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Socioeconomic status and health: the role of subjective social status

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Abstract

Studies have suggested that subjective social status (SSS) is an important predictor of health. This study examined the link between SSS and health in old age and investigated whether SSS mediated the associations between objective indicators of socioeconomic status and health. It used cross-sectional data from the second wave (2004–05) of the English Longitudinal Study of Ageing, which were collected through personal interviews and nurse visits. The study population consisted of 3368 men and 4065 women aged 52 years or older. The outcome measures included: self-rated health, long-standing illness, depression, hypertension, diabetes, central obesity, high-density lipoprotein cholesterol, triglycerides, fibrinogen, and C-reactive protein. The main independent variable was SSS measured using a scale representing a 10-rung ladder. Wealth, education, and occupational class were employed as covariates along with age and marital status and also, in additional analyses, as the main independent variables. Gender-specific logistic and linear regression analyses were performed. In age-adjusted analyses SSS was related positively to almost all health outcomes. Many of these relationships remained significant after adjustment for covariates. In men, SSS was significantly ($p \leq 0.05$) related to self-rated health, depression, and long-standing illness after adjustment for all covariates, while its association with fibrinogen became non-significant. In women, after adjusting for all covariates, SSS was significantly associated with self-rated health, depression, long-standing illness, diabetes, and high-density lipoprotein cholesterol, but its associations with central obesity and C-reactive protein became non-significant. Further analysis suggested that SSS mediated fully or partially the associations between education, occupational class and self-reported and clinical health measures. On the contrary, SSS did not mediate wealth's associations with the outcome measures, except those with self-reported health measures. Our results suggest that SSS is an important correlate of health in old age, possibly because of its ability to epitomize life-time achievement and socioeconomic status.

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Introduction

Socioeconomic inequalities in health are a key public health problem (Siegrist & Marmot, 2004). People of higher socioeconomic status (SES) live longer, enjoy better health and suffer less from disability, while those of lower SES die younger and suffer a greater burden of disease and disability (Dalstra, Kunst, Borrell, Breeze, Cambois, Costa et al., 2005; Huisman, Kunst, Bopp, Borgan, Borrell, Costa et al., 2005; Mackenbach, Kunst, Cavelaars, Groenhof, Geurts, Andersen et al., 1997; Marmot, Bosma, Hemingway, Brunner, & Stansfeld, 1997; Marmot, Rose, Shipley, & Hamilton, 1978; Minkler, Fuller-Thomson, & Guralnik, 2006). In many cases the associations between SES and health outcomes take the form of a gradient – the higher the SES the better the health (Adler, Boyce, Chesney, Cohen, Folkman, Kahn et al., 1994; Marmot, 2006). Many different explanations for socioeconomic gradients in health have been proposed, but the causal pathways through which SES determines health in such an orderly way, are not well established (Adler et al., 1994; Steptoe & Marmot, 2002). Nevertheless, the existence of socioeconomic gradients in health suggests that causal processes do not operate only below a certain threshold through an impact of poverty, instead it points to a generic effect of SES on the health of all people. One mechanism for such a generic effect could be subjective social status through its impact on stress or other pathways.

Subjective social status (SSS) refers to “the individual’s perception of his own position in the social hierarchy” (Jackman & Jackman, 1973) and relates to objective SES inasmuch as the socioeconomic resources people possess form the basis for their judgements about their social standing in a given society or community. Although people might use non-economic criteria (e.g. prestige) to make judgements about their own social status (Singh-Manoux, Adler, & Marmot, 2003) and identify to a variable extent with their objective socioeconomic situation, it is the objective indicators of SES that can be expected to constitute the basis of SSS. Current research, in line with these speculations, has suggested that SSS “reflects the cognitive averaging of standard markers of socioeconomic situation” (Singh-Manoux et al., 2003).

Until recently epidemiological research has relied on objective dimensions of SES, such as education and occupational class. SSS has only recently been used to explore health and health inequalities (Ostrove, Adler, Kuppermann, & Washington, 2000). This paper examines SSS as a health correlate and explores its role as a potential mediator of the associations between objective indicators of SES (education, occupational class, and wealth) and health. The exploration of SSS as a health correlate is expected to add an element of social meaningfulness to the association between SES and health (Nock & Rossi, 1979) by incorporating people’s assessments of their experiences of deprivation and perceptions of own social status. Moreover, it should be noted that this paper is of added value as it focuses on later stages of the life-course where evidence on the size and patterns of health inequalities is still ambiguous (Chandola, Ferrie, Sacker, & Marmot, 2007).

Evidence on SSS as a correlate of health in old age is scarce, with only one such study identified in our literature review (Hu, Adler, Goldman, Weinstein, & Seeman, 2005). Nevertheless, an increasing body of research, mostly cross-sectional, indicates that SSS (measured as a ladder score) relates over and above objective SES markers to self-rated health (Franzini & Fernandez-Esquer, 2006; Hu et al., 2005; Operario, Adler, & Williams, 2004; Ostrove et al., 2000; Singh-Manoux, Marmot, & Adler, 2005), mental health (Franzini & Fernandez-Esquer, 2006; Singh-Manoux et al., 2005), heart rate and sleep latency (Adler, Epel, Castellazzo, & Ickovics, 2000), cortisol levels (Wright & Steptoe, 2005), and dental outcomes (Sanders, Slade, Turrell, Spencer, & Marcenes, 2006). Also, there is evidence that SSS relates to adolescent health (Goodman, Adler, Daniels, Morrison, Slap, & Dolan, 2003; Goodman, Adler, Kawachi, Frazier, Huang, & Colditz, 2001). In contrast, research has shown that SSS is not related at all to body mass index, sleep quality, and resting systolic blood pressure in women (Adler et al., 2000), angina and respiratory illness in women (Singh-Manoux et al., 2003), and difficulties in Activities of Daily Living (Hu et al., 2005). Also, studies have shown that adjusting for objective indicators of SES attenuates the associations of SSS with perceptions of physical health (Franzini & Fernandez-Esquer, 2006), diabetes, self-rated health, and depression in both sexes, and angina and respiratory illness in men (Singh-Manoux et al., 2003).

As this paper aims at exploring the role of SSS for health as comprehensively as possible, it uses three objective SES indicators: education, occupational class, and wealth, along with SSS. The use of multiple indicators of SES accounts for both common and differential effects of the various SES dimensions on health and provides insights into their interrelationships, which are relevant for health over and above direct causal associations (Blane, 1995; Krieger, Williams, & Moss, 1997; Lahelma, Martikainen, Laaksonen, & Aittomaki, 2004; Singh-Manoux, Clarke, & Marmot, 2002).Unlike most studies we are able to include wealth as a measure of material inequalities. We consider this to be a major advantage of our study as wealth is a marker of SES that indicates command over assets and material resources, reflects accumulated advantage and future economic prospects, and lies in the core of material inequalities in health (Oliver & Shapiro, 1995; Ostrove, Feldman, & Adler, 1999). Moreover, the inclusion of wealth adds value to this study as, unlike education and occupational class, it reflects contemporary SES and therefore is a more appropriate measure for use in older adults.

