BMJ Public Health

Subjective social status and trajectories of frailty: findings from the English Longitudinal Study of Ageing

Asri Maharani [1], Lindsay Richards [2], Patrick Präg [3]

To cite: Maharani A, Richards L, Präg P. Subjective social status and trajectories of frailty: findings from the English Longitudinal Study of Ageing. *BMJ Public Health* 2024;**2**:e000629. doi:10.1136/bmjph-2023-000629

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/bmjph-2023-000629).

Received 5 October 2023
Accepted 4 March 2024

[1]Division of Nursing, Midwifery and Social Work, The University of Manchester, Manchester, UK
[2]Department of Sociology, University of Oxford, Oxford, UK
[3]CREST, ENSAE, Institut Polytechnique de Paris, Palaiseau, France

Correspondence to
Dr Asri Maharani; asri.maharani@manchester.ac.uk

ABSTRACT

Objectives Subjective social status is a known antecedent for many health outcomes, but little research has examined the association between subjective status and frailty among older people. Using longitudinal data, the goal of this study was, first, to identify latent trajectories of frailty over time, and second, to investigate the relationship between subjective social status and frailty trajectory.

Methods Data were drawn from the 2002–2019 surveys of the English Longitudinal Study of Ageing, involving 9484 individuals aged 50+ years at baseline. Group-based trajectory models were used to identify frailty trajectories over the 18-year period, and multinomial regression models were used to investigate the relationship between subjective social status and frailty trajectory membership. Controls were included for confounding factors, including a range of socioeconomic indicators and health behaviours.

Results Four trajectories of the frailty index were retained: low frailty (53% of participants), progressive mild frailty (25%), progressive moderate frailty (15%) and high frailty (6%). Higher subjective social status is associated with higher probabilities of being in the low-frailty group and lower probabilities of being in one of the progressive or high-frailty groups.

Conclusions Subjective social status is significantly associated with being in a milder frailty trajectory after controlling for age, health behaviours and a wide range of objective socioeconomic status markers.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Subjective social status has been found to be associated with health, including self-rated health, cognitive function and mental health.
⇒ Objective measures of socioeconomic status were associated with frailty.

WHAT THIS STUDY ADDS

⇒ Four trajectories of frailty index among older people were identified: low frailty, progressive mild frailty, progressive moderate frailty and high frailty.
⇒ Low subjective social status was associated with an increased risk of frailty independent of objective socioeconomic status and other factors.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Interventions to promote health and prevent frailty among older people should consider their perception of their social status.

INTRODUCTION

Ageing populations have placed an increasing burden on health and social care services, including increased healthcare services usage and its related expenditures.[1] Particularly, those who are frail are more likely to be in need of social care, to be hospitalised and have higher mortality.[2–4] Frailty is characterised by a decline in physiological and cognitive reserves and functions as a consequence of multiple, accumulated deficits in ageing.[2 5 6] While frailty generally increases with age, frailty progression is heterogeneous.[7–10] Verghese *et al*,[7] for example, identified four distinct frailty trajectories, ranging from relatively stable to severely frail, using panel data from a sample of Ashkenazi Jewish older adults. Understanding why certain older people become increasingly frail at a quicker rate than others do will enhance the ability to identify and treat those at the greatest risk of decline.

Socioeconomic inequalities in frailty have been shown in both cross-sectional[11 12] and longitudinal studies.[13–15] Higher education attainment was most consistently associated with a lower risk of being frail, as were higher income and better wealth.[13 15] Watts *et al*[16] calculated the minimum income for healthy living of individuals aged 65 and older ($MIHL_{65}$) in England and found that those living below $MIHL_{65}$ had two to three times higher odds of being frail than those living above $MIHL_{65}$. In addition to those individual and household-level variables, studies in England[13] and the Netherlands[12] showed that older people living in deprived neighbourhoods were more frail than those living in less deprived neighbourhoods.

Next to objective markers of socioeconomic status, subjective social status (SSS) has been suggested as a means by which social position 'gets under the skin',[17] that is, affects physical health. SSS is defined as the individuals' perception of their socioeconomic circumstances in relation to others. Many studies find an association between SSS and health that holds over and above objective socioeconomic status determinants to self-rated health,[18–20] cognitive function[21] and mental health.[22 23] The literature linking SSS and health outcomes posits that the causal mechanism is psychosocial, whereby the feeling of low status brings chronic stress and associated physiological reactions.[24] The sociopsychological literature further outlines the ways in which SSS is likely to be important for older people as they may face ageist attitudes and be judged as inferior to middle-aged adults in terms of power and social status, wealth, respect and influence.[25] These status perceptions may also affect the quality of social interactions,[26] leading to social isolation and stress. Together, these mechanisms highlighted in the literature suggest important consequences of subjective status for health and well-being among older people.[27] Despite this, recent evidence shows that SSS is not associated with allostatic load among older people.[28] Thus, our aim in this paper is to test the association between SSS and frailty to add to this body of evidence.

To date, the evidence on the link between subjective measures of socioeconomic status and frailty is limited. Addressing this gap, this study aims to empirically identify trajectories of frailty and explore whether SSS is related to frailty trajectories independently of the effects of demographic, objective socioeconomic, neighbourhood deprivation and health behaviours. Our study contributes to the literature in three ways. First, we document the heterogeneity of frailty trajectories in large nationally representative samples with longer follow-up (9 waves over 18 years). Second, we included a wide range of objective socioeconomic status as controls, namely education, occupation, income and wealth. Despite the importance of wealth as a health determinant, especially at the high end of the status scale,[29] few studies linking SSS and health have accounted for wealth. We further include parents' socioeconomic status during the respondents' childhood to account for 'the long arm of childhood circumstances' on health.[30] Finally, we include neighbourhood deprivation to address the effect of place of living on the frailty status of the respondents.[11 13]

DATA AND METHODS

Data

This was an observational study using a nationally representative dataset, the English Longitudinal Study of Ageing (ELSA),[31 32] which provides information on the sociodemographic, economic and health circumstances of community-dwelling individuals aged 50 years and older in England. The initial ELSA sample was taken to include people aged ≥50 years who had participated in the Health Survey for England in either 1998, 1999 or 2001. The data are collected every 2 years, starting from 2002. So far, there are nine waves of ELSA. The present analysis includes core respondents from ELSA wave 1 aged 50 years and older who participated in at least two waves. The final sample for the identification of latent classes comprises 9484 participants. After excluding incomplete cases for the regression models, there are 8385 participants.

