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The Frailty Index in Europeans: association with determinants of health

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Abstract

Aim—The Frailty Index (FI) summarizes differences in health status within individuals, and the *determinants of health* drive that variability. The aim of the present study was to investigate the influence of education, income, smoking, alcohol intake, and parental longevity on the FI variability in subjects of the same chronological age group.

Methods—Analyses were based on a 40-item FI based on the first wave of the Survey of Health, Ageing and Retirement in Europe (SHARE, http://www.share-project.org/), including 29,905 participants aged ≥ 50 from 12 countries. For each sex, the sample was divided into age categories (50s, 60s, 70s, 80s and ≥ 90) and FI quartiles within age categories were calculated. Multivariate ordinal regressions were computed to assess the relative contribution of the health determinants on the FI quartiles in each age group.

Results—In women, the most significant multivariate predictors were years of education (Odds Ratios [ORs] around 0.9), and difficulties making ends meet (ORs between 1.8 and 2.1). In men, the most significant multivariate predictors were years of education (ORs around 0.9), difficulties making ends meet (ORs between 1.6 and 2.1), mother's age of death (OR under 1), and father's age of death (ORs under 1).

Conclusions—Consistently with the literature, education and income explained, in both sexes, cross-sectional variability in FI in subjects of the same chronological age group. The influence of parental longevity seemed to be greater in men, which mirrors previous studies showing that genetic factors may have a higher impact on longevity in men.

Keywords

Frail Elderly; Severity of Illness Index; Epidemiologic Factors; Socioeconomic Status; Sex Differences

Introduction

Frailty in older adults is a state of vulnerability to poor resolution of homoeostasis after a stressor event and is a consequence of cumulative decline in many physiological systems during a lifetime [1]. Although there is no international consensus on a definition of frailty [2, 3], a popular operationalization is the Frailty *Index* (FI) [4, 5].

Disclosure statement
The author has no conflicts of interest.

The FI sees frailty in relation to the *accumulation of health deficits*. The FI is measured by comparing the ratio of health deficits present within an individual to possible health deficits, using a pre-specified list of 30 or more deficits [4]. A deficit can be any symptom, sign, disease, disability, or laboratory abnormality that is associated with age and adverse outcomes, present in at least 1% of the population, covers several organ systems and has no more than 5% missing data [6]. Age is not included as a deficit, but the FI increases exponentially with age [7].

The FI summarizes differences in health status, even within individuals of the same chronological age [8] (this is exemplified in Figure 1). Therefore, the FI helps represent the fact that population ageing is diverse, and the relationship between chronological age and health status is extremely variable [9].

The FI is generally presented separately for women and men because the rate of deficit accumulation is sex-sensitive [10]. On average, women accumulate more deficits than men of the same age, but their risk of mortality is lower [8].

While the construct validity of the FI is examined through its relationship to chronological age, its criterion validity is examined in its ability to predict adverse outcomes, including mortality and excess use of health and social care services [11]. The latter has been the focus of many epidemiological studies [12–14]. In addition, in recent years the FI approach has been adopted by non-geriatric clinicians for the prediction of adverse outcomes in specific clinical settings [15–17].

While the adverse consequences of the FI have been extensively demonstrated in non-clinical and clinical populations, the factors driving the FI variability in subjects of the same chronological age have been less studied. Such factors are likely to be related to the known *determinants of health* [18]. The World Health Organization recognizes that to a large extent, factors such as genetics, education, socio-economic status and lifestyle all have considerable impacts on health [19], especially in developed countries where, at the population level, the influence of other factors such as sanitation (environment) and access to health and social care has been minimized thanks to advances in Public Health and Social Policies [20].

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a multidisciplinary and cross-national panel database of micro data on health, socioeconomic status and social and family networks of Europeans aged 50 or over (http://www.share-project.org/). SHARE has been defined as a gold mine of individual, economic and health information that can provide insight into better understanding of frailty across diverse population settings [21].

Based on the first wave of SHARE, we previously operationalized a 40-item FI that had the expected properties in this large sample of Europeans [22]. For each sex, we showed a significant non-linear association between age and the FI, and that the FI was a much stronger predictor of mortality than age, even after adjusting for the latter. The aim of the present study was to use that validated FI to investigate the influence of key determinants of health such as level of education, income sufficiency, behavioural risks (i.e. smoking, alcohol intake) and parental longevity (as a surrogate for genetic factors) on the FI variability in subjects of the same chronological age group.