We aimed to explore more thoroughly than previously the associations of SSS with both self-perceived and clinical measures of health. Non-clinical measures have been chosen on account of their importance as determinants of quality of life and people's experiences of it. The selected clinical measures are risk factors for cardiovascular disease, and their inclusion is intended to establish whether SSS is involved in pathogenic processes related to cardiovascular outcomes.

Recent evidence suggests that there are gender differences in coronary heart disease and the distribution of related risk factors (i.e. hypertension and diabetes) (Dalstra et al., 2005; Thurston, Kubzansky, Kawachi, & Berkman, 2005) and that different SES dimensions might relate in a differential way to men's and women's health outcomes (Sacker, Firth, Fitzpatrick, Lynch, & Bartley, 2000). For this reason we have undertaken gender-specific analyses.

The aims of this paper are to examine: a) the associations between SSS and self-perceived and clinical health measures, b) whether these associations remain significant after adjustment for objective indicators of SES (wealth, occupational class and education), and c) the influence SSS might exert on the associations of objective SES markers (education, occupational class and wealth) with the selected health outcomes.

Methods

Sample, design and participants

Cross-sectional data from the second wave (2004–05) of the English Longitudinal Study of Ageing (ELSA) were used. ELSA is a multi-disciplinary study of ageing and the social, psychological, economic, and health factors that relate to it. The sample was drawn from three years of the annual cross-sectional Health Survey for England (HSE) (1998, 1999 and 2001), which each year is organized around a different health theme. The HSE annual samples are representative of the English population living in private households. The second wave ELSA data were collected from June 2004 to July 2005 when respondents were aged 52 years or older.

Details on the design, sampling, and response rates of the first two waves of ELSA can be found elsewhere (Cheshire, Cox, Lessof, & Taylor, 2006; Taylor, Conway, Calderwood, & Lessof, 2003). The second wave of ELSA data were used here because at this wave both subjective and objective health measures were measured.

The wave two ELSA sample included 8780 core sample members. Of these, 7433 (84.7% of the core sample members), 3368 men and 4065 women, reported their SSS. Nurse and blood data were not available for all 7433 cases. In total, nurse data were available for 90.2% of the study population (n=6707) and blood data for 74.5% of the study population (n=5540). Main reasons for missingness were: refusal or lack of consent (n=993), unsuccessful attempts to obtain a blood sample (n=360), and ineligibility to provide blood samples (n=351).

Measures

Subjective social status—SSS was measured using a graphical representation of a ladder with 10 rungs accompanied by the instruction: "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 the people at the very top and the lower you are, the closer you are to the people at the very bottom. Please mark a cross on the rung on the ladder where you would place yourself." (Adler et al., 2000). Respondents who had put their mark in between two rungs were assigned to the higher of these rungs.

Objective socioeconomic status—Three different measures of objective SES were used: education, occupational class and total net (non-pension) wealth. Education was measured as the highest qualification participants obtained. Occupational class (current or most recent) was measured using the National Statistics – Socio-Economic Classification scheme (NS-SEC), which is based on conditions of occupations and employment relationships. Those who have never worked or were long-term unemployed (n=104) were excluded from respective analyses. Wealth was operationalised as quintiles of the total net (non-pension) wealth measured at benefit unit level (benefit unit is either a couple or a single person with any dependent children they may have). The estimation of the wealth variable was based on very detailed information about the value of all financial assets at the disposition of the benefit unit (i.e. houses, businesses, any other physical assets and all forms of savings and investments) less debts owed by the benefit unit.

Socio-demographic characteristics—Two main sociodemographic variables were included: age and marital status. Age was coded in 5-year intervals with the exception of the first and last age categories; the youngest category included people 52–54 years old and the oldest all those 80 years and older. Marital status was treated as a dichotomy; those married against all other categories.

Health outcomes—The following health outcomes were used: self-rated health, long-standing illness or disability, depression, self-reported or measured hypertension, self-reported or measured diabetes, central obesity (waist circumference), HDL-cholesterol, triglycerides, fibrinogen, and C-reactive protein (CRP). Most health outcomes had clearly defined cut-off points to distinguish cases from non-cases, so were dichotomized to obtain clinically meaningful results. The exceptions were fibrinogen and CRP, which were used as continuous variables and were logarithmically transformed to yield an approximately normal distribution.

Self-rated health was measured with the following question: "Would you say your health is… excellent/very good/good/fair/poor". The two response categories were those who reported having poor or fair health against all others. Depression was measured by an eight-item version of the Centre for Epidemiological Studies – Depression (CES-D) scale (Radloff, 1977; Steffick, 2000). The cut-off point for its dichotomization was four or more depressive symptoms (Steffick, 2000). Long-standing illness or disability was assessed by the question: "Do you have any long-standing illness, disability or infirmity? By long-standing I mean anything that has troubled you over a period of time, or that is likely to affect you over a period of time" and possible responses were yes or no.

The clinical and blood data were collected by specially trained nurses (see Appendix A for details on the measurement protocols, blood analysis, eligibility, and other relevant technical issues). Central obesity was assessed in the form of waist circumference in centimetres. The mean value of two successive measurements of waist circumference was dichotomized at 94cm and 80cm for men and women, respectively, in accordance with the latest definition for metabolic syndrome (Alberti, Zimmet, & Shaw, 2006). Blood samples were collected from all consenting respondents. The cut-off points for the dichotomization of the blood data were: HDL-cholesterol < 1mmol/L in males and < 1.3 mmol/L in women and triglycerides ≥ 1.7 mmol/L in both sexes (Alberti et al., 2006). Cases with CRP>10mg/L were excluded from further analysis as high values of CRP might relate to acute inflammation and not be informative of chronic pathogenic processes (Pearson, Mensah, Alexander, Anderson, Cannon, Criqui et al. 2003). Respondents who reported being diagnosed with hypertension by a doctor in either the first or second wave of ELSA or who had a mean value of successive measurements of their systolic and diastolic hypertension $\geq$140/90mmHg were treated as hypertensive. Similarly, respondents who reported being diagnosed by a doctor with diabetes in either the first or second wave of ELSA or who had a glycated haemoglobin (HbA1c) value $\geq 6\%$ (American Diabetes Association, 2006) were treated as diabetic.

