

**Socioeconomic inequalities in resilience and vulnerability amongst older adults: A population-based birth cohort analysis**

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Socioeconomic inequalities in resilience and vulnerability amongst older adults: A  
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For Review Only

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3 Abstract

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6 Background:

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9 Ageing is associated with declines in physical capability; however, some individuals  
10 demonstrate high wellbeing despite this decline, i.e. they are “resilient”. We  
11 examined socioeconomic position (SEP) and resilience and the influence of  
12 potentially modifiable behavioural resources, i.e. social support and leisure time  
13 physical activity (LTPA), on these relationships.  
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21 Methods:

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24 Data came from the Medical Research Council National Survey of Health and  
25 Development, a nationally-representative birth cohort study. Resilience-vulnerability  
26 at age 60-64 (n=1756) was operationalised as the difference between observed and  
27 expected levels of wellbeing, captured by the Warwick-Edinburgh Mental Well-being  
28 Scale (WEMWBS), given the level of performance-based physical capability. SEP  
29 was assessed by father’s and own social class, parental education, and  
30 intergenerational social mobility. PA and structural/functional social support were  
31 reported at ages 53 and 60-64. Path analysis was used to examine mediation of  
32 SEP and resilience-vulnerability through LTPA and social support.  
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45 Results:

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48 Participants in the highest social class had scores on the resilience to vulnerability  
49 continuum which were an average of 2.3 units ( $\beta=0.46, 95\%CI 0.17, 0.75$ ) higher than  
50 those in the lowest social class. Greater PA ( $\beta=0.58, 95\%CI 0.31, 0.85$ ) and social  
51 support ( $\beta=3.27, 95\%CI 2.90, 3.63$ ) were associated with greater resilience; LTPA  
52 partly mediated participant social class and resilience (23.4% of variance).  
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3 Conclusions:  
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6 Adult socioeconomic advantage was associated with greater resilience. Initiatives to  
7  
8 increase LTPA may contribute to reducing socioeconomic inequalities in this form of  
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10 resilience in later life.  
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13 Keywords: resilience, social support, physical activity, socioeconomic position  
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## INTRODUCTION

As the number of older adults increases worldwide, understanding the relationship between physical and psychological health is increasingly important. It is well established that the likelihood of physical limitations and multimorbidity increase with age (Manton *et al.*, 1997; Wister *et al.*, 2016). Although lower levels of physical capability, that is the capacity to undertake the physical tasks of daily living (Cooper *et al.*, 2014a), have been associated with lower levels of mental wellbeing (Cooper *et al.*, 2014b), individuals in their 60s and 70s may also demonstrate high levels of mental wellbeing, a phenomenon often referred to as the “wellbeing paradox” (Windle *et al.*, 2010), or “disability paradox” (Albrecht and Devlieger, 1999). These findings suggest that individuals’ emotional responses to poor physical capability vary from positive to negative (Antonovsky, 1996) and that responses exist on a continuum of resilience, i.e. having higher levels of wellbeing than would be expected given the level of physical capability, to vulnerability, i.e. having lower levels of wellbeing than would be expected given the level of physical capability.

Research into resilience and vulnerability has its roots in developmental psychology, examining how certain children managed to fare better than others despite experiencing similar levels of adversity (Masten, 2001). These studies of early life have subsequently been expanded to later life (Ong *et al.*, 2006), examining the ways in which older adults respond more positively to a circumstance than would be anticipated based on the level of adversity experienced. Previous methodological work by Miller-Lewis, *et al.* (2013) suggests that this conceptual framework can be used to operationalise a continuum of resilience to vulnerability via residual values from linear regression models. This approach quantifies the difference between the observed and expected, or fitted, values. To help understand the disability paradox,

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3 it can be used to quantify how much higher (or lower) than expected is a person's  
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5 mental wellbeing than would be expected given their observed level of physical  
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7 capability. This salutogenic perspective on the ageing process draws attention to  
8  
9 processes distinct from pathogenic and disease-oriented pathways (Wister *et al.*,  
10  
11 2016).  
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13  
14 There are two possible theories that could explain the development of resilience.