Materials and methods

Setting

The study is based on the Survey of Health, Ageing and Retirement in Europe (SHARE, http://www.share-project.org/). Based on probability samples in all participating countries, SHARE represents the non-institutionalised population aged 50 and older. Spouses were also interviewed if they were younger than 50 but we excluded them from our analyses. The first wave was collected between 2004 and 2005.

Creation of the FI

Based on the first wave of SHARE, a 40-item FI was created as per standard procedure [23]. Each of the 40 deficit variables was scored such that 0 = deficit absent and 1 = deficit present. The scores were added and divided by the total number of deficits evaluated (i.e. 40), to produce a FI between 0.0 (i.e. no deficits present) and 1.0 (i.e. all deficits present). Appendix 1 shows the FI deficit variables and cut-off points.

Determinants of health

The following measures (which were not included as deficits in the FI definition) were used:

- *Education*: years of education.
- *Income sufficiency*: household has (some or great) difficulties making ends meet (yes or no).
- *Behavioural risks*: current smoker (yes or no), excess alcohol intake (i.e. drinking more than two glasses of alcohol almost every day or 5/6 days a week: yes or no).
- *Parental longevity* (as a surrogate marker for genetic factors): mother's age of death and father's age of death.

Statistical analyses

Statistics were computed with SPSS 16.0, separately for each sex. The level of significance was established at 0.01 throughout.

As previously described [22], the sample was divided into age categories (i.e. 50s, 60s, 70s, 80s and ≥ 90) and the FI quartiles within age categories were calculated.

In order to assess the correlation between the individual health determinants and the FI quartiles in each age group, the two-tailed Spearman's rank correlation coefficient was used for continuous variables and the chi-squared test for linear trend for dichotomous variables.

In order to assess the relative contribution of the individual health determinants on the FI quartiles in each age group, the ordinal regression procedure was used, which models the dependence of a polytomous ordinal response (i.e. FI quartiles) on a set of predictors (i.e. years of education, income sufficiency, smoking, excess alcohol intake, mother's age of death, father's age of death). Odds ratios with 95% confidence intervals (CI) were requested for each predictor.

Ethics

This is a secondary analysis of data obtained under the SHARE Data Access Rules (http://share-dev.mpisoc.mpg.de/data-access-documentation/research-data-center-data-access.html). Originally, SHARE received ethical approval by the University of Mannheim's Internal Review Board. All participants consented to the study.

Results

The first wave of SHARE included 29,905 participants aged ≥ 50 years from 12 countries (Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Greece,

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Switzerland, Belgium, and Israel). There were 16,217 women (54.2%) with a mean (SD) age of 64.8 (10.4) years, and 13,688 men (45.8%) with a mean (SD) age of 64.3 (9.8) years.

Of the 16,217 women, 6,083 were in their 50s (1,224 in the 1st FI quartile; 1,774 in the 2nd quartile; 1,531 in the 3rd quartile; 1,554 in the 4th quartile); 4,970 in their 60s (1,111 in the 1st FI quartile; 1,322 in the 2nd; 1,249 in the 3rd; 1,288 in the 4th); 3,461 in their 70s (778 in the 1st FI quartile; 898 in the 2nd; 890 in the 3rd; 895 in the 4th); 1,460 in their 80s (351 in the 1st FI quartile; 370 in the 2nd; 363 in the 3rd; 376 in the 4th), and 243 were aged 90 and above (52 in the 1st FI quartile; 69 in the 2nd; 55 in the 3rd; 67 in the 4th).

Of the 13,688 men, 5,153 were in their 50s (1,053 in the 1st FI quartile; 1,284 in the 2nd; 1,480 in the 3rd; 1,336 in the 4th); 4,471 were in their 60s (1,086 in the 1st FI quartile; 1,132 in the 2nd; 1,082 in the 3rd; 1,171 in the 4th); 2,996 were in their 70s (745 in the 1st FI quartile; 691 in the 2nd; 811 in the 3rd; 749 in the 4th); 954 were in their 80s (222 in the 1st FI quartile; 242 in the 2nd; 243 in the 3rd; 247 in the 4th); and 114 were aged 90 and above (28 in the 1st FI quartile; 28 in the 2nd; 28 in the 3rd; 30 in the 4th).

As regards the association with age and mortality, the properties of the FI have been described elsewhere [22]. As regards the association with utilization of health and social care services, results are presented in Appendix 2.