Analysis

The analysis consisted of four parts. The first part described the main sociodemographic characteristics of the sample. The second part examined the age-adjusted prevalence of all health outcomes across the 10 categories of SSS. The third part referred to the estimation of a series of multivariate linear (ordinary least square - OLS) and logistic regression models examining SSS as a correlate of health. This occurred in three steps. In the first step, models of the associations of SSS with health outcomes adjusted for age and marital status were estimated. Then, these models were interchangeably adjusted for objective indicators of SES (education, occupational class, and wealth) to examine if any of these indicators statistically explained the examined associations. In the third step a series of models adjusted for all covariates (age, marital status, education, occupational status, and wealth) was estimated. The fourth and final part of the analysis explored whether SSS mediated the associations between objective SES indicators and health outcomes. The potential mediating role of SSS was examined in two steps. The first step aimed at establishing the associations between each of the objective SES indicators (education, occupational class, and wealth) and health outcomes after adjusting for age and marital status by the estimation of linear OLS and logistic regression models. The second step included adjusting all estimated models for SSS. The correlations of SSS with education, occupational class, and wealth were examined using Spearman's rank correlation test. For the needs of this test cases with foreign educational qualifications were excluded and education was used as ordinal variable.

The analysis was carried out separately for men and women. No formal statistical testing of gender differences in the associations between SSS and health outcomes was performed as we did not aim at testing gender-related hypotheses. No variable elimination or variable selection techniques were used. All cases with missing values were excluded from respective analyses. No missing data were imputed. The level of statistical significance used was that of p value ≤.

05. The analysis was performed using STATA 9.2 (Statacorp, College Station, TX) with the complex sample design and weighting for non-response taken into account by the use of the STATA survey commands. By using the appropriate statistical tests (post-estimation tolerance and Variance Inflation Factor diagnostic tests) we ensured that collinearity and multi-collinearity between the various SES indicators was not a problem in our regression analyses.

Results

The distribution of SSS was normal and unimodal (figure 1). The full range of score distribution (1–10) was observed in both men and women. The mean SSS value for the entire sample was 5.88 (95% CI: 5.84, 5.93), while the median and mode coincided on the sixth rung. Both men and women thought of their social status as being slightly higher than the midpoint of the distribution, but men tended to report higher SSS (mean=5.95, 95% C.I.: 5.89, 6.01) than women (mean= 5.82, 95% CI: 5.77, 5.88) (difference significant at $p \leq 0.001$) (fig.1).

Table 1 describes the sociodemographic characteristics of the sample. The median ages were 65 and 66 years for men and women, respectively. The sample included more women (53.4%) than men (46.6%) and more married respondents (69.1%) than non-married (30.9%). A large proportion of our respondents had no educational qualifications (38.6%), whereas almost a third of them have (or had) managerial or professional positions (31%). Table 2 presents the breakdown of the age-adjusted prevalence of health outcomes by the ten categories of SSS. The test for trend shows that SSS was related to almost all health outcomes in the expected direction; people who reported lower SSS had worse health. The exceptions were central obesity (waist circumference) and triglycerides in men.

As expected, all bivariate correlations between SSS and education, class, and wealth were significant. Wealth was more strongly related to SSS than education or occupational class. The correlations of SSS with all three indicators were weaker for women than for men. The highest correlation between SSS and any of the three indicators was with wealth in men (rho=0.45) and the weakest with occupational class in women (rho=0.30).

Table 3 presents the results of the multivariate regression analyses of the associations between SSS and health outcomes. Adjusting for marital status in addition to age did not affect the associations of SSS with the health outcomes. Additional adjustment for education, or occupational class, somewhat weakened the observed associations between SSS and health outcomes, but the associations retained significance except for hypertension in women. In contrast, adjusting for wealth completely attenuated the associations of SSS with diabetes and CRP for men and partially ($p \leq 0.1$) those with hypertension and HDL-cholesterol. In women, the impact of wealth was smaller, only attenuating the associations of SSS with triglycerides and fibrinogen ($p \leq 0.1$). However, the associations of SSS with self-rated health, depression, long-standing illness or disability, and fibrinogen in men and with self-rated health, depression, long-standing illness, diabetes, waist circumference, CRP, and HDL-cholesterol in women remained statistically significant even after adjustment for wealth. The associations of SSS with self-rated health, depression, and long-standing illness or disability were particularly strong and remained significant even after adjustment for all objective markers of SES. Similarly, it was found that, in women, the association of SSS with diabetes and HDL-cholesterol was statistically significant irrespective of the effect of any of the covariates. However, in the fully adjusted models the relationship of SSS to fibrinogen in men and to waist circumference and CRP in women became non-significant.

Table 4 shows the results of the multivariate regression analyses investigating the potential mediating role of SSS. For education and occupational class SSS fully mediated the associations with long-standing illness or disability, diabetes, depression (only in men), hypertension (except its association with education in women), and HDL-cholesterol (only its association with education in women) and to a variable extent the other associations. However, SSS was not an equally important mediator of the associations between wealth and health outcomes, only mediating associations with the self-reported health measures (self-rated health, long-standing illness or disability, and depression).

Discussion

This paper has explored the associations between SSS and health outcomes in a national sample of non-institutionalised people aged 52 or over in England. It has also examined whether SSS mediated the associations between objective SES indicators and health outcomes. It was found that SSS was significantly related to the examined health outcomes and that these relationships could only partially be accounted for by either sociodemographic characteristics such as age and marital status or the objective SES indicators (education, occupational class, and wealth). Moreover, it was found that SSS exerted a significant mediating effect on most associations between education, occupational class and the examined health outcomes, but the impact was much less for wealth.

We found that, irrespective of sex, SSS was related to self-rated health, depression, and long-standing illness or disability over and above education, occupational status, wealth, age, and marital status. This was also the case for diabetes and HDL-cholesterol in women. Moreover, we found that the associations of SSS with waist circumference and CRP in women and with fibrinogen in men became non-significant only in models that adjusted for all objective SES measures. These findings accord with the existing literature suggesting that SSS is related to self-rated health (Franzini & Fernandez-Esquer, 2006; Hu et al., 2005; Operario et al., 2004; Ostrove et al., 2000; Singh-Manoux et al., 2005) and mental health (Franzini & Fernandez-Esquer, 2006; Singh-Manoux et al., 2005). However, they are not consistent with evidence suggesting that SSS is not related to diabetes in women over and above education (Singh-Manoux et al., 2003). The main conclusion that can be drawn from these findings is that SSS is an important correlate of health. They also suggest that SSS could capture dimensions of social status that objective indicators of SES do not. Finally, they indicate that SSS might play a role in specific pathogenic processes and pathways. This was in particular evident in women whose levels of diabetes and HDL-cholesterol, both constituent parts of the metabolic syndrome, were related to SSS.

