Socioeconomic position and the association between anticipated and actual survival in older English adults

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ABSTRACT

Background Socioeconomic disadvantage may cause individuals to have lower expectations of longevity and not engage in healthy behaviours because they judge the long-term health benefits of these to be minimal.

We explored demographic, health behaviour, health and socioeconomic correlates of subjectively estimated lifespan ('anticipated survival'); the ability of anticipated survival to predict actual survival; and whether the predictive ability of anticipated survival differed by other variables, particularly socioeconomic position.

Methods Data were from wave 1 of the English Longitudinal Study of Ageing. Anticipated survival for up to 25 years was measured on a scale of 0–100. Actual survival was measured over a mean of 6 years, and socioeconomic position using education, household income, occupational class and area deprivation.

Results Of 10 768 participants, 2255 (21%) died during follow-up. Anticipated survival was positively associated with socioeconomic position, and was greater in women, younger individuals, non-smokers and those who were not widowed, consumed more alcohol, were more physically active, and reported better physical and mental health. After full adjustment, anticipated survival remained positively associated with actual survival. Those reporting low anticipated survival were more likely to die over time than those reporting moderate anticipated survival (HR (95% CIs 1.11 (1.00 to 1.23). The relationship differed significantly by income and age, being strongest in younger individuals and those with higher household income.

Conclusions Anticipated survival varied with other variables as expected and reflected actual survival. Younger individuals and those with higher household income were better able to identify subtle differences associated with actual survival.

INTRODUCTION

Socioeconomic differences in smoking, physical activity, diet and alcohol consumption have been estimated to account for up to 72% of overall socioeconomic differences in mortality.[1] Socioeconomic inequalities in health behaviours are likely to be multifactorial,[2] resulting from a combination of environmental constraints making some behaviours difficult to adopt,[3] social norms making some behaviours socially unacceptable,[4] lack of knowledge of why behaviour should be changed, and lack of skills to enable change.[5] However, all these explanations rest on an assumption that individuals would adopt healthy behaviours if they could and understood they should.[6]

Alternatively, individuals living in more deprived circumstances may decide not to engage in healthy behaviours because they, accurately, estimate their remaining lifespan ('anticipated survival') to be shorter, and the benefits to their health and longevity of healthy behaviours to be less, than for more affluent individuals.[7–9] If the accuracy of anticipated survival also varies systematically by socioeconomic position (SEP), this would be expected to further exacerbate socioeconomic inequalities in health behaviours.[8] Thus, an important question in understanding socioeconomic inequalities in health and health behaviours is whether or not the accuracy of anticipated survival is socioeconomically patterned.

There is some inconsistent evidence that the association between self-rated health and mortality is stronger in more, versus, less affluent populations.[10–15] Anticipated survival is less commonly studied in the health literature than self-rated health. Previous research confirms that anticipated survival predicts life table estimates of mortality, as well as observed mortality over 2–3 years follow-up.[16–21] Furthermore, population groups known to have lower actual mortality report higher anticipated survival—including non-smokers, women, those with better health status,[18] and those living in more deprived circumstances.[18 22–24]

However, while socioeconomic differences in anticipated survival have been studied, differences in the relationship between anticipated and actual survival according to SEP have received less attention. Thus, while it is reasonably clear that those living in less affluent circumstances accurately rate their chances of survival as lower than those living in more affluent circumstances do, it is not clear if there are systematic socioeconomic differences in the accuracy of these anticipated ratings. Additionally, much previous work has relied on data from adults aged less than 75 years, where anticipated survival may be generally high.[16–18 20–22]

Our aims were to explore: whether SEP, demographic, health behaviours and markers of health correlated with anticipated survival; the ability of anticipated survival to predict actual survival; and whether the predictive ability of anticipated survival differed according to SEP, demographic, health behaviours, or markers of health in older English adults.

METHODS

Data and inclusion criteria

We used data from wave 1 of the English Longitudinal Study of Ageing (ELSA), collected in

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2002–2003, with mortality follow-up to the end of 2011. Designed to be representative of individuals aged 50 years or older living in private households in England, ELSA is a prospective cohort study of the factors associated with quality of life as individuals age.[25 26]

All core ELSA participants who took part in wave 1 data collection in 2002–2003 were considered for inclusion (n=12 100). We excluded individuals who were below 50 years of age at interview (n=636), new partners (n=72), and those with partially complete (n=205) or proxy (n=158) interviews where key questions were not asked. This left an eligible cohort of 11 029.

Variables of interest

Anticipated survival

We measured anticipated survival, using responses to the question 'What are the chances (from 0 to 100) that you will live to be x years or more?'. The target age, x, varied with participants' age, ranging from 1 to 25 years older than current age. For individuals aged ≤65 years, x=75; for those aged 66–69 years, x=80; for those aged 70–74 years, x=85; for those aged 75–79 years, x=90; for those aged 80–84 years, x=95; and for those aged 85–99 years, x=100. Due to response spikes at 25, 50, and 75%, we grouped responses into tertiles for analysis: low (0–33% chance of survival), medium (33–66%), and high (66–100%). Differences in the target age that individuals were asked about can be taken into account by controlling for the difference between current and target age. As this did not change any results, we report results without this control.

