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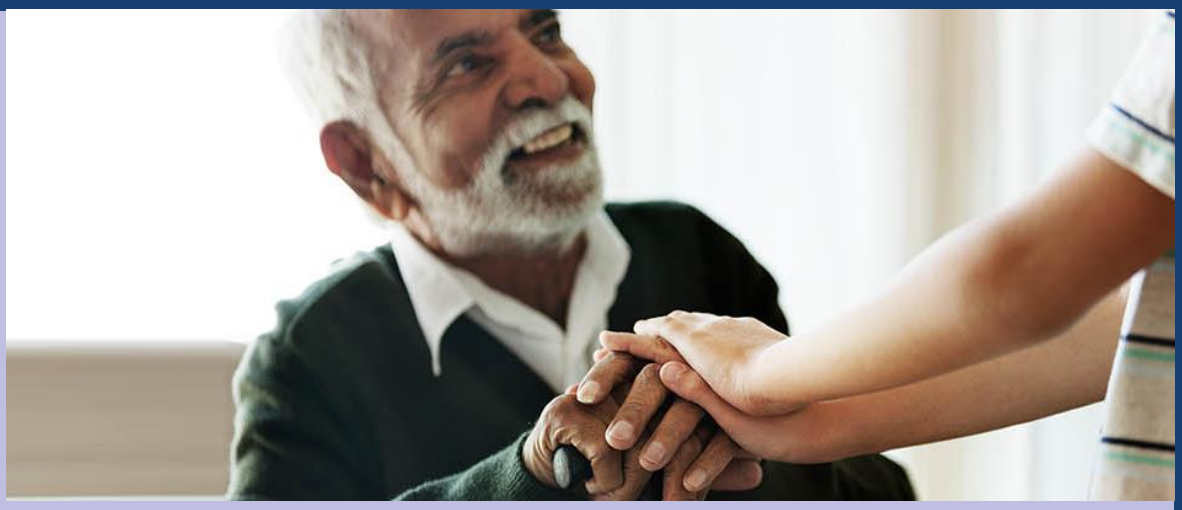

Using individual and neighbourhood profiles and trends to understand frailty with nationally representative population data

Part 3: Linking area level (rurality and deprivation) and individual factors/assets with levels of frailty

David Sinclair, Asri Maharani, Tarani Chandola, Peter Bower, Barbara Hanratty, James Nazroo, Neil Pendleton, Gindo Tampubolon, Chris Todd, Raphael Wittenberg, Terence W O'Neill, Fiona Matthews

Full Report

November 2021

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Full Report

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Background

We have previously reported substantial differences in pre-frailty and frailty between local authority districts in England (1). In this report, we examine the relationship between frailty and disadvantage at both individual and area levels, taking into account some important health behaviours.

The relationship between health outcomes and where people live, is well established. Living in urban areas, for example, is associated with poor health and shorter life expectancies (2). Area deprivation is known to drive poor health, with older people at the greatest risk (3, 4). Living in a deprived area is associated with worse self-reported physical function, cognitive function, and mental health among older people (5-9). There is also strong and uncontested evidence for the impact of individual socioeconomic factors on health (10-12). Brunner et al. found higher prevalences of frailty among individuals with low economic status in the UK, with these inequalities partly explained by behavioural and cardiometabolic risk factors (12).

There are strong relationships between income inequality and poorer health outcomes (13). However, the influence of area characteristics on older people's health, such as access to services, may reduce inequalities between the rich and the poor (4, 14).

It is currently unclear whether area-level characteristics have any additional impact on frailty among older people. Previous research has demonstrated an association between individual and neighbourhood socioeconomic factors and frailty (15). However, studies have not always considered health behaviours, such as smoking and physical activity, that may mediate the link between individual and neighbourhood socioeconomic factors and health. Previous work has demonstrated differences in health behaviours (including smoking and physical activity) between individuals with low socioeconomic status who were living in deprived and less deprived areas (16). In addition, a recent UK Biobank study also reported an association between higher levels of pre-frailty and frailty and increasing deprivation (17). [1]

This report aims to investigate the association between individuals' socioeconomic status and area deprivation on frailty, controlling for health behaviours by using a nationally representative cohort of community-dwelling older people in England.