The mediation analysis revealed that SSS mediated fully the associations of education and occupational class with long-standing illness or disability, diabetes, depression (only in men), hypertension (except its association with education in women), and HDL-cholesterol (only its association with education in women) and partially mediated most of their associations with the remaining health outcomes. These findings constitute evidence that SSS is a means through which education and occupational class influence health. A hypothesized mechanism is that education or occupational class are transformed to personal experience and self-perceptions about own social standing, which in turn translate into health and disease. Nevertheless, proper path analysis using longitudinal data is needed to test further these claims.

On the basis that the context of our analysis is old age and that SSS is a contemporary account of social standing that chronologically follows objective SES indicators such as education and occupational status, our findings seem to suggest that SSS might relate to older people's health in its capacity to epitomize life-time achievement and SES. Such a suggestion relates directly to the issue of measurement of SES in old age (Grundy & Holt, 2001) and argues for the importance of variables reflecting life-time successfulness and achievement, such as SSS, for older people's health. Our analysis provides evidence to reframe the discussion about how best to measure SES in old age within the context of cumulative life-time achievement and along the lines of assessing accumulated successfulness in life. Older adults, unlike their younger counterparts, have reached a stage in their lives where they are able to review and assess the degree to which they were successful or not in achieving a series of personal life-time targets. This special characteristic of old age is expected to influence older adults' lives and future prospects and needs to be taken into consideration when measuring SES in older populations. Thus, research intending to study SES in older adults needs not only to be able to measure an older person's contemporary SES but most importantly to measure cumulative SES and life-time successfulness.

Wealth was the only objective indicator of SES that explained some of the associations between SSS and health. It accounted fully for the associations of SSS with diabetes and CRP in men, while weakened and made statistically marginal ($p \leq 0.1$) those with hypertension and HDL-cholesterol in men and with triglycerides and fibrinogen in women. These findings suggest that SSS partially overlaps with wealth, which is an indicator that reflects older adults' life-time cumulative SES. This strengthens our argument that SSS is an indicator of life-time achievement and cumulative SES. The effect SSS exerted on the associations of wealth with the selected health outcomes was constrained and weak. SSS mediated mostly wealth's associations with self-reported health measures (self-rated health, long-standing illness or disability, and depression), while it had only slight or no influence on the associations between wealth and the remaining health outcomes. This evidence suggests that SSS and wealth, regardless of their overlap, were important correlates of older people's health independent of one another. This conclusion coincides with recent suggestions that objective and subjective measures of SES are related but not interchangeable (Hu et al., 2005) and indicates that SSS and wealth reflect cumulative SES but probably different dimensions of it.

A further finding that needs to be discussed is the observed gender differences. The influence of wealth on the associations between SSS and health outcomes appeared to be stronger in men than in women and more associations in women than in men were significant after adjusting for objective indicators of SES. These differences might reflect gender differences in the meaning of achievement in life and need to be considered in the light of the different ways that men and women understand the world and evaluate their life-time successfulness. For the women of our cohort life-time achievement might be less economic in nature than for the men and might relate to other cohort-specific or culture-based tasks, such as child-rearing or maintaining a happy family. But further research on this issue is needed.

A final point that needs to be raised is that SSS appears to have closer associations with self-reported measures than with clinical and laboratory health measures. This might have happened because both self-perceptions about health and self-perceptions about social status relate to common cognitive functions and are products of the same cognitive processing. Nevertheless, the fact that SSS and self-reported health measures share a common cognitive basis does not mean that any relationship between them is spurious and does not reflect real life phenomena. If that was the case, then, contrary to our findings, we should not have found any associations between objective health measures and SSS. But this study has found a wide variety of associations between SSS and objective health measures, some of which were significant in fully adjusted multivariate models.

Our findings have many implications for research on health inequalities in old age. First, it contributes to the establishment of SSS as a SES measure. Second, it highlights SSS as part of a hypothesized mechanism through which objective SES transforms into internalised personal realities and then into health outcomes. This hypothesized mechanism could be useful in understanding relative deprivation and health inequalities within the frame of the health gradient. It has potential for use in the development of an integrated socially more meaningful model of the health gradient. Third, it provides crucial clues about how to measure SES in old age by: a) underlining the importance of the cumulative dimension of SES and life-time achievement and b) showing the underperformance of traditional measures such as education and occupational class compared to SSS and wealth. Fourth, it brings to the forefront the concept of life-time achievement and successfulness, which either in relation to SES or not, appears to have promise for explaining health and wellbeing outcomes in old age. Fifth, it shows that SSS might be associated not only with general health status as measured by self-perceived health measures but also with specific pathogenic processes e.g. in women it might relate to cardiovascular health outcomes through its associations with constituent parts of the metabolic syndrome (i.e. diabetes and HDL-cholesterol).

Our paper has several strengths and weaknesses that should be taken into consideration when interpreting its results. The major weakness of our paper is that it used cross-sectional data. The use of cross-sectional data limits the ability to draw causal inferences. Our interpretation of the results is made on the basis of theories of social causation and it is not data-driven. A reverse causation interpretation of these results is plausible. An important advantage of this paper is the use of rich clinical and non-clinical health data, which has allowed a comprehensive and thorough exploration of the association of SSS with health. In particular the use of clinical data, has allowed us to establish that the observed association between SSS and self-reported health is not an artefact of reporting bias. To the best of our knowledge this is the first investigation of the relationship of SSS with objectively measured health measures such as hypertension, diabetes, waist circumference, triglycerides, HDL-cholesterol, CRP, and fibrinogen. A further advantage relates to the use of a wide range of objective SES markers, which provided the opportunity to adjust the SSS – health association in the most complete way. The use of wealth is a major advantage as wealth is a powerful objective SES marker and its inclusion in this study has allowed a more thorough assessment of the association of SSS with health. Finally, we consider the performance of gender-specific analyses a further strength of our study as it enables us to explore gender differences in the associations of SSS with health outcomes.

As this study is exploratory, many issues still remain to be dealt with by future research. A priority for future research should be the longitudinal analysis of the associations examined here so that causality can be established. Secondly, although there is convincing evidence that SSS is not a product of psychological bias (Adler et al., 2000; Hu et al., 2005; Operario et al., 2004; Singh-Manoux et al., 2003), future research could add to this line of research by testing the associations between SSS and health against potential confounders such as negative affectivity. Further, an examination of the role of gender in the associations of SSS with health outcomes is warranted given the gender differences this study has identified. Finally, a high priority for the future should be to develop further the promising concept of life-time achievement and successfulness, which could be a powerful tool for understanding and explaining health and well-being in old age and exploring health inequalities among older adults.