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16 First, the ability of ageing individuals to be resilient is hypothesised to be related to  
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18 the resources available to them; specifically social, individual, and environmental  
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20 resources (Wister *et al.*, 2016). The 'life course model of multimorbidity resilience'  
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22 theorises that individuals who build up reserves, by invoking these three resource  
23  
24 domains, are better able to accommodate adversity (Wister *et al.*, 2016). Further,  
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26 this model suggests a cumulative approach to the development of resilience, i.e.  
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28 over time reserves are developed in these resource areas in order to foster more  
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30 positive responses to adversity during the ageing process. This suggests that  
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32 individuals who have higher levels of these resources currently at their disposal will  
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34 have greater resilience; therefore, we hypothesise that individuals of higher  
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36 socioeconomic position (SEP) will have greater resilience, as they have greater  
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38 social and economic resources available to them when compared to individuals of  
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40 lower SEP. It is well established that health is socioeconomically pattern (Marmot,  
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42 2005). Those in socioeconomically disadvantaged groups have been shown to have  
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44 greater risk of a host of negative physical and psychological outcomes when  
45  
46 compared with socioeconomically advantaged groups (Marmot, 2005). Less clear,  
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48 however, is whether greater socioeconomic advantage in childhood as well as  
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50 adulthood yields resources that promote resilience. The second theory proposes a  
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52 different association between childhood SEP and later life resilience. In contrast to  
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3 the 'life course model of multimorbidity resilience', the theory of 'steeling' suggests  
4 that resilience may be developed through inoculation by exposure to mild adversity  
5 in early life (Cohen *et al.*, 1985). Therefore, according to the theory of steeling, we  
6 hypothesise that, for a given level of adult SEP, those who had a more  
7 socioeconomically disadvantaged childhood will have greater resilience. In other  
8 words, we hypothesise that low childhood SEP followed by high adult SEP (i.e.  
9 upward intergenerational social mobility) will be associated with greater resilience  
10 compared to those who have high SEP in childhood and adulthood.

11  
12 Key resources that are potentially amenable to change and may promote resilience  
13 include lifestyle and social factors (Wister *et al.*, 2016). In particular, leisure time  
14 physical activity (LTPA) (Sacker and Cable) and social support (Golden *et al.*, 2009;  
15 Kim and Nesselroade, 2003) are related to both physical capability and mental  
16 wellbeing. There is evidence that these are socioeconomically patterned (Elhakeem  
17 *et al.*, 2015; Turner and Marino, 1994) and may therefore be on the explanatory  
18 pathways from SEP to resilience/vulnerability. We hypothesise that those with  
19 greater levels of LTPA and social support will have higher levels of resilience and  
20 that these resources will partly mediate any relationship between SEP and  
21 resilience.

## 22 METHODS

### 23 Sample

24 The Medical Research Council National Survey of Health and Development (NSHD)  
25 is based on a social class stratified sample of 5,362 singleton births on mainland  
26 Britain in March 1946 (Wadsworth *et al.*, 2006). Data to operationalise resilience  
27 were collected at age 60-64 (Kuh *et al.*, 2011). The 60-64 year data collection  
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3 consisted of a postal questionnaire followed by an invitation to attend an assessment  
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5 in a clinical research facility or in the study member's home. Of the 3163 people in  
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7 the target sample, information was obtained from the postal questionnaire and/or  
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9 visits from 2662 (84.1%). No attempt was made to contact the remaining 2199 study  
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11 members: 718 (13.4%) had already died, 594 (11.1%) had previously withdrawn  
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13 from the study, 567 (10.6%) lived abroad and 320 (5.9%) had been untraceable for  
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15 more than ten years (Stafford *et al.*, 2013). Ethical approval for this data collection  
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17 was obtained from the Greater Manchester Local Research Ethics Committee and  
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19 the Scotland A Research Ethics Committee.  
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24 Resilience