[1] Note this study was unweighted, and individuals from more deprived areas, and the oldest age groups, are underrepresented in the UK Biobank (18)

Methods

Data

Our data are derived from Wave 8 of the English Longitudinal Study of Ageing (ELSA), a nationally representative panel study of people aged 50 years and older living in England (19). It collects information on the demographic and socioeconomic characteristics, lifestyle and health. Data collection was started in 2002, with survey waves every two years using face-to-face interviews and self-completed questionnaires. So far, there have been nine waves of ELSA. Details of the study design are given elsewhere (20).

Frailty measures

A frailty index was created using the method of Wade and colleagues (21). It included 51 variables ('deficits') representing conditions that accumulate with age and are associated with adverse outcomes, including disability, mobility, sensory impairments, cognitive function, and chronic diseases. A score of 1 is assigned to every present deficit, 0 if absent and a score between 0 and 1 for partial presence of the deficit. An individual's frailty index is calculated from their total score divided by the total number of deficits considered. Frailty indices with at least 30-40 deficits are able to accurately predict adverse outcomes (the full list of variables included is presented in Appendix 1) (22). Following Clegg et al., we categorised the frailty index into robust (≤ 0.24), pre-frailty (>0.24-0.36) and frailty (> 0.36) (23).

Individual-level determinants

Socioeconomic and demographic information on respondents includes age, gender (a binary variable with male as reference), ethnicity (a binary variable with white as reference), marital status (single, married as the reference, divorced, and widowed), and wealth (quintiles). We categorised age into four groups: 50-59, 60-69 (reference), 70-79, and □80. Wealth was measured as each respondent's net financial wealth (i.e. gross financial wealth minus financial debt), grouped by quintiles. Smoking status was categorised into non-smoker (reference), past smoker, and current smoker. We categorised the drinking behaviour into: (1) not at all; (2) 4 days a week or fewer; and (3) 5 days a week or more.

Area-level determinants

Deprivation was measured by the Index of Multiple Deprivation (IMD), grouped into quintiles (24). The IMD is comprised of seven domains of deprivation measured at the Lower layer Super Output Area (LSOA) level (a geographic area of 1,000-3,000 people), including (1) income deprivation, (2) employment deprivation, (3) education, skills and training deprivation, (4) health and disability deprivation, (5) crime, (6) barriers to housing and services, and (7) living environment deprivation. The geographical information in ELSA classified the areas of living into urban and rural based upon the size of the settlement and population density (25).

Statistical analyses

A generalised ordered logit model was used to investigate the association between pre-frailty, frailty and socioeconomic and demographic variables (26, 27). Model fitting was conducted with Stata's *gologit2* program (27, 28). Missing data on the variables were handled by Multivariate Imputation by Chained Equations (MICE) (29) (using Stata's MI program (30)). Twenty imputations were created. We performed two analyses: with simple adjustment (age, sex, ethnicity and IMD covariates only) and full adjustment (all covariates).

Results

Individual characteristics and area type

A total of 8,355 subjects, 3,727 men and 4,628 women were included in the analysis. Mean age was 69.1 years and the majority (96.3%) were white. The proportion of subjects in the unimputed, unweighted data who were frail and pre-frail are 7.0% and 10.8%, respectively (Table 1). Weighted estimates, imputed for missing data, are 9.9 (9.1-10.7)% frail and 8.0 (7.3-8.8)% pre-frail.

Descriptive characteristics and proportion of pre-frailty and frailty among adults aged 50 years and older in England are presented in Appendix 2. The majority (66.0%) were married, with 6.1% single, 12.7% separated/divorced and 15.0% widowed. Around 9.5% and 45.7% of the respondents were current and past smokers, respectively. The majority of the respondents (65.5%) drank 4 days a week or fewer, with 19.8% drinking 5 days a week or more, and 14.7% non-drinkers. Most of the respondents (73.1%) lived in urban areas.

Compared to those who were non-smokers, people who smoked, or were past smokers, were more likely to be frail (10.5% and 8.6% vs 6.8%) and prefrail (11.7% and 10.2% vs 8.8%). Compared to those who did not drink at all, people who reported drinking alcohol, both 4 days a week or fewer or, 5 days a week or more were less likely to be both frail and prefrail, see Appendix 2. The prevalence of frailty increased from 6-7% in the two least deprived area quintiles to 10.9% in the most deprived area quintile. Similarly, frailty increases from 4.1% of the wealthiest quintile to 12.7% of the least wealthy.