In conclusion, it was found that, independently of a range of covariates, SSS was significantly related to self-rated health, depression, and long-standing illness or disability in both men and women and to diabetes and HDL-cholesterol in women. Also, strong associations, which only became non-significant when adjusting for all covariates together, were observed between SSS and fibrinogen in men and between SSS and central obesity and C-reactive protein in women. Further, SSS mediated fully or partially the associations of education and occupational class with all outcome measures but none of their associations with wealth, except for the self-reported health measures.

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Appendix A. Information on the protocol for the collection of the clinical data and their analysis

The protocol for the collection of the clinical measurements and the blood samples can be found at: http://www.ifs.org.uk/elsa/docs_w2/project_instructions_nurse.pdf. The analysis of the blood data was carried out in the Royal Victoria Infirmary (RVI) in Newcastle-upon-Tyne, UK. Detailed information on the technicalities of the blood analysis and the internal quality control and the external quality assessment for the laboratories that carried it out can be retrieved from the 2004 Health Survey for England (HSE) technical report (Graig, Deverill & Pickering, 2006) at: http://www.ic.nhs.uk/pubs/healthsurvey2004ethnicfull/hse2004vol2/file as both HSE and ELSA employed the same laboratories and the same guidelines and protocols for the blood analysis.

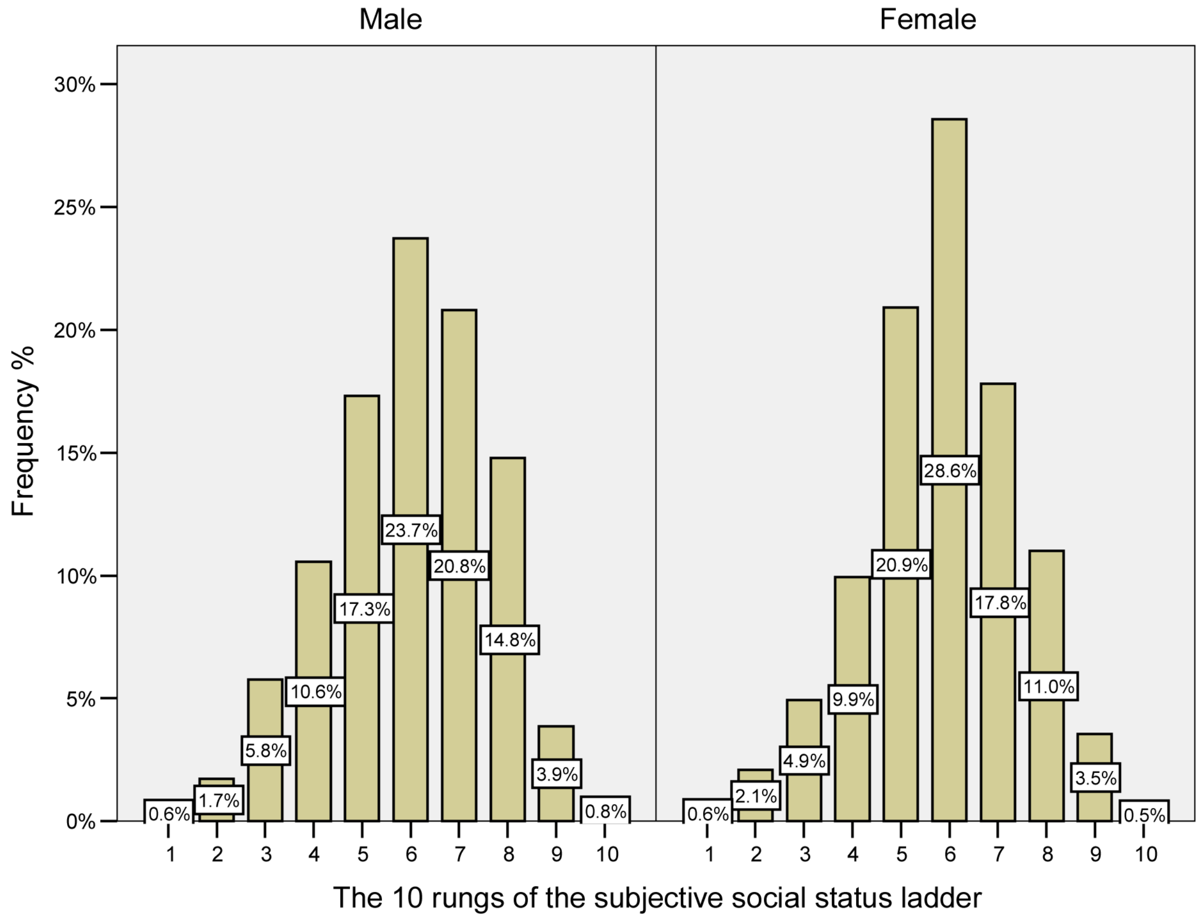

Figure 1.
The distribution of the subjective social status (1–10, lowest-highest rank) by sex

Table 1

The sociodemographic characteristics of the participants by sex, English Longitudinal Study of Ageing (2004–05) [a]

	Males (%)	Females (%)	Total (%)
Age			
Median (years)	65	66	
52–54	307 (10.8)	352 (9.4)	659 (10.1)
55–59	750 (23.8)	904 (21.9)	1654 (22.8)
60–64	583 (17.0)	731 (16.9)	1314 (16.9)
65–69	587 (16.7)	664 (15.3)	1251 (16.0)
70–74	493 (13.2)	541 (12.5)	1034 (12.9)
75–80	397 (11.3)	467 (12.2)	864 (11.8)
80+	251 (7.2)	406 (11.7)	657 (9.6)
Sex	3368 (46.6)	4065 (53.4)	7433 (100.0)
Marital status			
Married	2633 (77.8)	2480 (61.5)	5113 (69.1)
All other categories	735 (22.2)	1585 (38.5)	2320 (30.9)
Education			
Degree or equivalent	574 (16.1)	371 (8.3)	945 (11.9)
Higher education or equivalent	496 (14.0)	432 (9.9)	928 (11.8)
General Certificate of Education: Advanced Level or equivalent	278 (8.0)	231 (5.4)	509 (6.6)
General Certificate of Education: Ordinary Level or equivalent	540 (15.9)	789 (18.5)	1329 (17.3)
Certificate of Secondary Education or equivalent	270 (8.0)	82 (2.1)	352 (4.9)
Foreign or other type of qualifications	174 (5.2)	499 (12.1)	673 (8.9)
No qualification	1034 (32.8)	1659 (43.7)	2693 (38.6)
Occupational class			
Higher managerial and professional occupations	559 (15.3)	152 (3.4)	711 (9.0)
Lower managerial and professional occupations	811 (22.6)	902 (21.5)	1713 (22.0)
Intermediate occupations	176 (5.2)	877 (21.6)	1053 (13.8)
Small employers and own account workers	470 (14.1)	308 (7.7)	778 (10.7)
Lower supervisory and technical occupations	532 (16.8)	265 (6.9)	797 (11.6)
Semi-routine occupations	349 (11.2)	926 (24.2)	1275 (18.1)
Routine occupations	458 (15.0)	544 (14.7)	1002 (14.8)

