a person with critical interval or constant care needs would be bedfast or chairfast, or unable to get to or use the toilet, or be severely mentally impaired.

HEALTHY LIFE EXPECTANCY

Healthy life expectancy is the number of years a person, at a particular age, can expect to live in a healthy state (however health is defined). Healthy and disabled life expectancies together with confidence intervals were calculated using Sullivan's method.[16] Sullivan's method involves dividing expected years lived from the life table for the study population into active and inactive years, based on age specific prevalence estimates of the proportion of the population that is active or inactive (disabled). Age specific mortality rates for different social class

Table 2 Prevalence of disability, need for constant care, poor self assessed health and mortality during the two years after screening interview, by gender and age group

	Men		*Women*	
Age groups	*Social class I+II % (95% CI)*	*Social class III–V % (95% CI)*	*Social class I+II % (95% CI)*	*Social class III–V % (95% CI)*
*All disability**				
65–74	3.1 (1.7,4.5)	6.5 (5.3,7.7)	3.9 (2.5,5.3)	7.9 (6.7,9.1)
75–84	6.8 (4.4,9.2)	17.5 (15.2,19.8)	16.8 (14.0,20.0)	24.3 (22.3,26.3)
85+	26.7 (16.7,36.7)	38.8 (32.5,45.1)	53.8 (47.6,60.0)	55.9 (52.0,59.8)
Severe disability (needing constant care)†				
65–74	1.9 (0.8,2.9)	2.4 (1.7,3.1)	0.8 (0.2,1.4)	2.2 (1.6,2.8)
75–84	2.1 (0.7,3.4)	4.1 (2.9,5.3)	4.4 (2.9,5.9)	5.8 (4.7,6.9)
85+	6.8 (1.1,12.5)	9.4 (5.6,13.2)	14.7 (10.3,19.1)	15.1 (12.2,17.9)
Poor self assessed health‡				
65–74	3.6 (2.1,5.1)	7.3 (6.0,8.6)	3.2 (1.9,4.5)	7.0 (5.9,8.1)
75–84	3.3 (1.6,5.0)	7.9 (6.3,9.5)	3.5 (2.1,4.9)	7.7 (6.5,8.9)
85+	4.3 (0.0,9.1)	6.3 (3.0,9.6)	5.5 (2.5,8.5)	6.6 (4.5,8.7)
Mortality§				
65–74	6.1 (4.2,8.0)	7.8 (6.5,9.1)	2.5 (1.4,3.6)	4.0 (3.1,4.9)
75–84	12.1 (9.0,15.2)	17.2 (14.9,19.5)	9.1 (6.9,11.3)	11.8 (10.3,13.3)
85+	24.0 (14.3,33.7)	31.1 (25.1,37.1)	24.3 (19.0,29.6)	27.1 (23.6,30.6)

% Unclassified and excluded from table: *0.2%, †0.8%, ‡2.8%. †Needing constant care (that is, bedfast or chairfast or unable to get to or use the toilet or severely mentally impaired). §Died within two years from prevalence screen. Those unclassified on social class were randomly allocated in age/sex proportions to the two groups and those classified as armed forces were excluded.

categories were obtained from the *Health Inequalities* [17] data set published by the Office for National Statistics (1997), supplemented by further data obtained directly. Abridged life tables for the years 1987 to 1991 (England and Wales) were used as they were the most recent years for which figures were available and closest in time to the CFAS.

Age specific disability rates (as defined above) were obtained from the CFAS sample and combined with the mortality rates to estimate healthy and disabled life expectancies separately for men and women in social classes "I and II" and "III to V". People who were classified as "armed forces" were excluded from these calculations, but those who were unclassified were randomly allocated to the two groups (I+II or III–V) in the same age/sex specific proportions as the rest of the sample.