Actual survival

Actual survival was measured using mortality data up to the end of 2011. To maintain anonymity, only year of death was available.

Socioeconomic position

We used four different measures of SEP. These were: total years of full-time education; current weekly household income adjusted for household size;[27] occupational social class based on current or last main occupation of the main household wage earner, assigned using the UK National Statistics Socio-economic Classification (NS-SEC);[28] and Index of Multiple Deprivation score (IMD) of current small area of residence.[29]

For analysis, markers of SEP were recoded as follows: household income into tertiles (less than £141.22, £141.22–£251.95, or more than £251.95 per week); IMD score as least deprived (deciles 1–3), moderately deprived (deciles 4–6), or most deprived (deciles 7–10); occupational social class as managerial & professional, intermediate occupation, or routine & manual occupations; and education as no qualifications, O-levels or equivalent qualifications for school exit at age 16 years, A-levels or equivalent qualifications for school exit at age 18 years, or postschool-level qualifications.

Other potential explanatory and confounding variables

We included a range of potential confounding factors that have previously been reported to be associated with actual or anticipated survival or both.

Age at wave 1 was grouped into six categories, 50–65, 66–69, 70–74, 75–79, 80–84, or 85 years and older, corresponding to the bands used for the question on anticipated survival, but collapsing the oldest, least populated age groups together. Marital status was coded as never married, currently married, divorced or separated and not remarried, or widowed and not remarried.

Depression was measured using the CES-D 8-item scale that has been widely used as a screening tool.[30 31] As previously,[32] we dichotomised scores into those that did (4–20) and did not (0–3) suggest clinically meaningful depression.

Current cigarette smoking was determined using answers to the question 'Do you smoke cigarettes at all nowadays?': yes or no. Alcohol consumption was determined using the question 'In the past 12 months have you taken an alcohol drink….?': not at all, on special occasions only, once or twice a month, once or twice a week, daily or almost daily, and twice a day or more. As previously,[33] we dichotomised alcohol consumption as more than once or twice a week, or not. Total physical activity was dichotomised as sedentary or low, or moderate or high using answers to questions on occupational activity and frequency of sports or activities of mild, moderate, and vigorous intensity.[34]

Self-rated health was assessed using the question 'How is your health in general?' with response options collapsed for analyses into, excellent or very good, good, and fair or poor. An activities of daily living (ADL) score was calculated from the number of difficulties due to health problems in dressing, walking across a room, bathing or showering, eating, getting out of bed, and using the toilet (score 0–7). An instrumental ADL (IADL) score was calculated from the number of difficulties due to health problems with using a map, preparing a hot meal, grocery shopping, making telephone calls, taking medications, doing housework or gardening, and managing money (score 0–7).[35] For analysis, ADL and IADL scores were collapsed into 0, 1–2, or 3+ difficulties.

Analysis

Differences in the distribution of anticipated survival according to demographic, health and socioeconomic characteristics were assessed by fitting unadjusted ordinal logistic regression models.

To explore the ability of anticipated survival to predict actual survival, we fitted Cox proportional hazards regression models with actual survival as the dependent variable and anticipated survival as the independent variable. Unadjusted and adjusted models were fitted with adjustment for all demographic, health behaviour and health variables, and with each marker of SEP individually (to avoid possible multicollinearity).

To determine whether the relationship between anticipated and actual survival varied by markers of SEP (or other variables considered), we explored interactions with anticipated survival in the fully adjusted Cox models for all markers of SEP and for other variables which showed a significant main effect.

RESULTS

Of 11 029 individuals eligible for inclusion, 10 768 (97.6%) provided usable data on anticipated survival, and were included in the analyses. Distribution of demographic, health behaviour, health status and socioeconomic variables overall and by anticipated survival are shown in table 1.

There were significant differences in the distribution of anticipated survival across categories of all baseline demographic, health behaviour, health status and socioeconomic characteristics (table 1). Men, older respondents, those who were widowed, current smokers, those drinking less than once or twice a week, those reporting moderate or high physical activity, those reporting poorer self-rated health and higher ADL or IADL score, and those with a CES-D score suggesting clinically relevant depression, were more likely to indicate low anticipated survival and less likely to indicate high anticipated survival (ps<0.004). Lower SEP, according to all measures, was also associated with a