[a]Frequencies are weighted for non-response, while counts are not

Table 2

The age-adjusted prevalence of health outcomes by subjective social status [a]

Sex	Subjective social status rank										Total	Trend[b]
	1st Lowest	2nd	3rd	4th	5th	6th	7th	8th	9th	10th Highest		
Poor/fair self-rated health												
Males	70.4	58.8	52.9	36.2	28.6	25.7	19.2	15.5	16.4	8.7	25.6	p≤0.001
N	20	58	194	355	583	798	701	498	130	28	3365	
Females	82.3	45.1	46.1	34.8	26.3	24.2	18.6	18.8	15.5	32.0	24.8	p≤0.001
N	26	85	201	403	850	1162	724	447	144	22	4064	
Four or more depressive symptoms on an eight-item Center for Epidemiological Studies Depression (CES-D) scale												
Males	50.1	41.9	27.9	13.2	10.6	8.0	8.0	6.5	4.4	0.0	9.5	p≤0.001
N	19	58	191	345	579	793	692	497	128	28	3330	
Females	53.7	47.8	34.3	23.4	17.2	14.3	12.9	10.6	11.2	9.8	15.7	p≤0.001
N	25	85	196	401	842	1152	718	446	144	22	4031	
Existence of long-standing illness or disability												
Males	85.5	84.4	71.0	60.0	54.3	57.5	52.0	48.7	32.6	39.9	55.5	p≤0.001
N	21	58	194	356	583	799	700	497	130	28	3366	
Females	89.2	72.4	71.8	60.3	59.7	54.1	53.2	51.2	47.9	39.1	56.5	p≤0.001
N	26	85	201	404	850	1160	724	447	144	22	4063	
Diagnosed or measured hypertension ≥140/90mmHg												
Males	73.4	64.1	74.1	66.2	63.1	59.2	59.8	58.9	44.9	64.7	61.6	p≤0.001
N	16	38	158	262	465	604	576	396	93	21	2629	
Females	63.7	61.1	60.0	63.5	60.8	59.3	57.9	58.9	46.4	50.6	59.3	p=0.022
N	21	55	155	319	665	927	590	362	118	16	3328	
Diagnosed diabetes or glycated haemoglobin (HbA1c) ≥ 6.0%												
Males	26.7	30.2	25.2	13.9	17.0	18.2	14.4	13.4	17.7	5.5	16.6	p=0.004
N	17	37	127	227	404	556	517	362	91	21	2359	
Females	23.8	21.5	17.1	14.2	10.0	8.9	10.0	8.1	7.5	0.0	10.1	p≤0.001
N	17	54	138	274	582	806	523	314	102	13	2823	
Central obesity (waist circumference ≥ 94cm in men and ≥ 80cm in women)												
Males	73.2	77.1	72.4	76.0	77.9	72.2	75.5	76.3	69.7	68.8	74.9	p=0.646
N	17	43	169	297	506	697	616	430	110	27	2912	
Females	94.6	90.2	82.0	83.3	80.3	79.6	77.4	80.3	69.6	69.4	79.8	p≤0.001
N	20	69	170	337	739	1011	646	394	128	19	3533	
HDL-cholesterol < 1 mmol/L in men and < 1.3 mmol/L in women												
Males	24.2	27.7	14.3	19.3	13.6	16.8	12.7	10.4	7.9	12.0	14.3	p≤0.001
N	17	38	125	238	412	570	526	365	93	21	2405	
Females	30.1	23.6	24.8	18.4	14.5	14.7	11.5	10.2	13.4	0.0	14.2	p≤0.001
N	16	54	138	278	593	812	529	316	104	13	2853	
Triglycerides ≥ 1.7 mmol/L												
Males	53.8	54.2	49.9	52.4	48.8	47.6	46.3	46.7	42.2	70.2	48.3	p=0.138
N	17	38	126	238	412	570	527	366	93	22	2409	
Females	53.3	50.7	49.4	45.0	43.6	37.7	39.1	39.5	27.0	42.0	40.5	p≤0.001
N	16	54	138	278	592	812	529	316	104	13	2852	
Log-transformed fibrinogen (g/L) [c]												
Males	3.74	3.42	3.27	3.11	3.11	3.10	3.05	3.05	2.91	2.97	3.10	p≤0.001
N	17	38	126	234	409	566	523	365	91	22	2391	
Females	3.11	3.39	3.37	3.27	3.22	3.24	3.15	3.15	3.11	3.17	3.21	p≤0.001
N	17	55	138	274	588	801	522	317	102	13	2827	
Log-transformed C-reactive protein (mg/L) [c,d]												
Males	2.9	2.2	1.9	1.8	1.7	1.7	1.6	1.6	1.3	1.8	1.7	p≤0.001
N	11	33	116	219	378	526	492	340	90	22	2227	
Females	1.3	2.0	2.2	2.1	1.9	1.8	1.7	1.6	1.2	1.5	1.8	p≤0.001
N	15	44	121	256	546	756	501	286	97	12	2634	

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Sex	Subjective social status rank										Total	Trend[b]
	1st Lowest	2nd	3rd	4th	5th	6th	7th	8th	9th	10th Highest		

[a] Frequencies are weighted for non-response, while counts are not

[b] Derived from regression analyses adjusted for age

[c] Results are presented in the form of geometric mean

[d] Cases with CRP>10mg/L were excluded from analysis

Table 3

Multivariate logistic and linear regression analyses for the associations of subjective social status (SSS) with the health outcomes by gender [a]