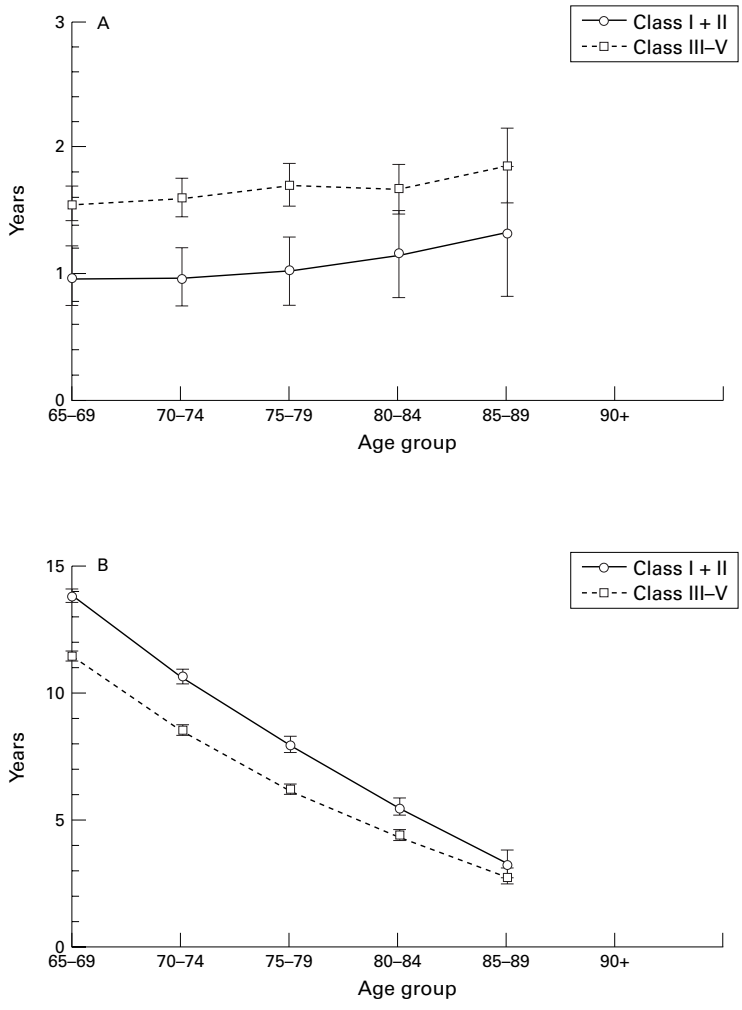

Figure 1 (A) Estimated years of disabled life (dependency in activities of daily living or cognitive impairment, or both) remaining (95% confidence intervals) by age and social class group for men, 1987–1991. (B) Estimated years of disability free life remaining (95% confidence intervals) by age and social class for men, 1987–1991.

PROJECTIONS

Three scenarios were adopted to project changes in the numbers of disabled elderly people (aged 65 plus) over the 20 year period from 1996 to 2016. All scenarios use the same 1994 based population projections for England and Wales,[18] which assume reductions in future mortality: for example a 28.9% fall in mortality for men aged 65 to 69 is expected by 2016. *Scenario 1* assumes baseline age/sex specific disability rates will remain constant. Estimates were calculated within age and sex groups for five yearly intervals. *Scenario 2* assumes age and sex specific disability rates decrease by the same percentage as mortality rates are projected to decrease over the same period. *Scenario 3* assumes that the overall prevalence of disability will linearly reduce to 1996 social class I and II patterns by 2016. This last scenario is based on past changes: overall life expectancy at 65 for men and women in 1991 had reached the levels seen in the upper two social classes in 1972.[17]

Results

Table 1 summarises the study population by age, gender, and social class. There were 10 377 people in the original sample of whom 39% were men and 61% were women. Two hundred and seventy nine people (2.7%) were not classified by social class but these have been randomly allocated in age/sex specific proportions to the two social class groups. One hundred and thirty four people (1.3%) were in the armed forces and these have not been included in the table: thus 10 241 people were included in the analyses.

Table 2 summarises the proportions of people with disability, constant care needs and poor self assessed health by gender and social class. The table also shows the proportion in each group who died during the two years from the baseline interview. The data illustrate the well established pattern of rising rates of disability with age and higher rates of disability in women. More importantly for this analysis, an overall pattern of significantly higher morbidity and mortality in less privileged social classes is evident.

The most meaningful index of both disability and mortality data is healthy and disabled life expectancy. In figure 1 (A and B), the disability rates presented above are combined with national data on life expectancy by social class to estimate healthy and disabled life expectancy across several age groups. Figure 1 (A and B)

Table 3 Disability free, disabled and total life expectancy in men and women aged 65–69, by alternative definitions of disability, 1987–1991