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Frailty index

The frailty index has been validated as a predictor of mortality and institutionalisation.[33–36] Frailty was measured using the Rockwood cumulative deficit model[37] in line with Davies *et al*,[33] taking into account 60 functional and psychological deficits (see online supplemental table A1).[13 38] Binary variables were coded as '0' and '1', and quintiles or quartiles were used for continuous or ordinal variables (with corresponding values assigned such as 0.00, 0.25, 0.50, 0.75, 1.00). We coded '1' for variables that were irreversible across waves (eg, Parkinson's disease). We summed each participant's deficits and divided them by the total possible to produce an index ranging between 0 and 1, in which higher scores indicated greater frailty (see online supplemental figure A1 for the distribution of the variables). We include participants in our study if they have non-missing values for at least 30 of the 60 frailty index components.[37]

Subjective social status

SSS measures participants' perceptions of their relative social position. We use SSS measured at wave 1, when ELSA data collectors asked participants to place themselves on 1 of 10 rungs of a ladder following the question: 'Think of this ladder as representing where people stand in our society. At the top of the ladder are the people who are the best off—those who have the most money, most education and best jobs. At the bottom are the people who are the worst off—who have the least money, least education and the worst jobs or no jobs. The higher up you are on this ladder, the closer you are to people at the very top and the lower you are, the closer you are to people at the very bottom. Please mark a cross on the rung on the ladder where you would place yourself.' Responses were recorded on a scale ranging from 5 ('worst off') to 100 ('best off') in increments of five. We divide by 10, as social status is more usually measured on a 10-point scale, to give a continuous measure with a value range from 0.5 to 10, with higher values denoting higher SSS. This measure resembles the one introduced by Adler *et al*,[39] is frequently used in current research[20 28] and the construct validity of the item has been shown by showing that measures of SSS were more closely connected with each other

than with various measures of psychosocial vulnerability or household income.[40]

Covariates

As we aim to examine the association between SSS and frailty, we control for a number of confounding variables. First, we control for demographic factors such as starting age, sex, ethnicity and marital status. We distinguished birth cohorts with a range of 5 years, that is, ≤1927 (starting age in 2002: ≥75), 1928–1932, 1933–1937, 1938–1942, 1943–1947 and 1948–1952. For ethnicity, we distinguish between white and non-white participants, the latter making up 3% of the sample. Marital status is divided into 'married/cohabitation' as a reference category as well as 'divorced/separated', 'widowed' and 'single/never married'. Further, we control for objective indicators of socioeconomic status, namely participant education (seven categories), participant social class (eight National Statistics Socio-Economic Classification (NS-SEC) classes), household wealth (in quintiles, based on net total wealth of a benefit unit and comprises the sum of savings, investments, physical wealth, and housing wealth after financial debt and mortgage debt have been subtracted), household income (in quintiles, based on employment income, self-employment income, state benefit income, state pension income, private pension income, asset income and other incomes, equivalised for differences in household size) and the English Index of Multiple Deprivation (IMD, in quintiles at the lower-layer super output area level, a geographical area of 1000–3000 people[41 42]). Richards *et al*[28] suggested that the social background of participants' parents can confound the subjective social status–health relationship; hence, we control for parental occupation at respondents aged 14 years (16 categories) and parental education (6 categories). Finally, we add participant drinking (five categories) and smoking status (current smoker, former smoker, non-smoker) as possible pathway variables to the equation. All contemporaneous covariates were measured in wave 1, with the exception of parental education, which was only measured in wave 3. All covariates are treated as time invariant, as the latent trajectory membership should also be viewed as time invariant, for example, Matthews *et al*.[43]

Statistical analysis

Analyses were performed in two steps. In the first step, we used group-based trajectory models[44]—a latent class model—to determine the type and prevalence of trajectories of frailty over the 18-year period. This exploratory approach was taken as we had no prior expectations of specific trajectory classification. Through these models, participants could be classified into distinct 'classes' based on their patterns of frailty over the nine waves. The number of distinct trajectories identified and chosen for final analyses was dependent on various criteria: a decreased Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) with each class added to the model, an entropy value of at least 0.8 and at least 5% of the respondents contained within each class. While AIC and BIC are commonly used in conjunction for model selection and are recommended to be used together,[45–47] they serve distinct purposes. One of the key differences between AIC and BIC is that BIC imposes a harsher penalty for the number of parameters in the model, and both are therefore informative in slightly different ways.[45] The AIC can thus be prone to preferring more complex models, and looking at both AIC and BIC together makes sure that model complexity is taken into account as well as model performance in terms of the log likelihood. Entropy is a measure of latent class separation based on a weighted average of individuals' likelihood of belonging to each of the trajectories. The goodness-of-fit criteria and class sizes are shown in table 1. The number of trajectories was also based on the assumption that they demonstrated distinct patterns of change over time. Respondents were assigned to a trajectory on the basis of their highest probability of trajectory membership.