	Model 1: Adjusted for age and marital status	**Model 2a: Model 1 adjusted for education**	**Model 2b: Model 1 adjusted for occupational class**	**Model 2c: Model 1 adjusted for wealth**	**Model 3: Model 1 adjusted for education, occupational class, and wealth**
			LOGISTIC REGRESSION ANALYSES		
	OR[b] (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Outcome: Poor/fair self-rated health					
Men	0.73** (0.70, 0.77)	0.77** (0.73, 0.81)	0.76** (0.72, 0.80)	0.81** (0.77, 0.86)	0.83** (0.78, 0.87)
Women	0.78** (0.74, 0.82)	0.82** (0.78, 0.87)	0.83** (0.79, 0.88)	0.86** (0.82, 0.90)	0.90** (0.85, 0.95)
Outcome: Four or more depressive symptoms on an eight-item Center for Epidemiological Studies Depression (CES-D) scale					
Men	0.72** (0.67, 0.78)	0.73** (0.68, 0.79)	0.73** (0.67, 0.78)	0.77** (0.71, 0.83)	0.76** (0.71, 0.83)
Women	0.76** (0.72, 0.81)	0.78** (0.74, 0.83)	0.79** (0.74, 0.83)	0.80** (0.76, 0.85)	0.82** (0.77, 0.87)
Outcome: Existence of long-standing illness or disability					
Men	0.83** (0.80, 0.87)	0.84** (0.80, 0.88)	0.84** (0.81, 0.88)	0.88** (0.84, 0.92)	0.88** (0.84, 0.92)
Women	0.87** (0.83, 0.90)	0.87** (0.83, 0.90)	0.89** (0.85, 0.93)	0.90** (0.86, 0.94)	0.91** (0.87, 0.95)
Outcome: Diagnosed or measured hypertension ≥140/90mmHg					
Men	0.91** (0.87, 0.95)	0.93** (0.88, 0.98)	0.92** (0.88, 0.97)	0.95 (0.90, 1.00)	0.96 (0.90, 1.01)
Women	0.95* (0.91, 1.00)	0.97 (0.93, 1.03)	0.96 (0.91, 1.01)	1.00 (0.94, 1.05)	0.99 (0.94, 1.05)
Outcome: Diagnosed diabetes or glycated haemoglobin (HbA1c) ≥6.0%					
Men	0.90** (0.84, 0.96)	0.92* (0.85, 0.99)	0.92* (0.85, 0.99)	0.97 (0.89, 1.04)	0.97 (0.89, 1.05)
Women	0.84** (0.77, 0.92)	0.85** (0.78, 0.93)	0.86** (0.78, 0.94)	0.87** (0.81, 0.97)	0.90* (0.82, 0.98)
Outcome: Central obesity (waist circumference ≥ 94cm in men and ≥ 80cm in women)					
Men	0.97 (0.93, 1.03)	1.00 (0.94, 1.05)	0.98 (0.92, 1.03)	0.99 (0.94, 1.05)	1.00 (0.95, 1.07)
Women	0.90** (0.85, 0.95)	0.93** (0.88, 0.98)	0.92** (0.87, 0.97)	0.93* (0.88, 0.99)	0.96 (0.90, 1.02)
Outcome: HDL-cholesterol < 1 mmol/L in men and < 1.3 mmol/L in women					
Men	0.89** (0.82, 0.95)	0.92* (0.85, 0.99)	0.89** (0.82, 0.96)	0.93 (0.86, 1.01)	0.94 (0.86, 1.02)
Women	0.84** (0.78, 0.91)	0.86** (0.80, 0.93)	0.87** (0.80, 0.94)	0.90** (0.83, 0.97)	0.91* (0.84, 0.99)
Outcome: Triglycerides ≥ 1.7 mmol/L					
Men	0.96 (0.91, 1.01)	0.99 (0.93, 1.04)	0.97 (0.92, 1.02)	1.01 (0.95, 1.06)	1.01 (0.96, 1.07)
Women	0.91** (0.86, 0.96)	0.93** (0.88, 0.98)	0.93** (0.88, 0.98)	0.95 (0.90, 1.01)	0.97 (0.91, 1.03)
			LINEAR REGRESSION ANALYSES		
	β[c] (95% C.I.)	β (95% C.I.)	β (95% C.I.)	β (95% C.I.)	β (95% C.I.)
Outcome: Log-transformed fibrinogen (g/L)					

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	Model 1: Adjusted for age and marital status	Model 2a: Model 1 adjusted for education	Model 2b: Model 1 adjusted for occupational class	Model 2c: Model 1 adjusted for wealth	Model 3: Model 1 adjusted for education, occupational class, and wealth
Men	−0.006** (−0.009, −0.004)	−0.004** (−0.006, −0.002)	−0.005** (−0.006, −0.003)	−0.003* (−0.005, −0.001)	−0.002 (−0.005, 0.001)
Women	−0.004** (−0.007, −0.002)	−0.003* (−0.006, −0.001)	−0.004** (−0.006, −0.001)	−0.002 (−0.005, 0.0003)	−0.002 (−0.004, 0.001)
Outcome: Log-transformed C-reactive protein (mg/L) [d]					
Men	−0.020** (−0.031, −0.010)	−0.013* (−0.024, −0.001)	−0.014* (−0.025, −0.002)	−0.005 (−0.017, 0.006)	−0.002 (−0.014, 0.011)
Women	−0.025** (−0.035, −0.015)	−0.015** (−0.026, −0.005)	−0.019** (−0.030, −0.009)	−0.011* (−0.022, −0.0003)	−0.006 (−0.017, 0.005)

** p≤ 0.01

* p≤ 0.05

[a] All presented results are weighted for non-response

[b] Multivariate logistic regression results are presented in the form of Odds Ratio (OR), which represents the odds of having the condition per unit increase in SSS

[c] Results for fibrinogen and C-reactive protein are presented in the form of regression coefficient (β), which represents the amount of change in the outcome variable (logarithmic) per unit increase in SSS

[d] Cases of C-reactive>10mg/L were excluded from analysis

Table 4

Multivariate regression analyses for the associations of education, occupational class, and total net (non-pension) wealth with the health outcomes before and after adjusting for subjective social status (SSS) by gender [a]