	Men				Women			
	Disability free expectancy (y)	*Disabled life expectancy (y)*	*Total*	*% of total expectancy that is disabled*	*Disability free expectancy (y)*	*Disabled life expectancy (y)*	*Total*	*% of total expectancy that is disabled*
Activity of daily living disability and/or cognitive impairment								
Social class I+II	14.0	1.0	15.0	6.6	15.5	3.2	18.7	17.0
Social class III–V	11.6	1.6	13.1	12.0	13.8	3.4	17.2	19.9
Social class III	*12.1*	*1.5*	*13.6*	*10.8*	*14.3*	*3.3*	*17.6*	*18.6*
Social class IV+V	*10.5*	*1.9*	*12.4*	*15.1*	*12.8*	*3.9*	*16.7*	*23.2*
Activity of daily living disability only (ignoring cognitive impairment)								
Social class I+II	14.4	0.6	15.0	3.7	16.7	2.1	18.7	11.0
Social class III–V	12.3	0.8	13.1	6.4	14.9	2.3	17.2	13.1
Severe disability (Need for constant care)*								
Social class I+II	14.6	0.4	15.0	2.5	17.9	0.9	18.7	4.6
Social class III–V	12.7	0.5	13.2	3.4	16.3	0.9	17.2	5.2
Poor self assessed health								
Social class I+II	14.4	0.5	15.0	3.5	18.0	0.7	18.7	3.8
Social class III–V	12.1	1.0	13.1	7.5	15.9	1.2	17.2	7.2

*Needing constant care (that is, bedfast or chairfast or unable to get to or use the toilet or severely mentally impaired).

shows that the upper quartile of social class men can expect a shorter duration of disability combined with a longer healthy life expectancy, although the differences are less statistically significant in the oldest groups. Thus, a man in social class III to V and age group 65 to 69 could expect to live 13.1 years, 11.6 without disability (table 3) and 1.6 years with disability, during 1987–91. On the other hand, a similar man in social class I and II can expect to live 1.9 years longer in total, 14 without disability but only 1 with disability.

By contrast with the pattern in men, the greater healthy life expectancy of upper social class women is associated with virtually unchanged expectancy of disability (fig 2 (A and B)). Thus, women in social class III to V and age group 65 to 69 could expect to live 17.18 years in all (table 3), 13.76 without disability and 3.42 years with disability. By contrast, a similar group of women in social class I and II could expect to live 1.5 years longer overall (18.72 years in total) with a statistically insignificant 0.2 of a year less of living with disability.

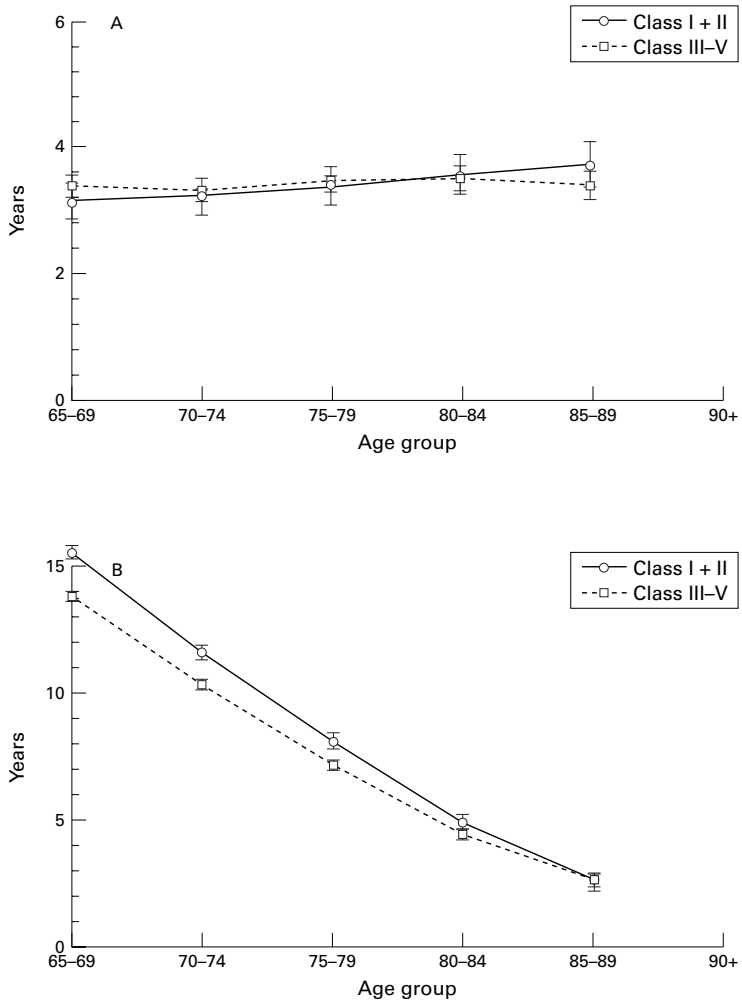

Figure 2 (A) Estimated years of disabled life (dependency in activities of daily living or cognitive impairment, or both) remaining (95% confidence intervals) by age and social class group for women, 1987–1991. (B) Estimated years of disability free life remaining (95% confidence intervals) by age and social class for women, 1987–1991.