The second phase of the analysis used multinomial logit models to investigate the association between SSS and frailty trajectory membership. We performed the analyses in three models. The first model (M1) included our key predictor variable, SSS, along with demographics (age, sex, ethnicity) and marital status. The second model (M2) includes objective socioeconomic status (education, social class, wealth, income), neighbourhood deprivation, and parents' education and occupation. The final model (M3) included all of those covariates plus health behaviours (smoking and drinking). The

Table 1 Fit statistics and class prevalence for models with k latent trajectories

No of trajectories (k)	AIC	BIC	Entropy	% trajectory 1	% trajectory 2	% trajectory 3	% trajectory 4	% trajectory 5
1	−76246	−76231	1	9484 (100)				
2	−108546	−108517	0.9136	7055 (74.4)	2429 (25.6)			
3	−118085	−118042	0.8683	5711 (60.2)	2576 (27.1)	1197 (12.6)		
4	−121690	−121633	0.8295	5059 (53.3)	2408 (25.4)	1419 (14.9)	598 (6.3)	
5	−123170	−123098	0.7883	4568 (48.1)	2217 (23.4)	1447 (15.2)	929 (9.8)	323 (3.4)

AIC, Akaike's Information Criterion; BIC, Bayesian Information Criterion.

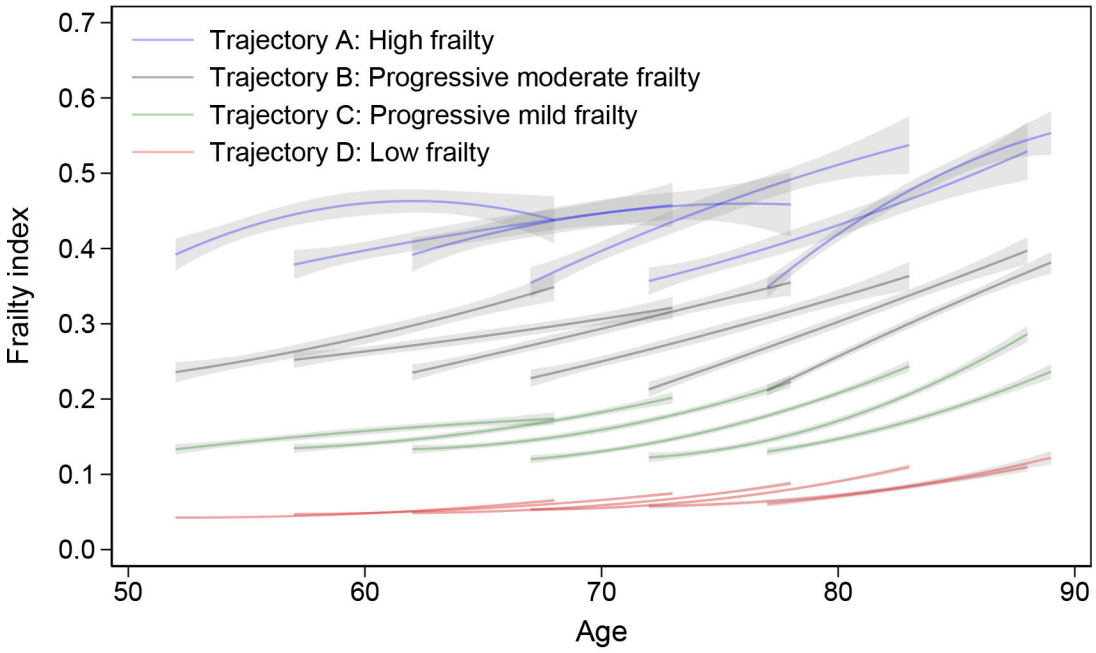

Figure 1 Four frailty trajectories over age, stratified by birth cohorts, quadratic prediction. Error bands denote 95% CIs, N=9484.

sample in each model was reduced to respondents with a full set of observed covariates. Results are presented using average marginal effects (AMEs), which reflect the average change in the probability of being in each of the frailty trajectories when a covariate increases by one unit (ie, one additional rung up the SSS ladder). By virtue of the AMEs, we report results without a reference category in the outcome variable. We show the full regression tables in the online supplemental file 1. We performed group-based trajectory modelling with Latent Gold V.5.1. The multinomial logistic regressions were done using Stata V.17.

RESULTS

Identifying frailty trajectories

Using AIC and BIC, as well as ensuring at least 5% of the sample was included in each identified class, and distinct trajectories were identified, a four-class model proved to be the best fit of data. The four-class model offered improvements to model fit compared with models with fewer classes and provided satisfactory entropy and group sizes. The average posterior probabilities of assignment for trajectories 1, 2, 3 and 4 are 0.94, 0.92, 0.89 and 0.96, respectively. This is considerably higher than the 0.70 threshold Nagin[44] suggests to ensure a high certainty when assigning participants to trajectories.

Figure 1 displays vector graphs of the model frailty trajectories in 5-year age cohorts, with 95% CIs represented by the grey areas. Each line represents a frailty trajectory for a specific cohort, which begins at the age midpoint of that cohort in 2002 and then tracks the change in frailty over the next 17 years until 2019. In general, the frailty trajectories of older people in England took the shape of curvilinear trajectories. As can be seen, the four trajectories differ both in their baseline starting point as well as in the steepness of their slopes. Trajectory D, which we label 'low frailty', comprises 53% of the sample and has the lowest frailty score at baseline and little change over time. Trajectory C, which we label 'progressive mild frailty', comprises 25% of the sample and has the second lowest frailty score at baseline, but evident progression across all cohorts over the 18-year observation window. Trajectory B, 'progressive moderate frailty', comprises 15% of the sample, and has a higher starting point than trajectories C and D as well as a clear progression over time. Trajectory A, finally, is the 'high-frailty' group comprising 6% of the sample. The smaller subsample size for trajectory A means that the CIs are wider for the cohort graphs; however, some progression is also evident in this group, particularly among the older cohorts.