Table 1 Distribution of anticipated survival by baseline characteristics

Variable	Level	All participants, n (%)	Anticipated survival			Unadjusted p value*
			Low, n (%)	Medium, n (%)	High, n (%)	
All participants		10 768 (100)	1924 (17.9)	5370 (49.9)	3474 (32.3)	
IMD (n=10 766)	Least deprived	3731 (34.7)	544 (14.6)	1866 (50.0)	1321 (35.4)	<0.0001
	Moderately deprived	3432 (31.9)	613 (17.9)	1716 (50.0)	1103 (32.1)	
	Most deprived	3603 (33.5)	765 (21.2)	1788 (49.6)	1050 (29.1)	
Social Class (n=10 585)	Managerial & professional	3141 (29.7)	446 (14.2)	1585 (50.5)	1110 (35.3)	<0.0001
	Intermediate	2535 (24.0)	418 (16.5)	1261 (49.7)	856 (33.8)	
	Routine and manual	4909 (46.4)	997 (20.3)	2447 (49.9)	1465 (29.8)	
Income (n=10 668)	High	3597 (33.7)	330 (9.2)	1869 (52.0)	1398 (38.9)	<0.0001
	Middle	3566 (33.4)	694 (19.5)	1742 (48.9)	1130 (31.7)	
	Low	3505 (32.9)	888 (25.3)	1706 (48.7)	911 (26.0)	
Education (n=9828)	Degree or equivalent	1203 (12.2)	114 (9.5)	601 (50.0)	488 (40.6)	<0.0001
	A-level or equivalent	1844 (18.8)	203 (11.0)	941 (51.0)	700 (38.0)	
	O-level or equivalent	2258 (23.0)	316 (14.0)	1135 (50.3)	807 (35.7)	
	No qualifications	4523 (46.0)	1129 (25.0)	2200 (48.6)	1194 (26.4)	
Sex (n=10 768)	Male	4912 (45.6)	907 (18.5)	2504 (51.0)	1501 (30.6)	0.001
	Female	5856 (54.4)	1017 (17.4)	2866 (48.9)	1973 (33.7)	
Age (years) (n=10 768	50–65	5968 (55.4)	443 (7.4)	3122 (52.3)	2403 (40.3)	<0.0001
	66–69	1280 (11.9)	186 (14.5)	719 (56.2)	375 (29.3)	
	70–74	1397 (13.0)	293 (21.0)	779 (55.8)	325 (23.3)	
	75–79	1017 (9.4)	378 (37.2)	433 (42.6)	206 (20.3)	
	80–84	723 (6.7)	393 (54.4)	234 (32.4)	96 (13.3)	
	85+	383 (3.6)	231 (60.3)	83 (21.7)	69 (18.0)	
Marital status (n=10 767)	Never married	584 (5.4)	119 (20.4)	290 (49.7)	175 (30.0)	<0.0001
	Currently married	7194 (66.8)	1021 (14.2)	3700 (51.4)	2473 (34.4)	
	Divorced/separated	1151 (10.7)	173 (15.0)	574 (49.9)	404 (35.1)	
	Widowed	1838 (17.1)	611 (33.2)	806 (43.9)	421 (22.9)	
CES-D score (n=10 669)	<4	8942 (83.8)	1359 (15.2)	4513 (50.5)	307 (34.3)	<0.0001
	≥4	1727 (16.2)	527 (30.5)	817 (47.3)	383 (22.2)	
Smoking (n=10 768)	Non-smoker	8829 (82.0)	545 (17.5)	4336 (49.1)	2948 (33.4)	<0.0001
	Smoker	1939 (18.0)	379 (19.6)	1034 (53.3)	526 (27.1)	
Alcohol intake (n=10 766)	≤once or twice/week	7735 (71.8)	1429 (18.5)	3858 (49.9)	2448 (31.7)	0.004
	>once or twice/week	3031 (28.2)	494 (16.3)	1511 (49.9)	1026 (33.9)	
Physical activity (n=10 756)	Moderate or high	3419 (31.8)	1010 (29.5)	1587 (46.4)	822 (24.0)	<0.0001
	Sedentary or low	7337 (68.2)	914 (12.5)	3773 (51.4)	2650 (36.1)	
Self-rated health (n=10 766)	Excellent/very good	4511 (41.9)	444 (9.8)	2128 (47.2)	1939 (43.0)	<0.0001
	Good	3389 (31.5)	551 (16.3)	1863 (55.0)	975 (28.8)	
	Fair/poor	2866 (26.6)	929 (32.4)	1378 (48.1)	559 (19.5)	
ADL score (n=10 768)	0	8050 (74.8)	1048 (13.0)	4121 (51.2)	2881 (35.8)	<0.0001
	1–2	1865 (17.3)	555 (29.8)	887 (47.6)	423 (22.7)	
	3+	853 (7.9)	321 (37.6)	362 (42.4)	170 (19.9)	
IADL score (n=10 768)	0	8500 (78.9)	1162 (13.7)	4361 (51.3)	2977 (35.0)	<0.0001
	1–2	1753 (16.3)	544 (31.0)	798 (45.5)	411 (23.5)	
	3+	515 (4.8)	218 (42.3)	211 (41.0)	86 (16.7)	

*From unadjusted ordinal logistic regression.
ADL, Activities of daily living; CES-D, Centre for Epidemiologic Studies Depression scale; IADL, instrumental activities of daily living; IMD, Index of Multiple Deprivation.

greater chance of reporting lower anticipated survival and lower chance of reporting high anticipated survival (p<0.0001).