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27 Physical capability

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30 Standardised protocols were used by trained research nurses to assess grip  
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32 strength, chair rise, standing balance and timed-up-and-go, described elsewhere  
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34 (Guralnik *et al.*, 2006; Kuh *et al.*, 2005) and summarised below. Grip strength was  
35  
36 assessed isometrically using an electronic handgrip dynamometer (Kuh *et al.*, 2006).  
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38 Three measurements were taken in each hand, with the highest value (in kilograms)  
39  
40 recorded used in analyses. Standing balance time was measured by timing how long  
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42 (up to a maximum of 30 seconds) participants could maintain a one-legged stance  
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44 with his/her eyes closed. Due to the positive skew of these data, natural logarithm  
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46 transformation ( $\ln(\text{seconds}+1)$ ) was used to normalise the distribution. Chair rise  
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48 time was measured as the time taken to rise from a sitting position to a standing  
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50 position (with straight back and legs) and back to a sitting position 10 complete  
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52 times. Chair rise speed was calculated as repetitions/minute ( $(10/\text{time})$ ) for use in  
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54 these analyses. The timed-up-and-go test involved recording the time taken for  
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3 participants to rise from an armless chair, walk 3 meters at a normal pace, turn  
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5 around, return to the chair, and sit back down (Podsiadlo and Richardson, 1991).  
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7 The test was performed a single time. Participants were allowed to use walking aids  
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9 in the timed-up-and-go test (n=24). In instances where participants could not  
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11 complete the tests for health reasons (n=49 for grip strength, n=136 for chair rise,  
12  
13 n=89 for standing balance, and n=34 for timed-up-and-go), participants were  
14  
15 assigned a value of 0. As per the method devised by Guralnik, et al, (2006) scores  
16  
17 on each measure were rescaled (0 (low) to 1 (high)) and summed to create a  
18  
19 composite continuous score of physical capability with a range from 0 (unable to  
20  
21 perform all 4 tests) to 4 (high performance on all 4 tests). This score has a  
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23 demonstrated relationship with mortality; further, the use of a composite score  
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25 demonstrated greater predictive value than any one test (Cooper *et al.*, 2014c).  
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### 30 Mental wellbeing

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33 Prior to the assessment of physical capability, participants self-completed the 14-  
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35 item Warwick-Edinburgh Mental Well-being Scale (WEMWBS) (Tennant *et al.*, 2007)  
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37 in the postal questionnaire. The WEMWBS was developed to capture both  
38  
39 eudemonic and hedonic aspects of mental wellbeing, and includes items on positive  
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41 affect, satisfying interpersonal relationships, and positive mental functioning  
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43 (Tennant *et al.*, 2007). Respondents are asked to indicate the frequency, on a five-  
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45 point scale, with which they have experienced each positively worded statement in  
46  
47 the last two weeks. Statements include 'I've been feeling good about myself', 'I've  
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49 been feeling close to other people', 'I've been interested in new things' and 'I've been  
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51 feeling optimistic about the future'. Higher scores indicate greater wellbeing.  
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55 Validation studies indicate good construct validity for a single factor structure as well  
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3 as good criterion validity and test-retest reliability, and support the use of the  
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5 WEMWBS in general population samples (Repetti *et al.*, 2002).  
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### 8 Operationalising resilience 9

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11 The residual approach to operationalising resilience quantifies the degree to which  
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13 an individual responds more or less positively to a circumstance than would be  
14  
15 predicted by the level of adversity experienced (Miller-Lewis *et al.*, 2013). In the  
16  
17 present study, the WEMWBS score quantified a participant's level of wellbeing, and  
18  
19 the composite physical capability score quantified the degree of adversity. Resilience  
20  
21 was modelled as the difference between observed and predicted WEMWBS score,  
22  
23 i.e. residual values, for the physical capability composite score in a linear regression  
24  
25 model. The distance between the fitted regression line, i.e. expected WEMWBS  
26  
27 score, and the participant's observed WEMWBS score was used as a continuous  
28  
29 metric of an individual's level of resilience (Figure 1). The greater the size of the  
30  
31 positive residual the greater the resilience the individual demonstrated. Conversely,  
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33 more negative residual scores indicated greater vulnerability.  
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### 38 Exposures 39

#### 40 41 Indicators of Socioeconomic Position 42

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44 Occupation-based social class was coded using the UK Registrar General's Social  
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46 Class scheme in six categories. Professional, managerial, technical/skilled non-  
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48 manual occupations were categorised as non-manual and skilled manual, partly  
49  
50 skilled and unskilled as manual occupations. Data for adult head of household social  
51  
52 class were collected from the participant at age 53 (or age 43 if missing at 53 (n=85)  
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54 and 36 if missing at 53 and 43 (n=16)). Study member's educational attainment by  
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3 age 26 was categorised as “No education or Sub-GCE”, “O-Level or equivalent”,  
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5 (typically obtained at age 16) “A-Level or equivalent” (typically obtained at age 18),  
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7 and “Degree or higher”. Indicators of childhood socioeconomic position were based  
8  
9 on father’s social class, collected in 1950, i.e. participant age 4, and on parental  
10  
11 education, collected in 1952, i.e. participant age 6. Father’s and mother’s educational  
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13 level was classified as ‘primary only’, ‘primary and further education (no  
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15 qualifications attained)’, ‘secondary only or primary and further education or higher’,  
16  
17 or ‘secondary and higher’.  
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#### 20 21 Social Mobility