Tables 1 and 2 present the correlation between the individual health determinants and the FI quartiles in each age group. In women, there were statistically significant gradients in years of education for those in their 50s, 60s, 70s and 80s (mean differences between 1st and 4th FI quartiles ranged between 2.4 to 2.8 years). In men, there were statistically significant gradients in years of education in all age groups, with mean differences between 1st and 4th FI quartiles ranging between 1.9 (80s) to 6.6 (90+) years.

In women, there were statistically significant gradients in difficulties making ends meet for those in their 50s, 60s, 70s and 80s (the percentage differences between 4th and 1st FI quartiles ranged between 29% and 36%). In men, there were statistically significant gradients in difficulties making ends meet for those in their 50s, 60s and 70s (the percentage differences between 4th and 1st FI quartiles ranged between 25% and 30%) (Tables 1 and 2).

In terms of behavioural risks, women in their 60s had a significant trend towards less excess drinking with FI quartile increases (3% less in the 4th than the 1st FI quartile), and women in their 70s had a significant trend towards less smoking with FI quartile increases (3% less in the 4th than the 1st FI quartile). Men in their 50s had a significant trend towards more smoking with FI quartile increases (4% more in the 4th than the 1st FI quartile), and men in their 70s had a significant trend towards less smoking with FI quartile increases (4% less in the 4th than the 1st FI quartile). Men in their 70s had a significant trend towards less excess drinking with FI quartile increases (7% less in the 4th than the 1st FI quartile) (Tables 1 and 2).

In terms of the mother's age of death, in women, there were statistically significant gradients for those in their 60s, 70s and 80s (mean differences between 1st and 4th FI quartiles ranged between 2 to 3 years). In men, there were statistically significant gradients for those in their 60s, 70s and 80s (mean differences between 1st and 4th FI quartiles were around 3 years) (Tables 1 and 2).

In terms of the father's age of death, in women, there were statistically significant gradients for those in their 60s and 70s (mean differences between 1st and 4th FI quartiles ranged between 2 to 3 years). In men, there were statistically significant gradients for those in their

50s, 60s, 70s and 80s (mean differences between 1st and 4th FI quartiles were between 3 and 5 years) (Tables 1 and 2).

Tables 3 and 4 present the results of the multivariable ordinal regression models. In women, the significant multivariate predictors were years of education (in those in their 50s, 60s, 70s and 80s; the Odds Ratios were around 0.9), and difficulties making ends meet (in those in their 50s, 60s, 70s and 80s; Odds Ratios were between 1.8 and 2.1). In men, the significant multivariate predictors were years of education (in those in their 50s, 60s, 70s and 90s; the Odds Ratios were around 0.9), difficulties making ends meet (in those in their 50s, 60s and 70s; Odds Ratios were between 1.6 and 2.1), mother's age of death (in those in their 60s; Odds Ratio was under 1), and father's age of death (in those in their 60s, 70s and 80s; Odds Ratios were under 1).

Discussion

The aim of the present study was to use a validated FI to investigate the influence of key determinants of health such as level of education, income sufficiency, behavioural risks (i.e. smoking, alcohol intake) and parental longevity (as a surrogate for genetic factors) on the FI variability in subjects of the same chronological age group. In multivariable analyses, years of education and difficulties making ends meet emerged as significant predictors of FI quartile membership. In addition, in males only, parental (and more consistently, paternal) longevity was predictive of FI quartile membership.

The findings of the present study need to be interpreted within the limitations of its cross-sectional design, which precludes the inference of causality. Another limitation is a likely survivor bias [24] in the identified relationships between smoking and the FI: indeed, men in their 50s had a significant trend towards more smoking with FI quartile increases, but men in their 70s had a significant trend towards less smoking with FI quartile increases. This could be explained by the fact that many frail smokers in the 50s may not live long enough to be 70 [25]. Another limitation is that sample sizes for the 90+ may have been too small to detect statistically significant associations.

Bearing the above limitations in mind, one of the strengths of the present study is that it highlights the importance of the *social determinants of health* [26] within a FI approach, echoing previous observations that the FI is influenced by social and environmental factors in keeping with the concept of frailty being multi-dimensional [27]. In terms of the importance of education, the Hispanic Health and Nutrition Examination Survey showed that Hispanics with the least years of schooling had the highest frailty rates, and those with the most years of schooling had the lowest frailty rates (frailty was defined in terms of disability) [28]. In a SHARE-based study (using Fried's frailty criteria [29]), lower educated persons were at increased risk of worsening in frailty [30]. In addition, the San Antonio Longitudinal Study of Aging (which also used Fried's criteria), showed that fewer years of education were a predictor of progression in any frailty characteristic [31].