	Model A1: Education adjusted for age and marital status	Model A2: Model A1 adjusted for SSS	Model B1: Occupational class adjusted for age and marital status	Model B2: Model B1 adjusted for SSS	Model C1: Wealth adjusted for age and marital status	Model C2: Model C1 adjusted for SSS
LOGISTIC REGRESSION ANALYSES						
	OR[b] (95% C.I.)	OR (95% C.I.)	OR[c] (95% C.I.)	OR (95% C.I.)	OR[c] (95% C.I.)	OR (95% C.I.)
Outcome: Poor/fair self-rated health						
Men	0.26** (0.20, 0.33)	0.44** (0.33, 0.59)	0.84** (0.81, 0.87)	0.92** (0.88, 0.96)	0.63** (0.60, 0.67)	0.71** (0.66, 0.76)
Women	0.31** (0.23, 0.42)	0.44** (0.31, 0.61)	0.81** (0.78, 0.83)	0.85** (0.81, 0.88)	0.66** (0.63, 0.70)	0.71** (0.66, 0.75)
Outcome: Four or more depressive symptoms on an eight-item Center for Epidemiological Studies Depression (CES-D) scale						
Men	0.49** (0.34, 0.69)	0.91 (0.60, 1.37)	0.89** (0.85, 0.93)	0.98 (0.93, 1.04)	0.69** (0.64, 0.75)	0.81** (0.74, 0.89)
Women	0.38** (0.26, 0.54)	0.54** (0.36, 0.82)	0.88** (0.85, 0.92)	0.93** (0.89, 0.98)	0.76** (0.71, 0.81)	0.84** (0.78, 0.90)
Outcome: Existence of long-standing illness or disability						
Men	0.66** (0.53, 0.80)	0.88 (0.69, 1.11)	0.93** (0.90, 0.96)	0.97 (0.94, 1.01)	0.78** (0.74, 0.82)	0.84** (0.79, 0.89)
Women	0.80* (0.64, 1.00)	1.02 (0.79, 1.31)	0.94** (0.91, 0.97)	0.97 (0.93, 1.00)	0.83** (0.79, 0.87)	0.86** (0.82, 0.91)
Outcome: Diagnosed or measured hypertension ≥140/90mmHg						
Men	0.71** (0.56, 0.90)	0.78 (0.59, 1.03)	0.95** (0.91, 0.98)	0.97 (0.93, 1.01)	0.86** (0.81, 0.91)	0.87** (0.81, 0.93)
Women	0.63** (0.49, 0.82)	0.67** (0.51, 0.89)	0.94** (0.91, 0.97)	0.96 (0.92, 1.00)	0.85** (0.81, 0.90)	0.85** (0.80, 0.90)
Outcome: Diagnosed diabetes or glycated haemoglobin (HbA1c) ≥ 6.0%						
Men	0.66* (0.46, 0.94)	0.75 (0.50, 1.13)	0.94* (0.89, 0.99)	0.95 (0.89, 1.01)	0.81** (0.75, 0.88)	0.80** (0.73, 0.89)
Women	0.52* (0.31, 0.88)	0.82 (0.47, 1.44)	0.91** (0.86, 0.97)	0.98 (0.91, 1.05)	0.74** (0.67, 0.81)	0.81** (0.73, 0.90)
Outcome: Central obesity (waist circumference ≥ 94cm in men and ≥ 80cm in women)						
Men	0.63** (0.49, 0.81)	0.69* (0.52, 0.92)	0.98 (0.94, 1.02)	0.99 (0.95, 1.04)	0.94 (0.89, 1.00)	0.95 (0.88, 1.02)
Women	0.51** (0.39, 0.66)	0.56** (0.42, 0.75)	0.93** (0.89, 0.97)	0.96* (0.91, 1.00)	0.85** (0.80, 0.91)	0.87** (0.81, 0.94)
Outcome: HDL-cholesterol < 1 mmol/L in men and < 1.3 mmol/L in women						
Men	0.45** (0.30, 0.67)	0.54** (0.34, 0.84)	0.95 (0.91, 1.01)	1.00 (0.94, 1.06)	0.82** (0.75, 0.89)	0.85** (0.76, 0.94)
Women	0.56* (0.35, 0.89)	0.64 (0.38, 1.08)	0.91** (0.86, 0.96)	0.93* (0.88, 0.99)	0.76** (0.70, 0.83)	0.78** (0.71, 0.86)
Outcome: Triglycerides ≥ 1.7 mmol/L						
Men	0.69** (0.54, 0.89)	0.70* (0.53, 0.94)	0.97 (0.93, 1.01)	0.98 (0.94, 1.03)	0.86** (0.81, 0.92)	0.86** (0.80, 0.92)
Women	0.62** (0.46, 0.84)	0.66** (0.48, 0.90)	0.93** (0.89, 0.97)	0.94** (0.90, 0.98)	0.81** (0.77, 0.86)	0.84** (0.78, 0.89)
LINEAR REGRESSION ANALYSES						
	β[d] (95% C.I.)	β (95% C.I.)	β[e] (95% C.I.)	β (95% C.I.)	β[e] (95% C.I.)	β (95% C.I.)

	Model A1: Education adjusted for age and marital status	Model A2: Model A1 adjusted for SSS	Model B1: Occupational class adjusted for age and marital status	Model B2: Model B1 adjusted for SSS	Model C1: Wealth adjusted for age and marital status	Model C2: Model C1 adjusted for SSS
Outcome: Log-transformed fibrinogen (g/L)						
Men	−0.035** (−0.047, −0.024)	−0.026** (−0.039, −0.013)	−0.005** (−0.007, −0.003)	−0.003** (−0.005, −0.001)	−0.010** (−0.013, −0.007)	−0.009** (−0.013, −0.006)
Women	−0.026** (−0.037, −0.015)	−0.020** (−0.032, −0.008)	−0.004** (−0.005, −0.002)	−0.002* (−0.004, −0.0001)	−0.009** (−0.012, −0.008)	−0.008** (−0.011, −0.006)
Outcome: Log-transformed C-reactive protein (mg/L) [f]						
Men	−0.156** (−0.204, −0.109)	−0.110** (−0.165, −0.054)	−0.020** (−0.028, −0.012)	−0.015** (−0.024, −0.007)	−0.047** (−0.060, −0.035)	−0.043** (−0.058, −0.029)
Women	−0.210** (−0.272, −0.149)	−0.183** (−0.247, −0.119)	−0.026** (−0.033, −0.018)	−0.019** (−0.027, −0.010)	−0.055** (−0.067, −0.042)	−0.050** (−0.064, −0.037)

** p≤ 0.01

* p≤ 0.05

[a] All presented results are weighted for non-response

[b] In the multivariate logistic regression models for education results are presented in the form of Odds Ratio (OR), which represents the odds degree holders have to have the condition compared to those of respondents with no educational qualifications (reference category)

[c] In the multivariate logistic regression models for occupational class and wealth results are presented in the form of Odds Ratio (OR), which represents the odds of having the condition per unit increase in the predictor variable

[d] In the multivariate linear regression models for education results are presented in the form of regression coefficient (β), which represents the amount of change in the outcome variable (logarithmic) for degree holders compared to respondents with no educational qualifications (reference category)

[e] In the multivariate linear regression models for occupational class and wealth results are presented in the form of regression coefficient (β), which represents the amount of change in the outcome variable (logarithmic) per unit increase in the predictor variable

[f] Cases of C-reactive>10mg/L were excluded from analysis