By 2011, 21% (n=2255) of the sample had died, with a mean follow-up time of 6.12 years (SD 2.73). In the unadjusted model, anticipated survival was significantly associated with actual survival (table 2). HR (95% CIs) of death in those reporting low compared to medium anticipated survival was 2.95 (2.68 to 3.24); in those reporting high compared to medium anticipated survival it was 0.74 (0.66 to 0.83). In the adjusted models, this relationship was attenuated, but partially remained. In all cases except when income was adjusted for, those reporting low anticipated survival continued to have a statistically significant higher risk of death than those reporting medium anticipated survival (eg, HR (95% CI) for low versus medium anticipated survival with full adjustment including education=1.11 (1.00 to 1.24)), but there was no difference in actual survival in those reporting high versus medium anticipated survival (eg, HR (95%CI) for high versus medium anticipated survival with full adjustment including education=0.98 (0.87 to 1.11)).

Apart from alcohol consumption, ADL score, CES-D score and measures of SEP, all other variables were significantly associated with survival in the adjusted models. Risk of mortality was lower in women; increased with age; was greater in those who were not currently married compared to those who were; was greater in current smokers and those taking part in low, or no, physical activity; and was greater in those with poorer self-rated health or greater IADL scores. Risk of mortality was greater in those with ADL scores of 1–2 compared to those with a score of 0, but there was no difference in risk of dying between those with an ADL score of 3+ compared to those with a score of 0. In the fully adjusted models, no marker of SEP was associated with actual survival.

Table 2 Cox regression models for effect of anticipated survival, and other variables, on actual survival, HRs and 95% CIs