Table 1: Characteristics of ELSA wave 8 participants (n=8,355). 600 individuals had missing data on at least one of the 51 variables comprising the frailty index, hence the smaller number of individuals in the frailty categories. Individuals with missing data were included by undertaking multivariate imputation by chained equations (MICE)

Characteristic	n	Percent	Imputed percent, unweighted (95% CI)
Sex			
Male	3,727	44.6	44.6
Female	4,628	55.4	55.4
Age			
50-59	1,254	15.0	15.0
60-69	3,355	40.2	40.2
70-79	2,424	29.0	29.0
80-89	1,322	15.8	15.8
Ethnicity			
White	8,047	96.3	96.3
Non-white	308	3.7	3.7
Frailty status			
Robust	6,374	82.2	81.0 (80.1-81.8)
Pre-frail	835	10.8	10.7 (10.0-11.4)
Frail	546	7.0	8.3 (7.7-8.9)
(Missing)	(600)	(7.2)	(-)

Individual and area effects on frailty

A generalised ordered logistic model was used to examine how individual and area characteristics affect frailty among older adults in England. For the area characteristics, we focused on areas as characterised by quintiles of area deprivation (IMD) and urban status. The analysis is comprised of two models. The first model includes only age group, gender, ethnicity and IMD quintile, while the second model included all the covariates.

Figure 1 shows the odds ratios of pre-frailty and frailty among older people who lived in areas with different level of deprivation. In model 1, people living in the most deprived areas had greater odds of frailty and pre-frailty than those living in the other four quintiles. The area deprivation association with pre-frailty and frailty is attenuated in model 2 in model 2, which accounts for a greater number of individual-level determinants and urban status. The odds of frailty is only significantly less for the three least-deprived quintiles compared to the most deprived quintile in the model 2.

In model 1, the second and third-most deprived areas have significantly greater odds of frailty and pre-frailty than the least deprived areas. However, this is not the case when additional covariates are accounted for in model 2.

The predicted probability of pre-frailty and frailty according to wealth and area deprivation are shown in Figure 2. These probabilities are calculated from model 2 (using average adjusted predictions for the other covariates (31)). The probability of pre-frailty among older people who are both in the poorest quintile of wealth and living in the most deprived areas (0.18 [95% CI 0.15-0.22]) was three times greater than among those in the group who are in the greatest wealth quintile and live in the least deprived areas (0.06 [95% CI 0.04-0.07]). This difference between the most disadvantaged and most advantaged groups was even greater for frailty: 0.17 [95% CI 0.14-0.21] and 0.04 [95% CI 0.02-0.05], respectively, slightly higher than a factor of four.

Independently of a person's wealth, increased deprivation increases their probability of pre-frailty and frailty (Appendix 3), with the most deprived area quintile associated with greater odds of pre-frailty and frailty relative to the least deprived area quintile (2.2 [95% CI 1.6-3.0] and 3.2 [95% CI 2.3-4.5] for pre-frailty and frailty, respectively). Similarly, independently of where a person lives, increased wealth decreases their probability of pre-frailty and frailty. Wealthier people are more likely to live in less deprived areas (Appendix 4).

A person in the lowest wealth quintile and lived in most deprived area quintile has a significantly greater probability of frailty than a person living in the 40% least deprived areas, independently of their wealth (Figure 2). Those most disadvantaged people (i.e. most deprived, least wealth) also have a significantly greater probability of frailty than a person in 60% most wealthy quintiles independently of the area deprivation. The most disadvantaged people also have a greater probability of pre-frailty than a person living in any other circumstance.

The full results of the generalised ordered logistic regression of models 1 and 2 are provided in Appendix 5. As with the results shown in Figure 2 (which assumes average values for all the covariates except deprivation and wealth), area deprivation is only associated with increased pre-frailty and frailty for those in the most deprived quintile in model 2. On the other hand, wealth is associated with increased pre-frailty and frailty across a wide range of wealth quintiles: the least wealthy quintile have approximately double the odds ratio of pre-frailty and frailty than the second-least-wealthy quintile (OR 0.56 [0.45-0.70]), and quadruple the odds ratio of the wealthiest quintile (OR 0.24 [0.17-0.34]).

Pre-frailty and frailty are associated with increased age and female sex. College or higher education is associated with lower odds of being pre-frail or frail, as is being married. The odds ratio of pre-frailty and frailty were higher among past smokers (OR 1.33 [1.12-1.58]) and current smokers (OR 1.73 [1.33-2.24]). Respondents who drank alcohol 4 days a week (OR 0.47 [0.37-0.58]) or fewer or 5 days a week or more (OR 0.49 [0.38-0.64]) have lower odds ratios of pre-frailty and frailty than those who never drink alcohol.