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24 Intergenerational social mobility was based on childhood and adult social class and  
25  
26 classified into four groups (childhood social class/adult social class): manual/manual;  
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28 manual/non-manual (upward); non-manual/manual (downward); non-manual/non-  
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30 manual.  
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#### 33 34 Leisure Time Physical Activity (LTPA)

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37 LTPA was captured at ages 53 and 60-64. In these waves of data collection study  
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39 members self-reported the number of times they had participated in any sports,  
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41 vigorous leisure activities or exercises in their spare time, not including getting to and  
42  
43 from work, in the past 4 weeks coded as : 0 times (coded 0), 1-4 times (1), or 5 or  
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45 more times (2). As in previous work (Cooper *et al.*, 2011), a cumulative score was  
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47 calculated ranging from 0, i.e. inactive at both ages, to 4, i.e. LTPA reported 5 or  
48  
49 more times at both ages. The validity of these LTPA measures has been considered  
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51 previously (Cooper *et al.*, 2011) and they have been shown to correlate with  
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53 monitored levels of daily activity at age 60-64 (Golubic *et al.*, 2014).  
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## Social Support

In the social relationships and health literature, studies have typically distinguished structural (capturing the quantity and breadth of a person's social contacts) and functional aspects (capturing the support derived from relationships (Cohen *et al.*, 1985)). Some have also distinguished between positive and negative aspects of functional support. Study members reported the quantity of social contact, perceived social support and marital status based on 13 items at ages 53 and 60-64 (Supplementary table).

To combine social support items to calculate a cumulative score, an indexing procedure was employed, i.e. putting ordinal values on a scale of 0 (lowest) to 10 (highest level of support), for each of the 13 social support variables. Scores from the 13 social support items at age 53 and at age 60-64 were then summed to create a cumulative score ranging from 0 (lowest) to 260 (highest). These scores were then standardised and are reported as z-scores.

## Statistical Analysis

Individuals' resilience scores, i.e. residual values from a linear regression of WEMWBS on physical capability, were used as the outcome variable. Residuals were approximately normally distributed indicating a linear association between wellbeing and physical capability. Linear regression models were used to examine the relationship between own and childhood socioeconomic indicators and resilience. The four levels of social mobility were dummy coded, first using downward social mobility as the reference group then using upward social mobility as the reference group to examine differences between different mobility patterns, notably between non-manual/non-manual and upward trajectories. Interactions

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3 between sex and each socioeconomic indicator were examined but we found no  
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5 evidence of modification by sex and so sex-adjusted analyses are presented  
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7 throughout.  
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10 Structural equation models, i.e. path analyses, were employed to examine mediation  
11  
12 of the associations identified between specific indicators of SEP and resilience  
13  
14 through cumulative PA scores and cumulative social support scores. This partitions  
15  
16 the total association between SEP and resilience into an indirect association  
17  
18 (through the mediators) and a direct association (not explained by included  
19  
20 variables). Root means square error approximation (RMSEA), comparative fit index  
21  
22 (CFI), and Tucker-Lewis Index (TLI) fit indices were used to assess model fit. Models  
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24 with RMSEA values lower than 0.05, CFI values greater than 0.9, and TLI values  
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26 greater than 0.95 are deemed to have adequate fit (Hu and Bentler, 1999).  
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30 Analytical sample:  
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34 A total of 1978 participants provided complete wellbeing data and of these 1756 had  
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36 complete data on all four physical capability measures, resulting in an analytical  
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38 sample of 1756 for these analyses. Missing data were handled using full information  
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40 maximum likelihood, based on the missing at random assumption. Sensitivity  
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42 analyses were conducted with complete cases as well as with full information  
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44 maximum likelihood estimation to accommodate for missing data; however, no  
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46 differences were revealed therefore these results are not presented (data are  
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48 available on request from the authors).  
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## 51 52 RESULTS

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55 Sample  
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3 The sample consisted of 53% women, with 58% having educational levels of O-level  
4 or lower, and 68% in non-manual occupations (Table 1). Almost 39% of study  
5 members were in the non-manual/non-manual social mobility group and 30% were in  
6 the upward mobility group.  
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12 <Table1>