Variable	Level	Unadjusted model (n=10 768)	Adjusted* (n=10 653)	Adjusted* & IMD (n=10 651)	Adjusted* & social class (n=10 471)	Adjusted* & income (n=10 554)	Adjusted* & education (n=9722)
Anticipated survival	Low	2.95 (2.68 to 3.24)	1.11 (1.00 to 1.23)	1.10 (1.00 to 1.22)	1.11 (1.00 to 1.24)	1.10 (0.99 to 1.22)	1.11 (1.00 to 1.24)
	Middle	reference	reference	reference	reference	reference	reference
	High	0.74 (0.66 to 0.83)	0.99 (0.88 to 1.11)	0.99 (0.88 to 1.11)	0.99 (0.88 to 1.11)	0.98 (0.88 to 1.10)	0.98 (0.87 to 1.11)
Sex	Male		reference	reference	reference	reference	reference
	Female		0.58 (0.53 to 0.63)	0.58 (0.53 to 0.63)	0.57 (0.52 to 0.62)	0.58 (0.53 to 0.63)	0.58 (0.53 to 0.64)
Age (years)	50–65		reference	reference	reference	reference	reference
	66–69		2.47 (2.09 to 2.93)	2.46 (2.10 to 2.92)	2.49 (2.10 to 2.95)	2.40 (2.02 to 2.85)	2.33 (1.95 to 2.79)
	70–74		4.42 (3.83 to 5.12)	4.43 (3.84 to 5.11)	4.41 (3.81 to 5.09)	4.28 (3.70 to 4.95)	4.36 (3.75 to 5.07)
	75–79		6.77 (5.84 to 7.85)	6.78 (5.85 to 7.86)	6.64 (5.71 to 7.71)	6.51 (5.60 to 7.57)	6.46 (5.52 to 7.55)
	80–84		10.17 (8.67 to 11.93)	10.22 (8.71 to 12.00)	10.25 (8.73 to 12.05)	9.71 (8.26 to 11.41)	9.62 (8.13 to 11.40)
	85+		14.89 (12.46 to 17.78)	14.97 (12.53 to 17.89)	14.89 (12.43 to 17.85)	14.28 (11.93 to 17.09)	14.04 (11.65 to 16.93)
Marital Status	Never married		1.38 (1.15 to 1.65)	1.37 (1.14 to 1.63)	1.39 (1.16 to 1.66)	1.36 (1.14 to 1.63)	1.38 (1.14 to 1.66)
	Currently married		reference	reference	reference	reference	reference
	Divorced/separated		1.21 (1.03 to 1.42)	1.20 (1.02 to 1.42)	1.23 (1.05 to 1.45)	1.19 (1.01 to 1.40)	1.20 (1.01 to 1.43)
	Widowed		1.10 (0.99 to 1.23)	1.09 (0.98 to 1.22)	1.10 (0.99 to 1.23)	1.08 (0.97 to 1.21)	1.09 (0.97 to 1.22)
Self-rated health	Excellent/very good		reference	reference	reference	reference	reference
	Good		1.36 (1.21 to 1.53)	1.36 (1.21 to 1.53)	1.34 (1.19 to 1.51)	1.35 (1.20 to 1.52)	1.30 (1.15 to 1.47)
	Fair/poor		1.84 (1.63 to 2.09)	1.83 (1.61 to 2.08)	1.83 (1.61 to 2.08)	1.82 (1.60 to 2.07)	1.77 (1.55 to 2.03)
ADL score	0		reference	reference	reference	reference	reference
	1–2		1.11 (0.99 to 1.25)	1.11 (0.99 to 1.25)	1.11 (0.99 to 1.24)	1.11 (0.99 to 1.24)	1.12 (0.99 to 1.26)
	3+		1.05 (0.89 to 1.22)	1.05 (0.89 to 1.23)	1.03 (0.88 to 1.21)	1.04 (0.89 to 1.22)	1.04 (0.88 to 1.23)
IADL score	0		reference	reference	reference	reference	reference
	1–2		1.26 (1.12 to 1.42)	1.26 (1.12 to 1.42)	1.26 (1.12 to 1.42)	1.26 (1.12 to 1.42)	1.30 (1.15 to 1.47)
	3+		1.81 (1.52 to 2.16)	1.81 (1.52 to 2.16)	1.82 (1.52 to 2.17)	1.81 (1.52 to 2.15)	1.83 (1.52 to 2.19)
CES-D score	<4		reference	reference	reference	reference	reference
	≥4		0.94 (0.84 to 1.06)	0.94 (0.84 to 1.06)	0.93 (0.83 to 1.04)	0.94 (0.84 to 1.05)	0.91 (0.81 to 1.02)
Smoking status	Non-smoker		reference	reference	reference	reference	reference
	Smoker		1.64 (1.47 to 1.84)	1.62 (1.45 to 1.82)	1.62 (1.44 to 1.81)	1.62 (1.45 to 1.81)	1.60 (1.42 to 1.80)
Alcohol consumption	≤once or twice/week		reference	reference	reference	reference	reference
	>once or twice/week		1.03 (0.93 to 1.13)	1.03 (0.94 to 1.14)	1.04 (0.94 to 1.15)	1.05 (0.95 to 1.16)	1.05 (0.94 to 1.16)
Physical activity	Moderate or high		reference	reference	reference	reference	reference
	Sedentary or low		1.36 (1.23 to 1.51)	1.36 (1.22 to 1.50)	1.34 (1.21 to 1.49)	1.35 (1.22 to 1.50)	1.40 (1.26 to 1.56)
IMD	Least deprived			reference			
	Moderately deprived			1.00 (0.90 to 1.11)			
	Most deprived			0.93 (0.83 to 1.04)			
Social class	Managerial & professional				reference		
	Intermediate				0.96 (0.86 to 1.07)		
	Routine & manual				0.86 (0.77 to 0.96)		
Income	High					reference	
	Middle					0.98 (0.89 to 1.08)	
	Low					0.85 (0.74 to 0.96)	
Education	Degree or equivalent						reference
	A-level or equivalent						0.84 (0.74 to 0.96)
	O-level or equivalent						0.92 (0.80 to 1.07)
	No qualifications						0.89 (0.74 to 1.07)

*Adjusted for sex, age, marital status, self-rated health, ADL score, IADL score, and CES-D score.
ADL, Activities of daily living; CES-D, Centre for Epidemiologic Studies Depression scale; IADL, instrumental activities of daily living; IMD, Index of Multiple Deprivation.

The only statistically significant interactions found were with age group and income. Differences in the relationship between actual and anticipated survival by age group and income are illustrated in figures 1 and 2, respectively. In the youngest group, the gradient of observed survival mirrored that of anticipated survival with those reporting high anticipated survival actually surviving the longest. This was not seen in older groups. In the highest income group, anticipated survival mirrored actual survival with clear differences in true survival between anticipated survival groups. In the medium and low income groups, this pattern was not as evident.

DISCUSSION

Summary of findings

This is the first attempt that we are aware of to explore whether the ability of anticipated survival to predict actual survival varies according to markers of SEP or other variables. Aadditionally, we contribute to the existing sparse literature on correlates of anticipated survival, particularly in very old adults.[18 22–24]

Anticipated survival was significantly and positively associated with observed survival. Older adults who reported a low probability of survival had shorter survival than those with a medium anticipated survival. In general, this relationship remained even after controlling for a wide range of demographic, health behaviours, markers of health and socioeconomic variables; however, there was no difference in actual survival between those reporting moderate and high anticipated survival once other variables were adjusted for. There was evidence that the positive relationship between anticipated and actual survival varied across age and income groups, but not according to any other markers of SEP, demographic or health status considered: anticipated survival failed to clearly mirror actual survival in those aged 66 years or older, and in those with lower incomes.