Bivariate associations between frailty trajectories and socioeconomic status

Figure 2A shows how the four trajectories vary by SSS at baseline. The SD of SSS is 1.7; thus, the average SSS of the group with the most severe frailty trajectory A is about 1 SD lower than that of the group with the mildest trajectory D. Figure 2B–F show associations, all in line with expectations arising from the literature, between the various dimensions of socioeconomic status and frailty. Figure 2B shows that the low-frailty group has the lowest proportion of respondents with no educational qualifications, and figure 2C shows that the low-frailty group has the highest proportion in the highest occupational class. Figure 2D–F show the least-frail group to be the wealthiest, have the highest incomes and live in the least deprived neighbourhoods. Full descriptive statistics and

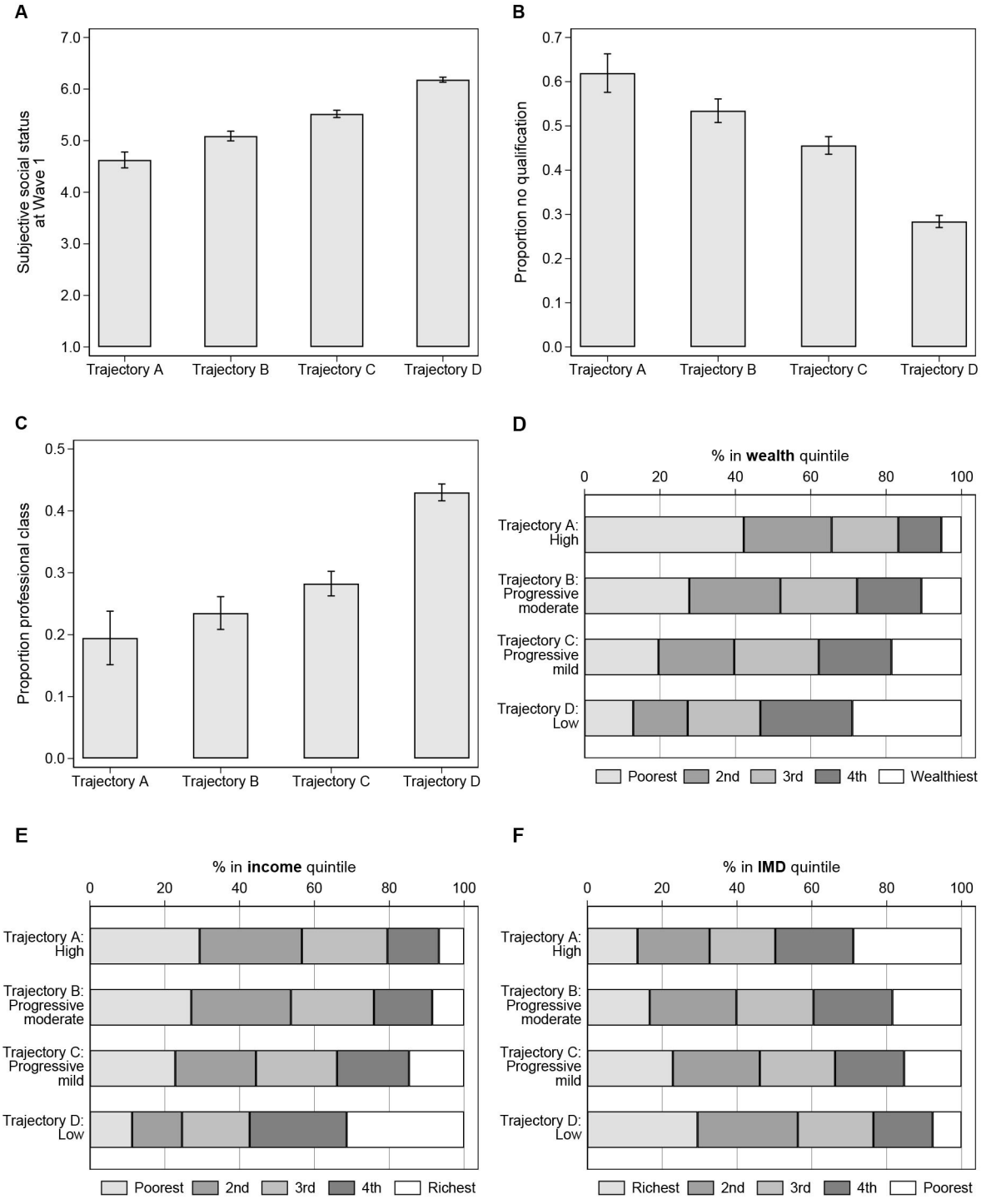

Figure 2 Social stratification of frailty trajectory membership, as shown by subjective social status (A), education (B), occupational class (C), wealth (D), income (E) and IMD (F). Error bars denote 95% CIs, N=8385. Full descriptive statistics and significance testing are shown in online supplemental table A2. IMD, Index of Multiple Deprivation.

significance testing are shown in online supplemental table A2.

Association of SSS with frailty trajectories

Figure 3 shows the association between SSS and the four frailty trajectories, expressed as AMEs. Model M1 only controls for age, sex, ethnicity and marital status at baseline. When comparing participants with the same age, sex, ethnicity and marital status, those with a 1-point higher SSS are 1.7 percentage points (95% CI: 1.4 to 2.0) less likely to be in the most severe high-frailty trajectory A and almost 6 (5.8, 5.3 to 6.4) percentage points more likely to be in the low-frailty trajectory D.