There was no evidence of an association between ethnicity and pre-frailty or frailty in either model, however, this may be due to the small sample size of non-white

respondents (308 out of 8,355 total). There was also no evidence of an association between urban status and either frailty or pre-frailty.

Figure 1 Odds ratios of pre-frailty and frailty for each deprivation quintile, relative to quintile 1 (most deprived). Results for model 1 (with parameters: age, sex, ethnicity and area deprivation) and model 2 (with additional parameters: wealth, education, marital status, drink frequency, smoking history and urban status). Deprivation measured by IMD (Index of Multiple Deprivation). Error bars show 95% confidence interval.

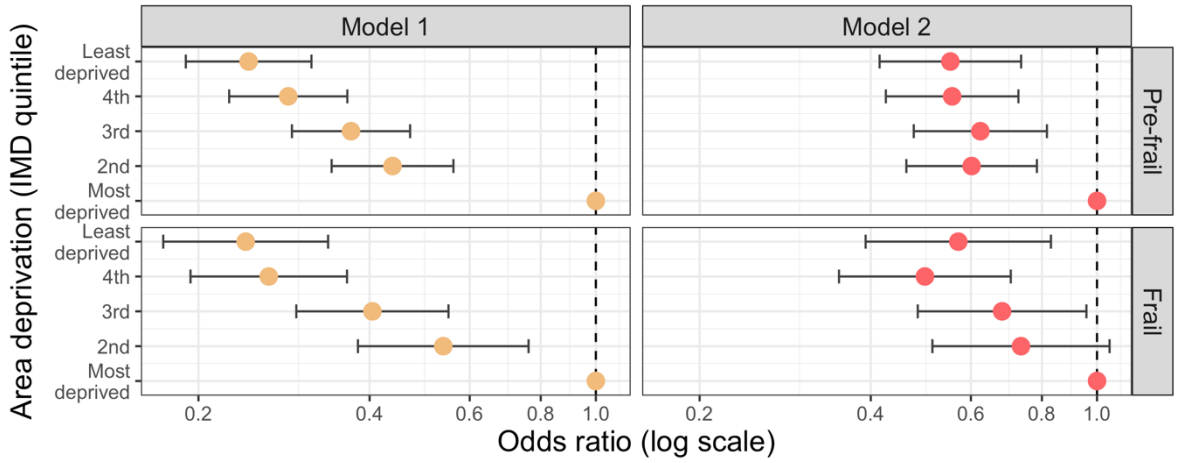
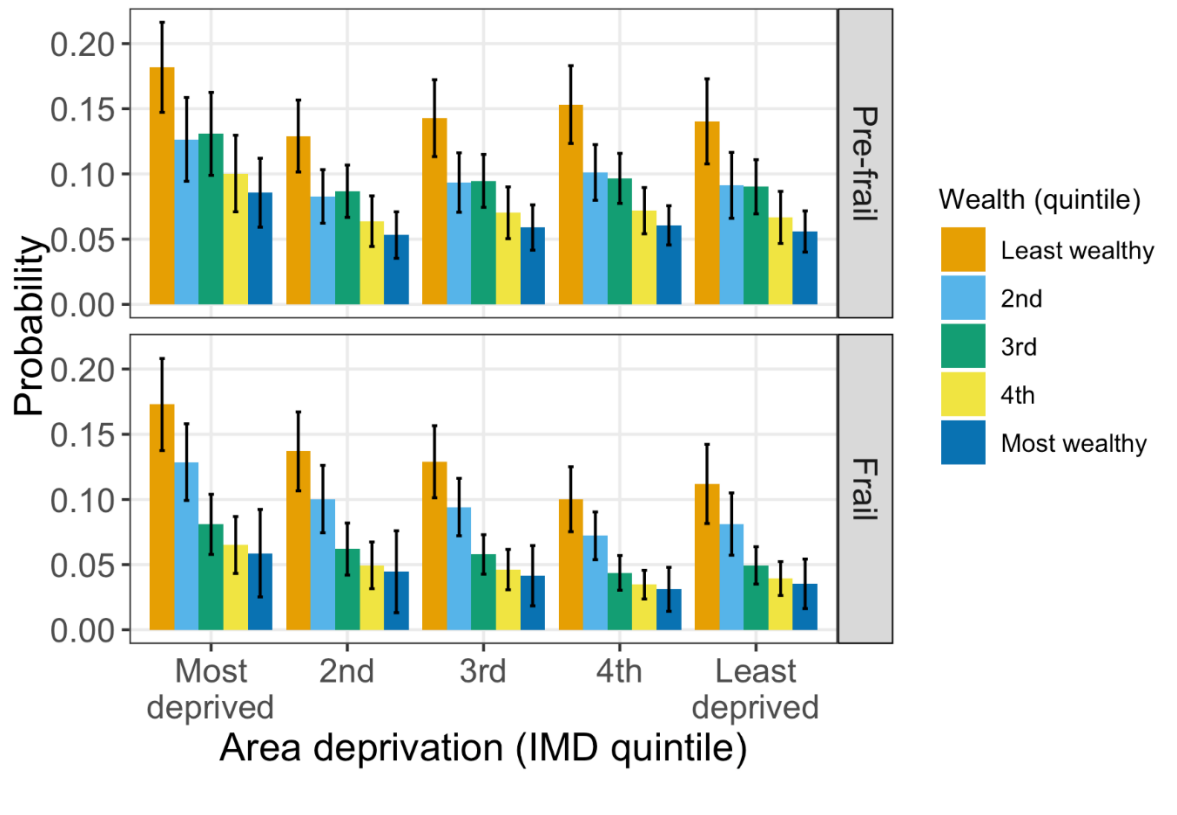