The literature is also consistent on the relationship between income sufficiency and frailty. In the Montreal Unmet Needs Study (which used Fried's criteria), frailty was associated with income and education [32]. In the Women's Health and Aging Studies (which also used Fried's criteria), the odds of frailty were increased for those of low education or income regardless of race [33]. The Hispanic Established Populations for the Epidemiologic Study of the Elderly (which used Fried's criteria) found that financial strain was related to increases in frailty over time [34]. The Hertfordshire Cohort Study highlighted socio-economic inequalities in frailty using Fried's criteria [35]. The English Longitudinal Study of Aging, based on a FI approach, showed that frailty in older adults is independently associated with individual and neighbourhood socioeconomic factors [36]. Furthermore, a FI in the Chinese Longitudinal Healthy Longevity Survey showed that the economic condition was significantly associated with levels of frailty [37].

Besides the influences of education and income on frailty, a more novel finding of the present study is the relationship of the FI with parental longevity. Even though parental longevity is a surrogate marker for hereditable factors conferring increased longevity to the offspring, a previous study showed that the accumulation of health deficiencies over the life course was not the same in the offspring of long-lived parents compared to the offspring of short-lived parents, likely due to inheritance related to parental longevity [38]. Appendix 3 shows the multivariate analyses repeated dividing the samples into those under the age of 70 and those aged 70 or more. These additional analyses reiterate parental longevity as a consistent predictor of FI in both young and old men; however, in women, parental longevity was only associated with frailty in those over 70 years of age.

Sex differences in the hereditability of longevity have been reported elsewhere. For example, a previous study investigated the association of the polymorphic ADA (Adenosine Deaminase) gene (which plays a crucial role in the regulation of the immune system and in the control of metabolic rates) and human longevity, and found that the negligible effect of ADA genetic polymorphism in females suggest a marginal influence of genetic factors in determining longevity in this sex, confirming previous reports [39]. Furthermore, one study reconstructed 202 families of nonagenarians from a population of southern Italy, and found that genetic factors in males have a higher impact than in females on attaining longevity [40]. Indeed, the sex difference in life expectancy in humans may have an underlying genetic basis independent of frailty [41].

Conclusion

Even though genetic factors in men may have a higher impact in the frailty process than in women, the results of our study agree with previous reports confirming the presence of various sources of social inequalities over the life course, where education and social protection systems may play a major role in accompanying, preventing or reducing the frailty process [42].