Model M2 additionally controls for everything we know about participants' objective socioeconomic status: education, social class, household income, household wealth, IMD, parental education and parental occupation. While

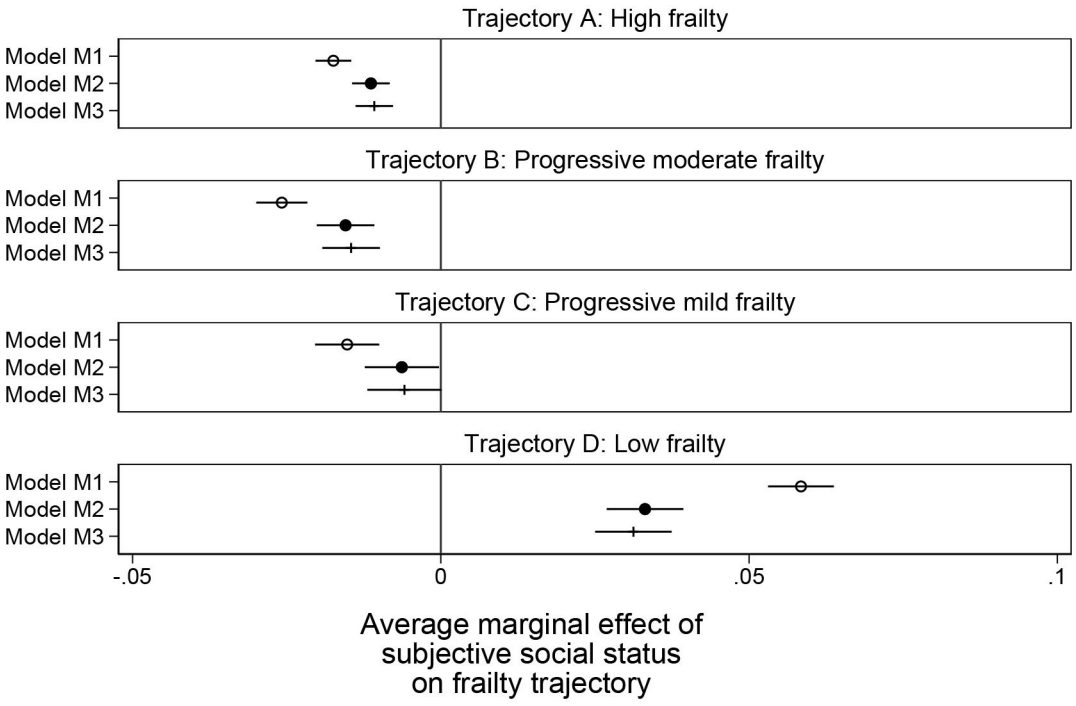

Figure 3 Association between subjective social status and trajectories of frailty index; average marginal effects obtained from multinomial logit models, N=8385. Error bars denote 95% CIs. Model M1: adjusted for age, sex, ethnicity and marital status; Model M2: additionally adjusted for education, class, wealth, income, Index of Multiple Deprivation, parental education and parental occupation; Model M3: additionally adjusted for drinking and smoking. Full models are shown in online supplemental table A3.

this reduces the association somewhat—the likelihood of belonging to the most severe high-frailty trajectory D is then 1.1 (0.8 to 1.4) percentage points lower for each rung on the ladder and 3.3 (2.7 to 3.9) percentage points higher for the mildest low-frailty trajectory A—the role of SSS remains substantial and different from zero at conventional levels of statistical precision. This is a marginal effect that is still similar to being 2.5 years younger. The AME of SSS on frailty trajectory memberships remained similar when we included drinking and smoking behaviour in the last model (M3). Full models are shown in online supplemental table A3.

As the four trajectories identified in the first step of the analyses can be seen as an ordered severity ranking of frailty trajectories, we also conducted analyses using ordered logit models (online supplemental table A4). While the proportional odds assumption was violated for some models, all models lead to the same conclusions as the ones reported (figure 3).

In analyses reported in the online supplemental figure A2, we explored the possibility of gender differences in the association between SSS and frailty trajectory membership. While models M1–M3 accounted for gender differences in frailty trajectory membership, they assumed that the status–membership association is the same for men and women. In analyses that do not make this assumption, we found no differences between men and women in the status coefficients (figure 3). To address measurement problems with the parental background variables, we estimated a further set of four models (online supplemental figure A3), which all lead to the same conclusions as the models reported in figure 3.

DISCUSSION

Using a large, representative panel dataset of community-dwelling older people in England, we identified four trajectories of frailty progression, ranging from low to high frailty. This is in line with the four distinct subgroups of frailty trajectories identified in a smaller, more specific ethnic cohort,[7] while Stow *et al* found three subgroups using data from medical records.[8] The difference may be due to different data sources, time points and characteristics of the participants. We further found that participants in each trajectory group are more similar to each other than those in other groups. It is worth noting that elsewhere (eg, Davies *et al*),[48] improvements in frailty have been empirically demonstrated, but our trajectories do not reflect this possibility, perhaps due to the longer time frame for observing change. Our study assessed frailty based on self-reported conditions of non-institutionalised older people, allowing us to generalise our findings to the national level. Despite the differences in the number of frailty trajectories identified between studies, across all studies, it is two factors that characterise the frailty trajectories: the starting point and the steepness of the slopes.

Our key finding was that higher SSS is associated with a lower probability of being in a high-frailty trajectory and a higher probability of being in a low-frailty trajectory, and

that these inequalities persist even when comparing participants with similar demographic and objective socioeconomic features, as well as the same health behaviours. In terms of the effect of objective socioeconomic status, we found that having low educational attainment was associated with a higher probability of being in the high-frailty trajectory, confirming the existing literature.[11 12 15] We further found that those in the lower income and wealth quintile and living in deprived neighbourhoods had a higher probability of being in the high-frailty trajectory, also in agreement with prior studies.[11 13] The presence of these objective status controls attenuates the effect of subjective status somewhat, suggesting they may partially confound the relationship. As regards health behaviour, however, the strength of the association between SSS and frailty remains the same when we compare participants with the same patterns of drinking alcohol and smoking. This suggests that the effect is not mediated by these factors, a point of contrast to studies showing an association between subjective status and health behaviours.[49 50]