Figure 2 Probability of a person aged over 50 being pre-frail and frail, by wealth and area deprivation



Discussion

Older people in the 20% most deprived areas are significantly more likely to be frail, compared to people the 40% least-deprived areas, taking into account wealth and other factors. There is also a significant increase in the probability of pre-frailty in the 20% most deprived areas, compared to all others. The only exception, is that the risk of frailty does not increase significantly with area deprivation for older people in the wealthiest 20%.

Outside of the 20% most deprived areas, differences in area-deprivation did not change the risk of frailty and had only a small differences for prefrailty. Consequently, targeting the 20% most deprived areas has the potential to provide a good return on investments in interventions, as these areas present the greatest opportunity for change.

Another approach to prevention would be to target the least wealthy, wherever they live. The probability of frailty in older adults decreases markedly between the least wealthy quintile and three most wealthy quintiles. Pre-frailty decreases in all weath quintiles relative to the least wealthy. As older adults in the lowest wealth quintile disproportionately live in the most deprived areas, targeting those with the least wealth will also preference the most deprived areas.

Our results find a threefold difference in the probability of pre-frailty, and a fourfold difference for frailty, between the least advantaged (the least wealthy in the most deprived areas) and the most advantaged (the most wealthy in the least deprived areas) people. The absolute difference in the probability of pre-frailty and frailty between those two groups are 0.13 (0.09-0.16) and 0.14 (0.10-0.18), respectively. Different policy interventions may more easily be targeted at the most deprived areas or least wealthy individuals. Our results suggest both approaches may provide significant benefits in decreasing the prevalence of pre-frailty and frailty in older people.

This finding strengthens the evidence base of the links between area deprivation and higher levels of mental and physical illhealth among older people (7, 15, 32). The relationship between neighbourhood deprivation, less healthy lifestyles, and higher mortality rates is well established (33, 34). Our findings suggest that the significant association between area deprivation and frailty is independent of two key health behaviours: smoking status and alcohol consumption. Other lifestyle factors have been identified as mediators of socioeconomic differences in frailty including diet and physical activity, however we were unable to take account of these factors in this study.

Other plausible mechanisms of the relationship between area deprivation and frailty include both the physical environment (e.g. environmental degradation and proximity to major roads (35)) and the characteristics of the neighbourhood (e.g. perceived safety, poor health is associated with increased high school dropout rates (36)). We found no evidence of an association between urban status and frailty after adjustment for demographic, socioeconomic, health behaviour and area deprivation variables. There is extensive evidence for higher mortality rates and worse health in

the general population living in urban areas in the UK (36-40). However, in Scotland studies have found evidence of greater health inequalities in remote rural areas compared to urban centres (41, 42). Our previous report described higher levels of pre-frailty and frailty in coastal areas of England, compared to inland (1). It would be helpful if future research could include coastal and inland characteristics in any analyses, to support the study of health inequalities between geographical areas.

We found no evidence of an association between ethnicity and frailty, which may be due to the low proportion of non-white respondents in ELSA (20). People who drink alcohol were found to have a lower risk of frailty compared to people who do not consume any alcohol. However, the relevance of this is uncertain, as our analysis was cross-sectional, with no information on alcohol consumption over the lifecourse. Consistent with previous studies, we found smoking was related to a higher risk of frailty and being married was related to a lower risk (43-45).