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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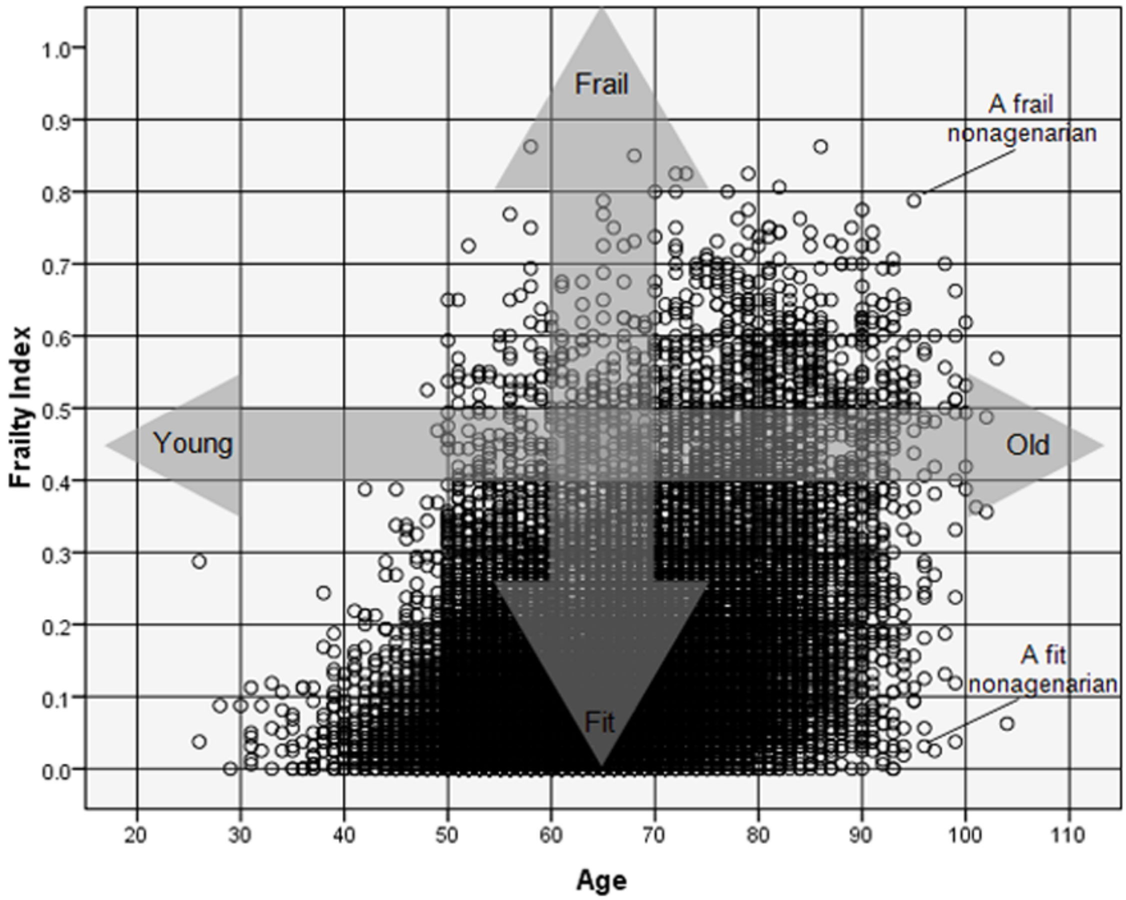

Figure 1.

Scatter plot between age and the Frailty Index (FI) in a theoretical population. The FI is reflects, at any given chronological age, where someone lies along the 'fitness-frailty spectrum'. Two different nonagenarians are exemplified: a nonagenarian with a high number of accumulated deficits (a 'frail' nonagenarian) and a nonagenarian with a low number of accumulated deficits (a 'fit' nonagenarian). The FI helps represent the fact that population ageing is diverse, and the relationship between chronological age and health (or 'biological age') is extremely variable.

Table 1

WOMEN	Age group	Lowest FI quartile	2nd FI quartile	3rd FI quartile	Highest FI quartile	*P* for linear trend
Education						
Years of education: mean (SD)	50s	12.1 (3.7)	11.2 (3.8)	10.6 (4.2)	9.5 (4.2)	**<0.001**$^{\Sigma}$
	60s	10.5 (4.1)	9.8 (4.1)	9.1 (4.2)	7.9 (4.4)	**<0.001**$^{\Sigma}$
	70s	9.0 (4.1)	8.1 (4.3)	7.3 (4.4)	6.2 (4.3)	**<0.001**$^{\Sigma}$
	80s	8.2 (4.1)	7.6 (4.0)	6.7 (4.0)	5.8 (4.1)	**<0.001**$^{\Sigma}$
	90+	6.8 (4.2)	7.2 (4.1)	6.4 (3.8)	5.4 (3.8)	0.033$^{\Sigma}$
Socioeconomic						
Household has difficulties making ends meet (%)	50s	24.8	36.3	43.1	57.7	**<0.001**$^{\chi}$
	60s	27.7	36.7	43.7	63.5	**<0.001**$^{\chi}$
	70s	30.3	35.0	46.7	59.4	**<0.001**$^{\chi}$
	80s	23.8	33.7	42.0	52.3	**<0.001**$^{\chi}$
	90+	33.3	37.1	29.8	48.8	0.248$^{\chi}$
Behavioural risks						
Current smoker (%)	50s	22.3	21.1	24.9	24.9	0.014$^{\chi}$
	60s	13.9	15.2	13.0	13.8	0.564$^{\chi}$
	70s	8.3	9.0	7.2	5.4	**0.007**$^{\chi}$
	80s	3.5	4.6	6.6	4.8	0.266$^{\chi}$
	90+	0.0	1.4	1.8	1.5	0.499$^{\chi}$
Drinking > 2 glasses of alcohol almost every or 5/6 days a week (%)	50s	6.5	7.2	6.7	5.5	0.165$^{\chi}$
	60s	8.0	7.9	7.0	5.0	**0.002**$^{\chi}$
	70s	5.8	4.6	5.4	3.1	0.029$^{\chi}$
	80s	5.6	4.6	3.9	2.9	0.070$^{\chi}$
	90+	4.0	4.3	5.5	0.0	0.239$^{\chi}$
'Longevity' factors						