The mechanisms by which SSS may influence frailty include sociopsychological and psychoneurobiological processes.[24] The sociopsychological component highlights that social comparison in SSS may lead to relative deprivation, in which people perceive a lack of education, wealth or social prestige relative to other members of society they look up to.[51] Evidence suggests that negative emotions, including dissatisfaction, resentment or injustice as a result of relative deprivation, are associated with poor health.[52] The psychoneurobiological component posits that the negative emotions caused by low SSS are processed in the limbic system of the brain, which then alters immune system functioning, including increasing inflammatory process.[53] The psychoneurobiological processes, therefore, that are the likely linking mechanism between SSS and frailty are that chronic increase of inflammation leads to non-communicable diseases that collectively represent the leading causes of functional disability and frailty, such as ischaemic heart disease, stroke, diabetes mellitus, cancer, and autoimmune and neurodegenerative disorders; in short, the chronic inflammation arising from psychosocial stress of low status raises the risk of becoming frail.[54]

Strengths and limitations of this study

A key strength of our study is that it analyses data from a large number of men and women drawn from a representative longitudinal study of older people in England and includes a wide range of objective socioeconomic status measures. In addition to individual objective socioeconomic status, such as education, income and wealth, we include neighbourhood deprivation to capture the place effect on health and parental occupation and education to capture the 'long arm' of childhood conditions on frailty. Another strength is the longer follow-up period, which allowed us to examine the trajectories of frailty scores among respondents with different SSS and objective socioeconomic status categories. The use of latent frailty trajectories emphasises the long-term consequences that occur after measuring SSS. Distinguishing the four trajectories (instead of the conventional robust, pre-frail and frail categories) allowed us to assess the changes in frailty as participants grew older. The conventional categories capture only a single point in time. Our two middle 'progressive' frailty trajectories could perhaps be understood as the equivalent of moving from less frail into more frail conditions.

While we show that a significant association remained even after we included income, wealth, social class, socioeconomic conditions during childhood and neighbourhood deprivation, we acknowledge the possibility of other unexplored pathways between subjective status and frailty, including trust and personal relationships. For example, a study using panel data of older adults aged 60+ years in China found that social trust mediated the relationship between SSS and self-rated health.[19] Moreover, in a study in Korea, the quality of interpersonal relationships mediated the link between SSS and happiness among males, but not females.[55] Thus, future studies identifying the mechanisms of the relationships between SSS and health, especially among the older population, will provide crucial input for interventions aimed at improving health among those with low SSS. Another limitation is its observational design, which means that the relationship between SSS with frailty index may be affected by unmeasured predictors of frailty, such as dietary intake. Therefore, the findings should be interpreted with caution.

A second limitation relates to our finding that health behaviours did not affect the link between SSS and frailty, which could reflect the limited categorisation of health behaviours in this study. For example, the information on drinking behaviour was limited to the frequency of drinking alcohol, and the data on the amount of alcohol were not available. Third, we are unable to explore differences by ethnicity due to the small number of ethnic minority group members in our sample. This small sample of non-white participants is mainly due to the funding constraints precluding ELSA from oversampling ethnic minority participants.[31]

A further possible limitation is that the effect of SSS on frailty trajectories may have been underestimated due to attrition. As with any longitudinal survey, ELSA is subject to attrition, with respondents most likely to drop out of the study having poorer health and higher frailty. Finally, the observational design of this study means the association between SSS and frailty trajectory memberships may be affected by confounding factors uncaptured by the data. The causal relationships between SSS and frailty trajectory memberships thus should not be inferred from this study.

Conclusion

In conclusion, this study provides evidence for socioeconomic inequalities in the development of frailty, where low SSS could lead to an increased risk of frailty independent

of objective measures of socioeconomic status and other predisposing factors. The substantively important association between SSS and frailty in this study emphasises the need to better understand the SSS among older people. Health in later stages of the life course is distinctive given that it results from the accumulation of health and conditions in prior stages of life,[30] and the evidence on the size and patterns of health inequalities among this age group is still ambiguous.[56] These results emphasise the importance of older people's perception of their social status in designing interventions to promote health and prevent frailty in this age group.

Acknowledgements We thank Dr Bram Vanhoutte for his help and suggestions on some parts of the data analysis. We also thank the Anonymous Reviewers for the comments.

Contributors AM had the initial idea for the study, contributed to the design of the study, cleaned the data, conducted statistical analyses, interpreted the statistical findings, drafted the manuscript and responsible for the overall content as guarantor. LR had the initial idea for the study, contributed to the concept and design of the study, interpreted the statistical findings and drafted the manuscript. PP had the initial idea for the study, conducted statistical analyses, interpreted the statistical findings, annotated the Stata syntax and drafted the manuscript. All authors critically revised the manuscript for important intellectual content. All authors have read and approved the final version.

Funding ELSA is funded by the National Institute on Aging (R01AG017644) and by the UK government departments coordinated by the National Institute for Health and Care Research (NIHR). PP is supported by the French National Research Agency (ANR), 'Investissements d'Avenir' (LabEx Ecodec/ANR-11-LABX-0047).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants. ELSA wave 1 received ethical approval from the London Multi-Centre Research Ethics Committee on 7 February 2002 (MREC/01/2/91). ELSA wave 2 received ethical approval from the London Multi-Centre Research Ethics Committee on 12 August 2004 (MREC/04/2/006). ELSA wave 3 received ethical approval from the London Multi-Centre Research Ethics Committee on 27 October 2005 (05/MRE02/63). ELSA wave 4 received ethical approval from the National Hospital for Neurology and Neurosurgery and Institute of Neurology Joint Research Ethics Committee on 12 October 2007 (07/H0716/48). ELSA wave 5 received ethical approval from the Berkshire Research Ethics Committee on 21 December 2009 (09/H0505/124). ELSA wave 6 received ethical approval from the NRES Committee South Central-Berkshire on 28 November 2012 (11/SC/0374). ELSA wave 7 received ethical approval from the NRES Committee South Central-Berkshire on 28 November 2013 (13/SC/0532). ELSA wave 8 received ethical approval from the South Central-Berkshire Research Ethics Committee on 23 September 2015 (15/SC/0526). ELSA wave 9 received ethical approval from the South Central-Berkshire Research Ethics Committee on 10 May 2018 (17/SC/0588). This information was retrieved from elsa-project.ac.uk/ethical-approval. Participants gave informed consent to participate in the study before taking part. Our specific study was exempt from formal ethical review based on the University of Manchester guidelines (available at: https://www.manchester.ac.uk/research/environment/governance/ethics/approval/) as it is a secondary data analysis in which: (1) the data are completely anonymous with no personal information being collected (apart from their name, their publicly available contact details and a record of consent), (2) the data are not considered to be sensitive or confidential in nature, (3) we obtained consent from UK Data Service and the National Centre for Social Research to access the data, and (4) our study purpose falls within the remit of the original consent provided by data subjects.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. ELSA data from the main survey (SN 5050), and the COVID-19 substudy (SN 8688), are available through the UK Data Service (https://ukdataservice.ac.uk/[ukdataservice.ac.uk]). Details on how to access ELSA, including the conditions of use, can be found on the ELSA website (https://www.elsa-project.ac.uk/accessing-elsa-data [elsa-project.ac.uk]) and the UK Data Service website. The authors provide a replication package (https://doi.org/10.17605/OSF.IO/RTC8U) [doi.org].