This report must be viewed in light of several limitations. First, this is a cross-sectional study, and it is not possible to draw conclusions about causality. Further research investigating the effect of living in deprived areas over time using prospective or retrospective methods is required. A second limitation is that there were relatively few non-white participants, as funding constraints precluded oversampling ethnic minority respondents (20).

Conclusion

Area deprivation is associated with frailty among older adults in England, independent of individual socioeconomic and demographic characteristics and individual health behaviours. Wealth is also associated with frailty, independent of demographic characteristics, individual health behaviour and area deprivation. There are likely to be benefits in implementing interventions to reduce frailty in both the most deprived areas and the least wealthy people. Policies focused on the most deprived areas will also benefit many of the least wealthy individuals.

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Additional resources

Appendix 1 Frailty index variable

Table A.1.1 Variable included in the frailty index, using the English Longitudinal Survey of Ageing (ELSA) (21)

No	Variable
1	Difficulty walking 100 yards
2	Difficulty sitting for 2 hours
3	Difficulty getting up from chair after sitting long periods
4	Difficulty climbing several flights stairs without resting
5	Difficulty climbing one flight stairs without resting
6	Difficulty stooping, kneeling, or crouching
7	Difficulty reaching or extending arms above shoulder level
8	Difficulty pulling or pushing large objects
9	Difficulty lifting or carrying weights over 10 pounds
10	Difficulty picking up 5p coin from the table
11	Difficulty dressing, including putting on shoes and socks
12	Difficulty walking across the room
13	Difficulty bathing or showering
14	Difficulty eating, such as cutting up food
15	Difficulty getting in and out of bed
16	Difficulty using the toilet, including getting up or down
17	Difficulty using map to figure out how to get around strange
18	Difficulty preparing a hot meal
19	Difficulty shopping for groceries
20	Difficulty making telephone calls
21	Difficulty taking medications
22	Difficulty managing money, such as paying bills and keeping tracks of expenses
23	Difficulty doing work around the house or garden
24	Self-reported general health
25	Hypertension
26	Angina
27	Heart attack
28	Congestive heart failure
29	Abnormal heart rhythm
30	Diabetes/high blood sugar
31	Stroke
32	Lung diseases
33	Asthma
34	Arthritis
35	Osteoporosis
36	Cancer
37	Parkinson diseases
38	Psychiatric conditions
39	Alzheimer diseases
40	Dementia
41	Poor or fair self-reported eyesight
42	Poor or fair self-reported hearing
43	Fallen down
44	Fractured hip
45	Had joint replacement

46	Cannot answer correct day of month
47	Cannot answer correct month
48	Cannot answer correct year
49	Cannot answer correct day
50	Immediate recall
51	Delayed recall

Appendix 2 Descriptive characteristics and proportion of pre-frailty and frailty among adults aged 50 and older in England. *Presented are frequency (%), unimputed data. ** Presented are proportion (95% confidence intervals), estimated using multiple imputation for missing variables and survey weights. Pre-frail and frail columns are weighted to survey weight; total column is unweighted.