CONFIRMATORY ANALYSES

The pattern of shorter expectation of disability in upper class men, with stable expectation in women is evident in a range of confirmatory analyses. Calculating the Sullivan table using single years (rather than abridging to five year groups), with mortality measured from the CFAS study, produces little difference in the pattern of results: an expectation of disability at age 65 for men in social class I and II of 1.63 years versus 2.00 years in classes III to V, and for women 4.22 years and 4.29 years respectively.

Expectation of severe disability assessed as constant care needs (table 3), is 0.38 years in social class I and II men aged 65 to 69, but 0.45 years in social classes III to V. On self assessed health, a similar pattern is evident: expectation of time with poor health is 0.52 years in social class I and II men, but 0.98 years in social classes III to V. It should be noted that the proportion of life expectancy that is disabled for men and women in the upper social class groups is always lower than that for the rest, but as presented above, this is only of sufficient magnitude to reduce absolute time lived with a disability in men.

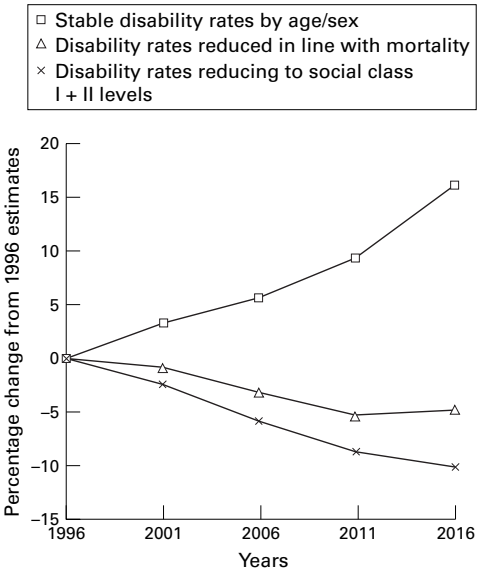

Figure 3 Projected percentage change in numbers of frail older people from a 1996 baseline for three scenarios: stable age specific rates of disability, disability reductions in line with projected mortality and overall disability progressively reaching rates currently enjoyed by non-manual occupational classes.

PROJECTED NUMBERS WITH DISABILITY

In figure 3 we present projected percentage changes in the numbers of disabled older people in England and Wales under the three chosen scenarios (see methods). The first two scenarios follow frequently used assumptions of (a) stable age and sex specific rates of disability and (b) rates of disability that reduce in line with projected reductions in mortality. The third scenario shows the percentage change in numbers that we can expect if average rates of disability for all older people linearly reduce to the rates currently achieved in social class I and II, over the next 20 years. This last grouping and time period projects forward for disability the changes in life expectancy in the UK at age 65 seen between 1972 and 1991.[17] All three scenarios incorporate the official estimate of future population growth and its associated fall in mortality.

Figure 3 shows that under the conventional projection of no change in age and sex specific rates of disability, substantial increases in total numbers of disabled elderly people should be expected. However, if disability rates reduce to those of the upper social class group, a fall of 10% could be expected in total numbers. Changes in disability rates in line with mortality would result in a slightly less optimistic scenario.

Discussion

The results presented above are consistent with a large body of research on disability in old age. Levels of disability in women are substantially higher than those in men and lower socioeconomic groups are again shown to experience higher mortality and a higher prevalence of disability, both in men and women.[1 2 10 19–22] The results are also consistent with recent work on healthier sub-populations of older people, previously defined by years of education[23 24] or healthy behaviour.[25] This analysis goes further however, in showing that the net effect of differences in mortality and disability on healthy and disabled life expectancy in older people in the UK is complex, with evidence of a significantly shorter expectation of disability in relatively privileged older men.

However, a number of methodological issues need to be considered in evaluating these results. The study is not based on national data, but rather samples from four sites in England, although basic socioeconomic characteristics across these populations are similar to the national pattern.[11] The study method has involved some re-allocation of missing data on a random basis within age/sex groupings, although this process will have had the effect of reducing the reported differences. In any event, these effects will be small, because for example, the highest percentage of data missing was 2.8% of the total in the measure of needing constant care and supervision.

The definition of disability is crucial in evaluating the results of any study of healthy life expectancy.[26] Work on trends in disability have found diverging patterns with different measures of disability[27] and thus we have reported several measures including disability in activity of daily living or cognitive impairment, the same definition ignoring cognitive impairment, severe disability sufficient to imply a need for constant care and attention and finally, self assessed health. It is clear from table 3 that the overall pattern of substantially lower rates, especially in men in privileged socioeconomic groups is present across these variables, although these do not always reach statistical significance, mostly because the prevalence and study numbers are small. The social class classification can also be criticised as not reflecting the circumstances of people who may have retired long ago, especially for older women.[21] However, when the analyses were repeated with the population divided on the basis of more than 10 years in education (which included the upper 22%), a similar pattern was seen.