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WOMEN	Age group	Lowest FI quartile	2nd FI quartile	3rd FI quartile	Highest FI quartile	*P* for linear trend
Mother's age of death: mean (SD)	50s	72.0 (13.0)	71.9 (13.7)	72.6 (13.0)	71.5 (12.9)	0.312$^{\Sigma}$
	60s	76.8 (13.2)	75.7 (14.2)	76.0 (13.8)	75.1 (13.0)	**0.001**$^{\Sigma}$
	70s	76.6 (15.2)	76.0 (15.1)	74.4 (15.8)	73.9 (16.1)	**<0.001**$^{\Sigma}$
	80s	75.3 (14.8)	75.9 (15.3)	71.7 (17.2)	72.0 (17.9)	**0.002**$^{\Sigma}$
	90+	76.5 (15.5)	72.7 (18.4)	72.3 (15.9)	70.6 (17.2)	0.057$^{\Sigma}$
Father's age of death: mean (SD)	50s	71.0 (12.5)	71.5 (12.2)	70.0 (13.5)	70.5 (12.8)	0.074$^{\Sigma}$
	60s	71.8 (15.1)	71.1 (15.3)	70.7 (15.2)	70.1 (15.0)	**<0.001**$^{\Sigma}$
	70s	71.8 (14.6)	71.0 (14.7)	70.3 (15.0)	68.9 (16.1)	**<0.001**$^{\Sigma}$
	80s	73.0 (14.6)	71.1 (14.8)	72.3 (15.4)	69.7 (15.7)	0.030$^{\Sigma}$
	90+	73.7 (17.3)	70.1 (17.8)	70.8 (16.9)	71.3 (15.3)	0.330$^{\Sigma}$

$^{\Sigma}$Two-tailed Spearman's rank correlation coefficient

$^{\chi}$Chi-squared test for linear trend.

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Table 2

MEN	**Age group**	**Lowest FI quartile**	**2nd FI quartile**	**3rd FI quartile**	**Highest FI quartile**	***P* for linear trend**
Education						
Years of education: mean (SD)	50s	12.4 (3.8)	11.8 (3.9)	11.6 (3.9)	10.1 (4.3)	**<0.001**$^{\Sigma}$
	60s	11.3 (4.4)	10.8 (4.3)	10.5 (4.4)	9.3 (4.7)	**<0.001**$^{\Sigma}$
	70s	10.1 (4.5)	9.8 (4.6)	8.9 (4.8)	7.6 (4.9)	**<0.001**$^{\Sigma}$
	80s	9.8 (4.5)	8.8 (4.8)	8.7 (4.4)	7.9 (4.7)	**<0.001**$^{\Sigma}$
	90+	11.0 (4.7)	6.8 (5.3)	8.0 (4.3)	4.4 (4.3)	**<0.001**$^{\Sigma}$
Socioeconomic						
Household has (some or great) difficulties making ends meet (%)	50s	27.2	29.8	36.0	52.6	**<0.001**$^{\chi}$
	60s	21.5	26.9	34.2	51.8	**<0.001**$^{\chi}$
	70s	26.2	29.2	35.5	53.3	**<0.001**$^{\chi}$
	80s	27.3	32.5	35.8	40.3	0.013$^{\chi}$
	90+	33.3	27.3	52.2	66.7	0.018$^{\chi}$
Behavioural risks						
Current smoker (%)	50s	32.7	29.8	32.1	37.1	**0.005**$^{\chi}$
	60s	24.8	20.2	22.3	21.7	0.214$^{\chi}$
	70s	16.1	13.8	12.1	11.7	**0.007**$^{\chi}$
	80s	12.4	9.2	10.7	12.1	0.900$^{\chi}$
	90+	7.7	7.1	3.6	0.0	0.124$^{\chi}$
Drinking > 2 glasses of alcohol almost every or 5/6 days a week (%)	50s	17.5	20.9	22.2	20.7	0.051$^{\chi}$
	60s	22.5	22.0	23.5	21.0	0.600$^{\chi}$
	70s	23.1	20.8	21.8	15.8	**0.002**$^{\chi}$
	80s	14.4	13.3	18.1	12.6	0.934$^{\chi}$
	90+	19.2	17.9	3.6	6.7	0.058$^{\chi}$
‘Longevity’ factors						