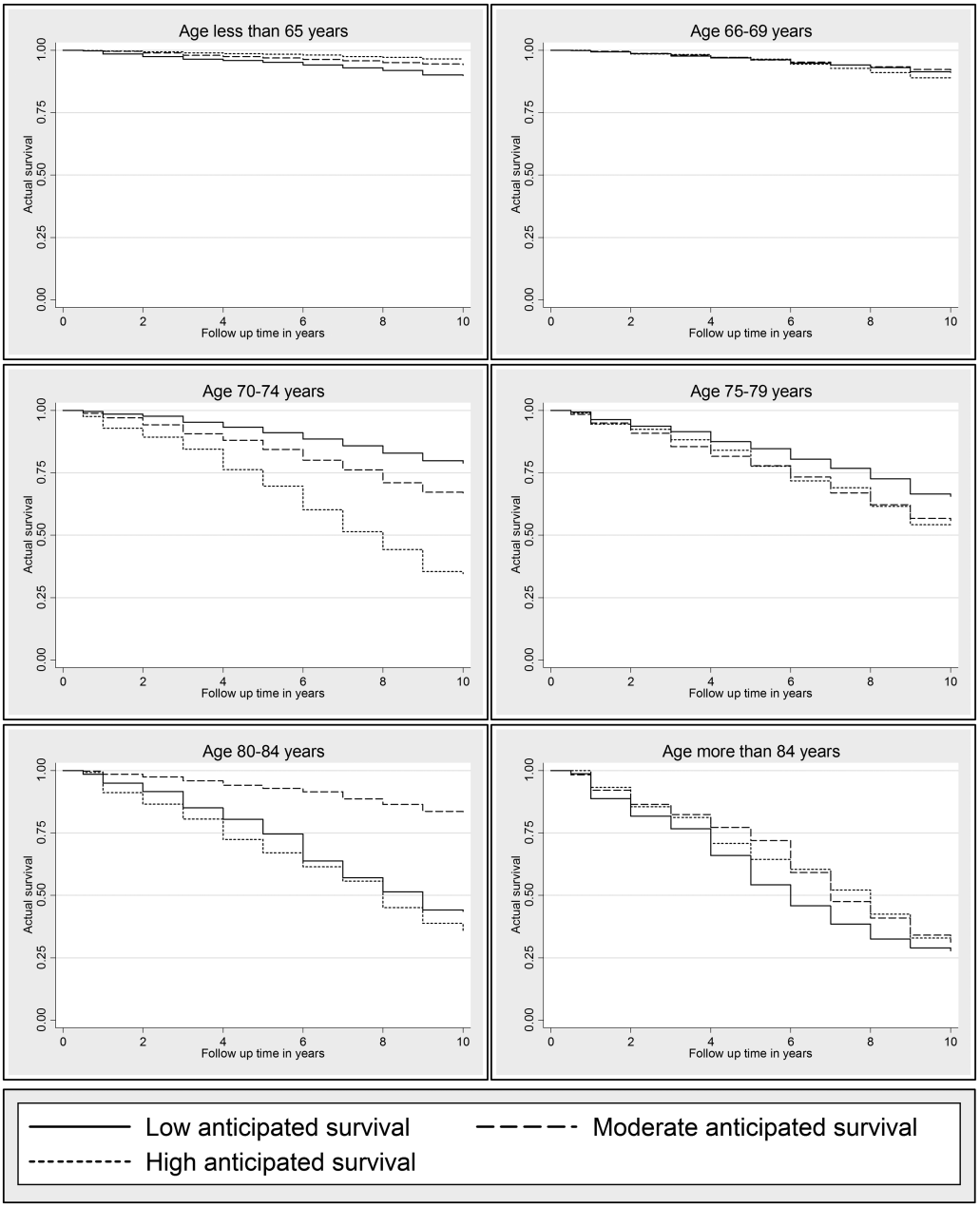

Figure 1 Actual probability of survival by three levels of anticipated survival across age groups.