The Sullivan method for assessing healthy and disabled life expectancy, used here, is based on current rates of disability measured on a cross sectional basis in the population. In theory this measure may be biased if rates of becoming disabled and remission have undergone sudden and irregular changes over the longer term. As there is no evidence of abrupt changes in patterns of onset and recovery from the broad categories of disability presented here, Sullivan's method should provide a good measure of healthy and disabled life expectancy.[6 28] Using the alternative multi-state models (based on computed risks of transition to disability, recovery from disability or death over a set time period) also raises difficulties as estimates can be unstable[29] and sensitive to the details of study method. These methodological differences may explain the differences in findings between this study and the US studies by Guralnik[5] (who reported some excess of expected duration of disability in more educated subgroups) and Crimmins[9] (who found

similar expectations of disability across educational groups). Further work to explore these diverging patterns is justified.

The measured healthy and disabled life expectancy at younger ages is clearly significantly different in upper social class men (fig 1) but differences appear to reduce in very old age groups. Caution needs to be exercised about the findings in the oldest old, as lack of statistical power, perhaps greater levels of misclassification by social class and healthy survivor effects may be operating. For women, the pattern is different in that both groups have far higher expectations of disability, although with no sign of the additional healthy life expectancy in upper class women being associated with more years of disability. Establishing whether disease specific expectations of disability explain the different male and female patterns in duration of disability by socioeconomic status is an important next step.

As far as the projections are concerned, there are strong reasons for wanting to estimate future numbers of older people with disability. In line with most developed and developing countries, the UK population is aging and as the postwar generation reaches retirement the pace of that aging will increase dramatically, with profound social effects. The current decade is therefore the ideal time in which to prepare institutions for the challenges ahead. One major difficulty in planning for future health and long term care needs, however, is the lack of agreed estimates of future numbers and needs.

In theory, longitudinal studies over long periods of time offer the best prospect of answering questions about trends in disability, although these studies cannot, of course, take account of the effects of future preventive or curative interventions. Recent analyses of a number of longitudinal studies from the USA suggest that after rising in the 1970s, disability rates in older people fell during the 1980s.[30 31] Unfortunately there is no adequate source of data on long term trends in disability in the whole elderly population in the United Kingdom.[27]

For policy purposes, estimates of future numbers of older people with disabilities have accommodated the uncertainties by providing a range of projections. For example, in the USA Kunkel and Applebaum[32] computed four models, of which the optimistic one assumed a 15% reduction in disability over 25 years, while the UK Department of Health provided projections based on 1% annual increases or decreases in age specific morbidity rates.[33]

The projections presented here contrast the "standard" projections of stable rates of disability or disability reductions in line with projected mortality changes with a new scenario, based on the current disability rates in the upper two social classes. This last scenario is based on past changes: overall life expectancy at 65 in England for men and women in 1991 had reached the levels seen in the upper two social classes in 1972.[17] These scenarios illustrate again the very different pattern of challenges that might develop over the relatively short period to 2016. One possible objection to the social class based scenario is that it assumes the same population projections as the others. However, the population projections used already assume age/sex specific mortality rates for 2016 that are 10% to 29% lower than those experienced by social classes I and II around the time of this study. Obviously, if mortality rates fall even further, more people would live to even older ages, making the estimate from scenario 3 too low.

KEY POINTS

- The elderly upper social classes in England can expect longer lives and lower prevalence rates of disability than those less privileged.
- Disabled life expectancy for upper class men is shorter than for other men, but for women is similar across class.
- If overall, the elderly could achieve by 2016 disability prevalences now achieved by classes I–II, absolute numbers disabled could fall, despite projected increases in population and longevity.

Uncertainty over future trends in numbers of disabled older people and the existence of relatively low disability sub-populations argues for policies that concentrate on shorter term issues[5] including prevention of disability, rather than on efforts to limit the entitlement of older people to services, on the assumption that state budgets will be unable to cope in 20 years time.[34]

This study provides cross sectional evidence that privileged sub-populations defined by occupationally based social class in the UK can expect to live longer and be disabled for a shorter time before death than their less privileged counterparts. This pattern of shorter expectation of disability in old age in longer lived and more privileged sections of the population is more marked in men than women. These findings lend weight to the argument for more optimistic scenarios for future numbers of older people with disability in the aging population of developed countries.

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Conflicts of interest: none.

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