MEN	**Age group**	**Lowest FI quartile**	**2nd FI quartile**	**3rd FI quartile**	**Highest FI quartile**	***P* for linear trend**
Mother's age of death: mean (SD)	50s	73.2 (13.0)	72.1 (13.4)	72.6 (12.8)	71.7 (12.9)	0.032^{Σ}
	60s	77.0 (13.7)	75.4 (13.4)	75.9 (13.6)	74.2 (14.5)	**<0.001**$^{\Sigma}$
	70s	77.4 (14.0)	77.3 (14.0)	75.1 (15.1)	74.6 (15.3)	**<0.001**$^{\Sigma}$
	80s	76.8 (15.5)	75.7 (15.7)	74.7 (15.4)	73.6 (16.1)	**0.008**$^{\Sigma}$
	90+	77.8 (17.8)	70.7 (13.4)	76.4 (14.7)	73.5 (17.0)	0.492^{Σ}
Father's age of death: mean (SD)	50s	72.4 (11.8)	70.8 (12.4)	70.3 (12.5)	69.5 (12.5)	**<0.001**$^{\Sigma}$
	60s	71.7 (15.0)	70.7 (15.6)	70.9 (15.7)	69.0 (16.3)	**<0.001**$^{\Sigma}$
	70s	73.6 (14.7)	72.3 (14.5)	70.7 (15.2)	70.2 (15.0)	**<0.001**$^{\Sigma}$
	80s	75.3 (15.0)	72.2 (15.0)	72.2 (13.7)	70.7 (16.7)	**0.002**$^{\Sigma}$
	90+	75.5 (13.3)	67.0 (13.8)	75.8 (15.5)	72.6 (15.5)	0.844^{Σ}

$^{\Sigma}$Two-tailed Spearman's rank correlation coefficient

$^{\chi}$Chi-squared test for linear trend.

Table 3

WOMEN	Age group	B	Std. Error	Hypothesis Test			Odds Ratio	95% Wald Confidence Interval for Odds Ratio	
				Wald Chi- Square	df	*P*		Lower	Upper
Household has (some or great) difficulties making ends meet	50s	0.732	0.102	51.933	1.000	**<0.001**	2.078	1.703	2.536
	60s	0.741	0.081	82.871	1.000	**<0.001**	2.098	1.789	2.461
	70s	0.663	0.085	60.510	1.000	**<0.001**	1.941	1.643	2.295
	80s	0.613	0.123	24.701	1.000	**<0.001**	1.846	1.450	2.351
	90+	0.095	0.325	0.085	1.000	0.770	1.099	0.582	2.078
Current smoker	50s	0.133	0.108	1.518	1.000	0.218	1.142	0.925	1.410
	60s	−0.007	0.107	0.005	1.000	0.946	0.993	0.804	1.225
	70s	−0.237	0.144	2.718	1.000	0.099	0.789	0.596	1.046
	80s	0.624	0.246	6.436	1.000	0.011	1.866	1.152	3.021
	90+	0.598	1.095	0.299	1.000	0.585	1.819	0.213	15.542
Drinking > 2 glasses of alcohol almost every or 5/6 days a week	50s	−0.328	0.188	3.040	1.000	0.081	0.720	0.498	1.042
	60s	−0.338	0.150	5.067	1.000	0.024	0.713	0.531	0.957
	70s	0.057	0.195	0.086	1.000	0.770	1.059	0.722	1.552
	80s	−0.180	0.271	0.438	1.000	0.508	0.836	0.491	1.422
	90+	−1.461	0.965	2.290	1.000	0.130	0.232	0.035	1.539
Years of education	50s	−0.094	0.012	57.822	1.000	**<0.001**	0.911	0.889	0.933
	60s	−0.072	0.009	58.337	1.000	**<0.001**	0.931	0.914	0.948
	70s	−0.071	0.010	52.519	1.000	**<0.001**	0.932	0.914	0.950
	80s	−0.075	0.015	25.690	1.000	**<0.001**	0.928	0.901	0.955
	90+	−0.069	0.039	3.162	1.000	0.075	0.933	0.865	1.007
Mother's age of death	50s	−0.002	0.004	0.309	1.000	0.578	0.998	0.990	1.005
	60s	0.000	0.003	0.002	1.000	0.968	1.000	0.995	1.006
	70s	−0.004	0.003	2.503	1.000	0.114	0.996	0.991	1.001
	80s	−0.008	0.004	4.664	1.000	0.031	0.992	0.986	0.999
	90+	−0.016	0.009	3.020	1.000	0.082	0.985	0.967	1.002
Father's age of death	50s	0.001	0.004	0.024	1.000	0.876	1.001	0.993	1.008