ORCID iDs
Asri Maharani http://orcid.org/0000-0002-5931-8692
Lindsay Richards http://orcid.org/0000-0003-0880-1104
Patrick Präg http://orcid.org/0000-0001-6175-8470

REFERENCES

1 O'Caoimh R, Sezgin D, O'Donovan MR, *et al*. Prevalence of frailty in 62 countries across the world. A systematic review and meta-analysis of population-level studies. *Age Ageing* 2021;50:96–104.
2 Hanlon P, Nicholl BI, Jani BD, *et al*. Frailty and pre-frailty in middle-aged and older adults and its association with Multimorbidity and mortality. A prospective analysis of 493,737 UK Biobank participants. *Lancet Public Health* 2018;3:e323–32.
3 Cegri F, Orfila F, Abellana RM, *et al*. The impact of frailty on admission to home care services and nursing homes: eight-year follow-up of a community-dwelling, older adult, Spanish cohort. *BMC Geriatr* 2020;20:281.
4 Ensrud KE, Ewing SK, Taylor BC, *et al*. Frailty and risk of falls, fracture, and mortality in older women. The study of Osteoporotic fractures. *J Gerontol A Biol Sci Med Sci* 2007;62:744–51.
5 Fried LP, Tangen CM, Walston J, *et al*. Frailty in older adults. evidence for a phenotype. *J Gerontol A Biol Sci Med Sci* 2001;56:M146–56.
6 Clegg A, Young J, Iliffe S, *et al*. Frailty in elderly people. *Lancet* 2013;381:752–62.
7 Verghese J, Ayers E, Sathyan S, *et al*. Trajectories of frailty in aging. prospective cohort study. *PLoS One* 2021;16:e0253976.
8 Stow D, Matthews FE, Hanratty B. Frailty Trajectories to identify end of life. A longitudinal population-based study. *BMC Med* 2018;16:171.
9 Chamberlain AM, St Sauver JL, Jacobson DJ, *et al*. Social and behavioral factors associated with frailty Trajectories in a population-based cohort of older adults. *BMJ Open* 2016;6:e011410.
10 Welstead M, Jenkins ND, Russ TC, *et al*. A systematic review of frailty trajectories: their shape and influencing factors. *Gerontologist* 2021;61:e463–75.
11 Lang IA, Hubbard RE, Andrew MK, *et al*. Individual socioeconomic status, and frailty in older adults. *J Am Geriatr Soc* 2009;57:1776–80.
12 Franse CB, van Grieken A, Qin L, *et al*. Socioeconomic inequalities in frailty and frailty components among community-dwelling older citizens. *PLoS One* 2017;12:e0187946.
13 Maharani A, Sinclair DR, Chandola T, *et al*. Household wealth, neighborhood deprivation, and frailty amongst middle-aged and older adults in England. A longitudinal analysis over 15 years (2002–2017). *Age and Ageing* 2023;52:1–10.
14 Brunner EJ, Shipley MJ, Ahmadi-Abhari S, *et al*. Midlife contributors to socioeconomic differences in frailty during later life. A prospective cohort study. *Lancet Public Health* 2018;3:e313–22.
15 Dugravot A, Fayosse A, Dumurgier J, *et al*. Social inequalities in Multimorbidity, Frailty, disability, and transitions to mortality. A 24-year follow-up of the Whitehall II cohort study. *Lancet Public Health* 2020;5:e42–50.
16 Watts PN, Blane D, Netuveli G. Minimum income for healthy living and frailty in adults over 65 years old in the English longitudinal study of aging. A population-based cohort study. *BMJ Open* 2019;9:e025334.