Characteristic	Total*	Pre-frail**	Frail**
Individual characteristics			
Frailty status			
Robust	6,374 (82.2)	-	-
Pre-frail	835 (10.8)	0.099 (0.091; 0.107)	-
Frail	546 (7.0)	-	0.080 (0.073; 0.088)
Age group			
50-59	1,254 (15.0)	0.033 (0.019; 0.046)	0.035 (0.019; 0.050)
60-69	3,355 (40.2)	0.084 (0.072-0.097)	0.070 (0.059; 0.082)
70-79	2,424 (29.0)	0.142 (0.126; 0.157)	0.090 (0.077; 0.104)
80+	1,322 (15.8)	0.218 (0.191;0.246)	0.195 (0.166; 0.223)
Sex			
Male	3,727 (44.6)	0.090 (0.078; 0.101)	0.076 (0.065; 0.087)
Female	4,628 (55.4)	0.106 (0.947; 0.117)	0.085 (0.074; 0.095)
Ethnicity			
White	8,047 (96.3)	0.100 (0.092; 0.108)	0.081 (0.073; 0.089)
Non-white	308 (3.7)	0.074 (0.038; 0.110)	0.086 (0.051; 0.120)
Education			
Less than high school	2,490 (29.8)	0.113 (0.099; 0.127)	0.088 (0.077; 0.099)
High school	1,589 (19.0)	0.076 (0.059; 0.092)	0.086 (0.067; 0.105)
College or higher	4,276 (51.2)	0.095 (0.084; 0.107)	0.071 (0.059; 0.082)
Marital status			
Single	516 (6.1)	0.094 (0.065; 0.124)	0.082 (0.054; 0.111)
Married	5,515 (66.0)	0.093 (0.082; 0.103)	0.076 (0.066; 0.087)
Separated/divorced	1,064 (12.7)	0.107 (0.086; 0.128)	0.079 (0.061; 0.097)
Widowed	1,256 (15.0)	0.113 (0.094; 0.131)	0.094 (0.076; 0.111)
Wealth			
1st quintile (least wealthy**)**	1,644 (20.0)	0.147 (0.126; 0.168)	0.127 (0.109; 0.145)
2nd	1,636 (19.9)	0.097 (0.081; 0.113)	0.093 (0.078; 0.108)
3rd	1,632 (19.9)	0.098 (0.081; 0.114)	0.057 (0.045; 0.069)
4th	1,648 (20.1)	0.073 (0.056; 0.090)	0.046 (0.033; 0.058)
5th (most wealthy**)**	1,650 (20.1)	0.061 (0.047; 0.076)	0.041 (0.019; 0.064)
Smoking behaviour			
Non-smoker	3,743 (44.8)	0.0885 (0.080; 0.096)	0.068 (0.059; 0.076)
Past smoker	3,821 (45.7)	0.102 (0.094; 0.112)	0.086 (0.076; 0.096)
Current smoker	791 (9.5)	0.117 (0.102; 0.132)	0.105 (0.087; 0.124)
Drinking frequency			
Not at all	1,200 (14.7)	0.135 (0.119; 0.150)	0.126 (0.105; 0.147)

Drink 4 days a week or fewer	5,340 (65.5)	0.0891 (0.083; 0.099)	0.067 (0.060; 0.075)
Drink 5 days a week or more	1,614 (19.8)	0.094 (0.082; 0.106)	0.071 (0.059; 0.082)
Area characteristics			
Urban status			
Urban	6,090 (73.1)	0.099 (0.090; 0.108)	0.078 (0.063; 0.092)
Rural	2,246 (26.9)	0.095 (0.079; 0.112)	0.082 (0.073; 0.090)
Area deprivation			
1st quintile (most deprived)	993 (11.9)	0.128 (0.104; 0.152)	0.109 (0.088; 0.130)
2nd	1,406 (16.9)	0.086 (0.071; 0.101)	0.085 (0.065; 0.106)
3rd	1,730 (20.8)	0.095 (0.079; 0.111)	0.080 (0.065; 0.095)
4th	2,157 (26.0)	0.101 (0.085; 0.116)	0.061 (0.049; 0.074)
5th (least deprived)	2,025 (24.4)	0.092 (0.073; 0.111)	0.069 (0.053; 0.085)

Appendix 3: Odds ratio of pre-frailty and frailty for different deprivation quintiles and wealth. Deprivation measured by Indices of Multiple Deprivation (IMD) quintiles (with 1 the most deprived). Odds ratio calculated from multinomial logistic regression. Multiple imputation by chained equations used to account for missingness. Wealth is gross financial wealth minus financial debt (the amount was divided with 100,000 in the analysis). A possible interaction effect between deprivation and wealth was checked, but was found not to be significant. Robust (i.e. not frail) and deprivation quintile 5 are base outcomes.

Variable	**Quintile**	**Pre-frail**	**Frail**
Deprivation	1 (most deprived)	2.20 (1.61-3.00)	3.19 (2.27-4.48)
	2	1.22 (0.92-1.64)	1.81 (1.27-2.56)
	3	1.31 (0.99-1.74)	1.53 (1.12-2.10)
	4	1.16 (0.87-1.53)	1.09 (0.79-1.51)
	5 (least deprived)	(reference)	(reference)
Wealth	(continuous)	0.79 (0.69-0.90)	0.61 (0.47-0.80)
baseline		0.11 (0.09-0.14)	0.08 (0.06-1.07)

Appendix 4: Regression results for net wealth per £100,000 against deprivation quintile.