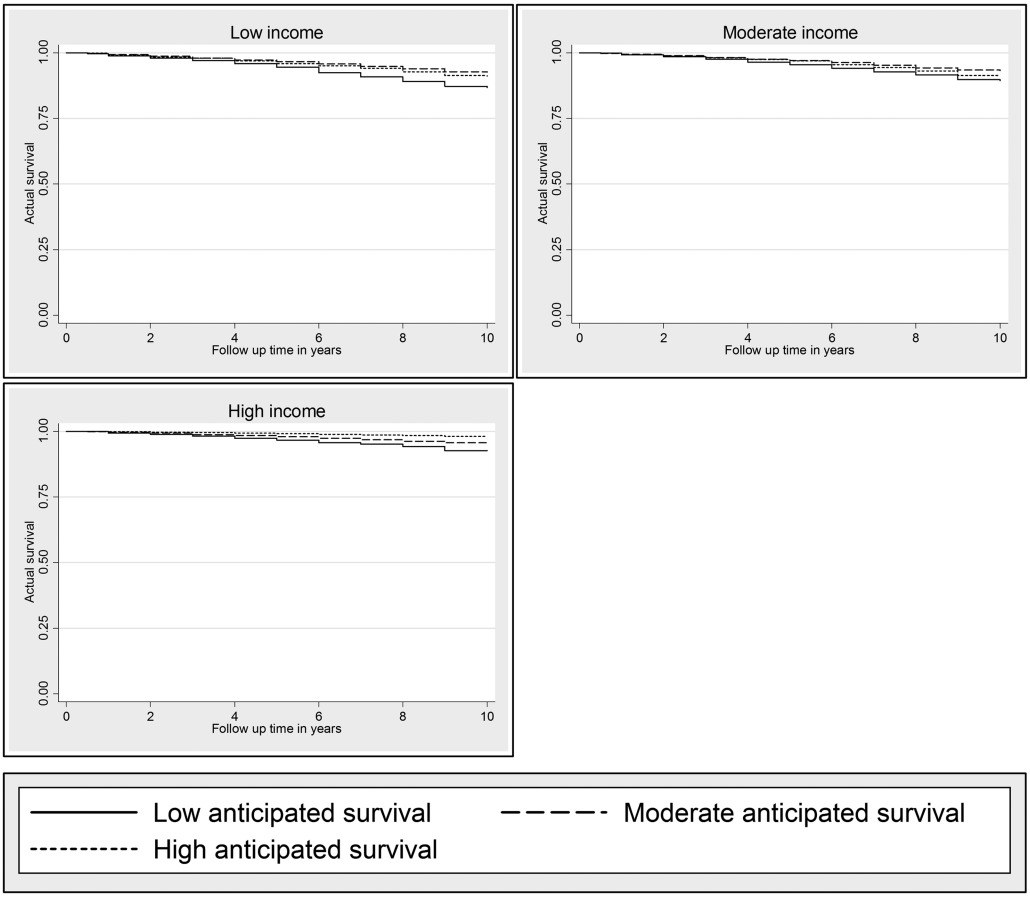

Figure 2 Actual probability of survival by three levels of anticipated survival across household income groups.

Strengths and limitations of methods

The large cohort we used includes adults of all ages above 50 years. This represents a substantial improvement on the majority of previous research in this area which has relied on data from individuals aged less than 75 years.[17 18 20 21 23]

The ELSA cohort also has high data completeness and mortality follow-up which allowed us to compare anticipated survival to actual survival over a mean of 6 years. Although this is longer than some previous research,[17 21] the follow-up period did not necessarily reflect the time-horizon that participants were asked to consider in the question on anticipated survival. Repeating our analyses with mortality up to 25 years, post-wave 1 data collection would allow a 'fairer' comparison of anticipated to actual survival in this cohort.

The different target age that participants were asked to consider in the question used to assess anticipated survival means that we have not necessarily compared 'like-with-like' across participants. To take account of this, we repeated our analyses additionally controlling for the difference between target age and age at data collection throughout, and this had no impact on our findings. Measuring anticipated survival on a single scale in a cohort of individuals of differing ages is inherently difficult, as actual survival varies with age. The only way of avoiding the problem entirely is to restrict the cohort, as others have done,[15–17 19–21] to a small age range, which would limit the generalisability of findings.

We included a wide range of potential confounding variables across the spectrum of demographic, health behaviours, health and SEP in our analyses—guided throughout by the results of previous research. However, as with any analysis, it is possible that there remains uncontrolled confounding in our models. For example, diagnosis of a chronic illness, or existing comorbidities, might have a strong effect on anticipated survival without being captured by self-rated health or ADL. Similarly, mild cognitive impairment may have influenced participants' ability to understand and answer some questions, particularly on anticipated survival, without being fully captured by the measures of health status adjusted for. Throughout, most measures we included have been widely used in previous research and well validated. Although the measures of health behaviours used have been used previously, they rely on self-report and may be open to error and bias.

Comparison of findings to previous research and interpretation of findings

As with previous work,[16 18 22–24] in univariable analyses, we found that a wide range of demographic, health and socioeconomic factors that are known to be associated with actual survival were also associated with anticipated survival in the expected directions. Many of these variables were also significantly associated with actual survival in multivariate analyses.

Furthermore, and again as previously,[17 19–21 23] we found that anticipated survival was associated with actual survival. However, in the fully adjusted models, we did not find any difference in actual survival between those reporting medium and high anticipated survival—although there was a difference in the unadjusted model. It is not clear why adjustment extinguished the difference in actual survival between those reporting medium and high anticipated survival, but not between those reporting medium and low anticipated survival. This may just

reflect the stronger original unadjusted effect of low versus medium, compared to high versus medium.