17 McEwen BS. Brain on stress: how the social environment gets under the skin. *Proc Natl Acad Sci U S A* 2012;109:17180–5.
18 Coustaury C, Jeannot E, Moreau A, *et al*. Subjective socioeconomic status and self-rated health in the English longitudinal study of aging. A fixed-effects analysis. *Soc Sci Med* 2023;336:S0277-9536(23)00592-0.
19 Zhou J, Guo W, Ren H. Subjective social status and health among older adults in China. The longitudinal mediating role of social trust. *BMC Public Health* 2023;23:630.
20 Präg P. Subjective socioeconomic status predicts self-rated health irrespective of objective family socioeconomic background. *Scand J Public Health* 2020;48:707–14.
21 Zahodne LB, Kraal AZ, Zaheed A, *et al*. Subjective social status predicts late-life memory Trajectories through both mental and physical health pathways. *Gerontology* 2018;64:466–74.
22 Schubert T, Süssenbach P, Schäfer SJ, *et al*. The effect of subjective social status on depressive thinking. An experimental examination. *Psychiatry Res* 2016;241:22–5.
23 Präg P, Mills MC, Wittek R. Subjective socioeconomic status and health in cross-national comparison. *Soc Sci Med* 2016;149:84–92.
24 Hoebel J, Lampert T. Subjective social status and health: Multidisciplinary explanations and methodological challenges. *J Health Psychol* 2020;25:173–85.
25 Abrams D, Russell PS, Vauclair C-M, *et al*. *Ageism in Europe: Findings from the European Social Survey. 2011*. London: Age UK, 2011.
26 Fiske ST, Cuddy AJC, Glick P, *et al*. A model of (often mixed) stereotype content. competence and warmth respectively follow from perceived status and competition. *J Pers Soc Psychol* 2002;82:878–902.
27 Demakakos P, Nazroo J, Breeze E, *et al*. Socioeconomic status and health. The role of subjective social status. *Soc Sci Med* 2008;67:330–40.
28 Richards L, Maharani A, Präg P. Subjective social status and Allostatic load among older people in England. A longitudinal analysis. *Soc Sci Med* 2023;320:S0277-9536(23)00105-3.
29 Andersson MA. An odd ladder to climb. socioeconomic differences across levels of subjective social status. *Soc Indic Res* 2018;136:621–43.
30 Pakpahan E, Hoffmann R, Kröger H. The long arm of childhood circumstances on health in old age. *Adv Life Course Res* 2017;31:1–10.
31 Steptoe A, Breeze E, Banks J, *et al*. Cohort profile: the English longitudinal study of aging. *Int J Epidemiol* 2013;42:1640–8.
32 Banks J, Batty GD, Breedtveldt J, *et al*. English longitudinal study of aging, waves 0-9, 1998-2019. 37th edn. Colchester: UK Data Service, 2021.
33 Rockwood K, Mitnitski A, Song X, *et al*. Long-Term risks of death and Institutionalization of elderly people in relation to deficit accumulation at age 70. *J Am Geriatr Soc* 2006;54:975–9.
34 Rockwood K, Mitnitski A. Frailty in relation to the accumulation of deficits. *J Gerontol A Biol Sci Med Sci* 2007;62:722–7.
35 Ravindrarajah R, Lee DM, Pye SR, *et al*. The ability of three different models of frailty to predict all-cause mortality: results from the European male aging study (EMAS). *Archives of Gerontology and Geriatrics* 2013;57:360–8.
36 Kulminski A, Yashin A, Arbeev K, *et al*. Cumulative index of health disorders as an indicator of aging-associated processes in the elderly: results from analyses of the National long term care survey. *Mech Ageing Dev* 2007;128:250–8.
37 Searle SD, Mitnitski A, Gahbauer EA, *et al*. A standard procedure for creating a frailty index. *BMC Geriatr* 2008;8:24:1–10.:.
38 Marshall A, Nazroo J, Tampubolon G, *et al*. Cohort differences in the levels and Trajectories of frailty among older people in England. *J Epidemiol Community Health* 2015;69:316–21.
39 Adler NE, Epel ES, Castellazzo G, *et al*. Relationship of subjective and objective social status with psychological and physiological functioning. *Health Psychology* 2000;19:586–92.
40 Cundiff JM, Smith TW, Uchino BN, *et al*. Subjective social status. construct validity and associations with Psychosocial vulnerability and self-rated health. *Int J Behav Med* 2013;20:148–58.
41 Smith T, Noble M, Noble S, *et al*. *The English Indices of Deprivation 2015*. London: Department for Communities and Local Government, 2015.
42 Office for National Statistics. *English Indices of Deprivation 2019*. London: Ministry of Housing, Communities, and Local Government, 2019.
43 Matthews K, Dawes P, Elliot R, *et al*. Trajectories of self-reported hearing and their associations with cognition: evidence from the United Kingdom and United States of America. *Age Ageing* 2023;52:afad017.
44 Nagin DS. *Group-Based Modeling of Development*. Harvard University Press, 2005.
45 Kuha J. AIC and BIC: comparisons of assumptions and performance. *Soc Method Res* 2004;33:188–229.
46 Tein J-Y, Coxe S, Cham H. Statistical power to detect the correct number of classes in latent profile analysis. *Struct Equ Modeling* 2013;20:640–57.
47 Vermunt JK, Magidson J. How to perform three-step latent class analysis in the presence of measurement non-Invariance or differential item functioning. *Structural Equation Modeling: A Multidisciplinary Journal* 2021;28:356–64.
48 Davies K, Maharani A, Chandola T, *et al*. A prospective analysis examining frailty remission and the association with future falls risk in older adults in England. *Age Ageing* 2023;52:afad003.
49 Kraft P, Kraft B, Hagen T, *et al*. Subjective socioeconomic status, cognitive abilities, and personal control. associations with health behaviors. *Front Psychol* 2021;12:784758.
50 D'Hooge L, Achterberg P, Reeskens T. The impact of subjective social status on health outcomes and health behaviors. *PLoS One* 2018;13:e0202489.
51 Präg P, Mills M, Wittek R. Income and income inequality as social determinants of health. do social comparisons play a role? *Eur Sociol Rev* 2014;30:218–29.
52 Wilkinson RG. *Unhealthy Societies. The Afflictions of Inequality*. London and New York: Routledge, 1996.
53 Yong JC, Hartanto A, Tan JJX. Subjective social status and inflammation. The role of culture and anger control. *Health Psychol* 2021;40:62–70.
54 Furman D, Campisi J, Verdin E, *et al*. Chronic inflammation in the etiology of disease across the life span. *Nat Med* 2019;25:1822–32.
55 Kim J-W, Lim C, Falci C. Subjective social class, perceived quality of social relationships, and happiness. A case of mediation and moderation across gender. *Int Sociol* 2020;35:312–35.
56 Chandola T, Ferrie J, Sacker A, *et al*. Social inequalities in self-reported health in early old age. follow-up of prospective cohort study. *BMJ* 2007;334:990.