Variable	**Quintile**	**Coefficient**
Deprivation	1 (most deprived)	(reference)
	2	0.23 (0.11-0.35)
	3	0.59 (0.43-0.75)
	4	0.83 (0.69-0.98)
	5 (least deprived)	1.23 (0.95-1.51)
constant		0.30 (0.22-0.39)

Appendix 5 Individual and area determinants of frailty status: results of generalised ordered logit models 1 and 2. Results are presented as odds ratios, relative to the baseline odds. The proportional odds / parallel lines assumption is valid for all variables except age. The odds ratios for deprivation differ from those presented in Figure 1, as these are relative to the baseline odds, whereas Figure 1 is relative to the most deprived quintile.

	Model 1	Model 2
Pre-frailty		
Baseline odds	0.32 (0.26; 0.40)	0.75 (0.52; 1.09)
Individual characteristics		
Age group, reference: 60-69 years old		
50-59	0.47 (0.34; 0.86)	0.36 (0.26; 0.50)
70-79	1.87 (1.59; 1.83)	1.76 (1.49; 2.09)
80+	5.67 (4.74; 5.35)	4.70 (3.83; 5.76)
Female	1.46 (1.27; 1.70)	1.23 (1.04; 1.45)
Non-white	1.11 (0.73; 1.69)	0.83 (0.53; 1.30)
Area deprivation, reference: 1st quintile (most deprived)		
2nd	0.44 (0.34; 0.56)	0.60 (0.46; 0.78)
3rd	0.37 (0.29; 0.47)	0.62 (0.48; 0.82)
4th	0.29 (0.23; 0.37)	0.56 (0.43; 0.73)
5th (least deprived)	0.25 (0.19; 0.32)	0.55 (0.41; 0.74)
Urban		1.07 (0.90; 1.28)
Education, reference: less than high school		
High school		0.72 (0.57; 0.90)
College or higher		0.75 (0.63; 0.89)
Marital status, reference: married		
Single		1.07 (0.75; 1.51)
Separated/divorced		1.15 (0.91; 1.46)
Widowed		1.35 (1.11; 1.64)
Wealth, reference: 1st quintile (least wealthy)		
2nd		0.56 (0.45; 0.70)
3rd		0.42 (0.33; 0.53)
4th		0.29 (0.22; 0.38)

5th (most wealthy)		0.24 (0.17; 0.34)
Smoking behaviour, reference: non smoker		
Past smoker		1.33 (1.12; 1.58)
Active smoker		1.73 (1.33; 2.24)
Drinking behaviour, reference: Not at all		
Drink 4 days a week or fewer		0.47 (0.37; 0.58)
Drink 5 days a week or more		0.49 (0.38; 0.64)
Frailty		
Baseline odds	0.13 (0.09; 0.17)	0.26 (0.16; 0.43)
Individual characteristics		
Age group, reference: 60-69 years old		
50-59	0.54 (0.35; 0.86)	0.46 (0.27; 0.78)
70-79	1.44 (1.14; 1.83)	1.33 (1.05; 1.70)
80+	4.21 (3.31; 5.35)	3.57 (2.72; 4.70)
Female	1.38 (1.12; 1.69)	1.14 (0.91; 1.43)
Non-white	1.33 (0.81; 2.17)	1.08 (0.63; 1.83)
Area deprivation, reference: 1st quintile (most deprived)		
2nd	0.54 (0.38; 0.76)	0.73 (0.51; 1.05)
3rd	0.40 (0.30; 0.55)	0.68 (0.48; 0.96)
4th	0.27 (0.19; 0.37)	0.50 (0.35; 0.71)
5th (least deprived)	0.24 (0.17; 0.34)	0.57 (0.39; 0.83)
Urban		1.07 (0.82; 1.38)
Education, reference: less than high school		
High school		0.97 (0.71; 1.33)
College or higher		0.77 (0.60; 0.98)
Marital status, reference: married		
Single		1.10 (0.69; 1.75)
Separated/divorced		1.05 (0.76; 1.44)
Widowed		1.29 (0.98; 1.70)
Wealth, reference: 1st quintile (poorest)		

2nd	0.68 (0.52; 0.88)
3rd	0.39 (0.29; 0.52)
4th	0.30 (0.21; 0.43)
5th (wealthiest)	0.27 (0.14; 0.52)
Smoking behaviour, reference: non smoker	
Past smoker	1.33 (1.12; 1.58)
Active smoker	1.73 (1.33; 2.24)
Drinking behaviour, reference: Not at all	
Drink 4 days a week or fewer	0.47 (0.37; 0.58)
Drink 5 days a week or more	0.49 (0.38; 0.64)

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