Overall, it seems that reporting low (rather than medium or high) anticipated survival is the important predictor of true survival. Thus, while members of the ELSA cohort appear to be reasonably good at distinguishing when they have low probability of survival, they are not good at distinguishing fine-grained differences in non-low probability of survival. Perhaps there is something particularly predictive of death, not captured by our covariates, that alerts individuals to their low probability of survival, but does not, conversely, help them distinguish between higher probabilities of survival.

Lawlor *et al*[7] have previously described the accuracy of 'lay epidemiology'. Our cross-sectional findings on the correlates of anticipated survival suggest that individuals make good use of relevant information to assess their anticipated survival. However, our data cannot confirm how individuals arrive at their assessments of anticipated survival. Qualitative methods would help shed light on this.[36]

We are not aware of other research that has attempted to explore socioeconomic variations in the association between anticipated and actual survival. Previous work exploring the association of self-rated health with mortality has found inconsistent evidence that the association is stronger in those living in more affluent circumstances.[10–15] Our findings of a stronger relationship between true and anticipated survival in those with the highest incomes would confirm this. However, the fact that this was not found for other markers of SEP suggests that previous inconsistent findings may reflect the use of different markers of SEP. Measuring SEP in older people can be difficult, with cohort effects in educational attainment,[37] and changes in income and occupational status over the retirement transition. Household income reflects current access to resources, and it may be this, rather than other status-related aspects of SEP, that is particularly important in this context. Our findings suggest that more affluent individuals are better able than most to assess survival. Income-related differences in accuracy of survival assessments may drive differences in health behaviours with those identifying that they have the best probability of survival choosing to adopt healthier patterns of behaviour to maximise quality of life during their extended life years. Alternatively, healthier patterns of behaviour may drive survival assessments. Longitudinal work will be required to explore the direction of any causal relationship between anticipated survival and health behaviours. Although qualitative exploration of how individuals arrive at their assessments of anticipated survival may also shed light on this issue.

Those in the youngest age groups also showed stronger relationships between anticipated and actual survival that were not evident in older groups. This may be an artefact of smaller numbers in older age groups, or a reflection of differential survival effects in the oldest old.

Implications of findings for research and practice

Our findings should be replicated in other contexts to determine generalisability. Further work exploring how individuals arrive at their assessments of their anticipated survival[36] could be explored using 'think-aloud' interviews[38] asking respondents to describe their thought processes while arriving at their response to the questions used to determine anticipated survival.

Our findings support the view that there is some degree of accuracy in perceptions of likely remaining life years. This view is one crucial premise of the argument that individuals pursue patterns of healthy behaviours commensurate with their own accurate assessments of likely remaining life years,[7 8] although longitudinal work is required to confirm the direction of any causal relationship between health behaviours and anticipated survival. Rather than not understanding what behaviours they can engage in to maximise their health, it is possible that individuals with lower life expectancies, including those living in less affluent circumstances, make informed decisions not to pursue such behaviours because they are unlikely to contribute much benefit to their length or quality of life. This would explain why many health promotion interventions are differentially effective according to SEP[39] and would suggest a need for a different approach to health behaviour change.

We did not find consistent evidence that the accuracy of anticipated survival varied systematically by markers of SEP. Thus, we cannot conclude that socioeconomic variations in estimated anticipated survival further exacerbate existing socioeconomic inequalities in health behaviours.

CONCLUSION

In a representative cohort of older English adults, anticipated survival was associated with a range of demographic, health behaviour, health and socioeconomic variables known to predict actual survival. After adjustment for these variables, true survival over a mean of 6 years follow-up differed between those reporting low versus medium anticipated survival, but not between those reporting medium versus high anticipated survival. There were significant interactions between age and income, but not other markers of SEP and anticipated survival on actual survival. Those in younger age groups and with higher household income appeared better able to identify subtle differences in probability of survival.

What is already known on this subject

People living in more socioeconomically deprived circumstances have more pessimistic views of the future and, in particular, how long they are likely to live. These, at least partly, reflect reality and may influence individuals' beliefs about the value of taking part in healthy behaviours. However, it is not known if there is an interaction between socioeconomic position and pessimism about survival such that pessimism about survival increases as disadvantage increases. If there are, this might further exacerbate socioeconomic inequalities in health behaviours and health.

What this study adds

Anticipated survival was associated with socioeconomic, demographic, health behaviours or health variables in expected directions. Younger individuals and those with higher household income were better able to identify subtle differences associated with actual survival.

Contributors JA conceived the idea for the work. JA, DN, EMGM and CJ developed the methods. ES obtained and analysed the data. JA and ES drafted the manuscript. All authors critically reviewed previous versions of the manuscript.

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Competing interests None.

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