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WOMEN	Age group	B	Std. Error	Hypothesis Test			Odds Ratio	95% Wald Confidence Interval for Odds Ratio	
				Wald Chi- Square	df	*P*		Lower	Upper
	60s	−0.005	0.003	3.629	1.000	0.057	0.995	0.990	1.000
	70s	−0.006	0.003	4.966	1.000	0.026	0.994	0.988	0.999
	80s	−0.005	0.004	1.467	1.000	0.226	0.995	0.988	1.003
	90+	−0.016	0.009	2.956	1.000	0.086	0.985	0.967	1.002

Table 4

MEN	Age group	B	Std. Error	Hypothesis Test			Odds Ratio	95% Wald Confidence Interval for Odds Ratio	
				Wald Chi- Square	df	*P*		Lower	Upper
Household has (some or great) difficulties making ends meet	50s	0.509	0.109	21.672	1.000	**<0.001**	1.663	1.343	2.060
	60s	0.757	0.087	75.868	1.000	**<0.001**	2.133	1.798	2.529
	70s	0.482	0.097	24.597	1.000	**<0.001**	1.619	1.338	1.959
	80s	0.141	0.175	0.649	1.000	0.421	1.151	0.817	1.620
	90+	0.513	0.472	1.186	1.000	0.276	1.671	0.663	4.211
Current smoker	50s	0.216	0.106	4.183	1.000	0.041	1.241	1.009	1.527
	60s	−0.088	0.091	0.943	1.000	0.332	0.916	0.766	1.094
	70s	−0.292	0.126	5.356	1.000	0.021	0.747	0.583	0.956
	80s	0.032	0.242	0.017	1.000	0.895	1.032	0.643	1.659
	90+	0.073	1.212	0.004	1.000	0.952	1.076	0.100	11.563
Drinking > 2 glasses of alcohol almost every or 5/6 days a week	50s	−0.028	0.116	0.060	1.000	0.806	0.972	0.775	1.219
	60s	0.004	0.087	0.002	1.000	0.965	1.004	0.846	1.191
	70s	−0.073	0.102	0.509	1.000	0.476	0.930	0.761	1.136
	80s	0.166	0.202	0.671	1.000	0.413	1.180	0.794	1.754
	90+	−1.359	0.675	4.051	1.000	0.044	0.257	0.068	0.965
Years of education	50s	−0.067	0.012	29.175	1.000	**<0.001**	0.935	0.913	0.958
	60s	−0.039	0.009	19.292	1.000	**<0.001**	0.962	0.945	0.979
	70s	−0.054	0.010	31.004	1.000	**<0.001**	0.948	0.930	0.966
	80s	−0.022	0.017	1.661	1.000	0.198	0.978	0.945	1.012
	90+	−0.163	0.049	11.274	1.000	**0.001**	0.850	0.773	0.935
Mother's age of death	50s	−0.002	0.004	0.382	1.000	0.537	0.998	0.990	1.005
	60s	−0.011	0.003	16.167	1.000	**<0.001**	0.989	0.983	0.994
	70s	−0.006	0.003	3.572	1.000	0.059	0.994	0.989	1.000
	80s	−0.009	0.005	2.962	1.000	0.085	0.991	0.980	1.001
	90+	−0.015	0.015	1.032	1.000	0.310	0.985	0.958	1.014
Father's age of death	50s	−0.008	0.004	3.809	1.000	0.051	0.992	0.984	1.000

MEN	Age group	B	Std. Error	Hypothesis Test			Odds Ratio	95% Wald Confidence Interval for Odds Ratio	
				Wald Chi- Square	df	*P*		Lower	Upper
	60s	−0.008	0.003	10.306	1.000	**0.001**	0.992	0.987	0.997
	70s	−0.009	0.003	9.653	1.000	**0.002**	0.991	0.985	0.997
	80s	−0.015	0.006	7.466	1.000	**0.006**	0.985	0.975	0.996
	90+	−0.022	0.015	1.970	1.000	0.160	0.979	0.950	1.009