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15 Resilience analysis

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18 There was a positive relationship between higher physical capability and higher  
19 WEMWBS scores in a sex-adjusted model (standardised regression coefficient  
20  $\beta=2.68$ ,  $p<0.001$ , 95% CI 1.82, 3.54) (Figure 1).  
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26 <Figure 1>

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29 There was a trend towards higher resilience in those with higher own and parental  
30 educational attainment though these associations did not attain statistical  
31 significance (Table 2).  
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37 Higher adult social class was associated with higher resilience scores in sex-  
38 adjusted models (Table 2). Those in the highest social class had resilience scores on  
39 average 2.3 units (or 0.29 standard deviations) higher than those in the lowest social  
40 class. Childhood social class and parental education were not associated with  
41 resilience. Upward and non-manual/non-manual social mobility were associated with  
42 greater resilience when compared with downward social mobility; however, when  
43 upward social mobility was used as the reference category only an association  
44 between upward and downward mobility was observed. Based on this, the mediation  
45 analysis focused on explanatory pathways linking adult social class to resilience.  
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3 Higher levels of social support ( $\beta=3.27$ ,  $p<0.001$ , 95% CI 2.90, 3.63) and greater  
4 participation in LTPA ( $\beta=0.58$ ,  $p<0.001$ , 95% CI 0.31, 0.85) were associated with  
5 greater resilience-vulnerability scores in sex-adjusted linear regression models. In a  
6 sex-adjusted ordinal logistic regression model higher participant social class was  
7 associated with higher levels of LTPA (OR=1.36,  $p<0.001$ , 95% CI 1.27, 1.44). A  
8 sex-adjusted linear regression model revealed no association between higher  
9 participant social class and social support ( $\beta =0.59$ ,  $p=0.21$ , 95% CI -0.33 1.51);  
10 therefore, analysis of the mediation of participant social class and resilience by social  
11 support was not conducted.  
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25 In a mediation model of SEP and resilience by LTPA, the model demonstrated  
26 adequate fit (RMSEA = 0.00 (90%CI 0.00-0.04); CFI = 1.00; TFI = 1.00). The total  
27 effect of adult SEP on resilience was 0.46 (95% CI 0.17, 0.75) and the indirect effect  
28 through LTPA was 0.11 (95% CI 0.04, 0.17), i.e. LTPA accounted for 23.4% of the  
29 variance in the relationship between SEP and resilience.  
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## 39 DISCUSSION

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41 Adult social class was positively associated with a level of mental wellbeing greater  
42 than expected for the level of physical capability observed, i.e. greater resilience (or  
43 lower vulnerability). Here we operationalised resilience on a continuum from resilient  
44 to vulnerable and found a linear association with adult social class indicating that  
45 those in the most advantaged social class were most resilient and those in the most  
46 disadvantaged social class were most vulnerable. There was no evidence that this  
47 type of resilience in adulthood was associated with childhood SEP, based on father's  
48 social class or parental education, or with intergenerational social mobility.  
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3 Since we found no evidence of differences in levels of resilience between the upward  
4 and non-manual/non-manual trajectories, these analyses provide no support for the  
5 theory of “steeling”, i.e. developing resilience through inoculation to adversity and  
6 exposure to stress in early life. This theory, has been supported by positive results in  
7 animal models (Lyons *et al.*, 2009), but evidence has been much weaker in  
8 humans (Rutter, 2012). Our results suggest that current SEP is more closely  
9 associated with this type of adult resilience than prior SEP. These findings align with  
10 the ‘life course model of multimorbidity resilience theory’, in which access to and  
11 accumulation of resources is suggested to foster greater resilience (Wister *et al.*,  
12 2016). Regardless of their childhood SEP, individuals with high adult SEP were  
13 more likely to demonstrate greater resilience. Accumulation of resources is more  
14 closely associated with resilience than perseverance in the absence of resources.  
15  
16 Our findings supported our hypothesis that individuals who had greater LTPA, and  
17 social support would demonstrate greater levels of resilience and lower levels of  
18 vulnerability. In addition, the cumulative scores of LTPA and social support at age  
19 53 and 60-64 were associated with greater resilience, supporting the accumulation  
20 of resources component of the ‘life course model of multimorbidity resilience’ (Wister  
21 *et al.*, 2016). Whilst a relationship was observed between higher LTPA and higher  
22 adult social class, no relationship was observed for our composite measure of  
23 structural and functional social support and social class leading us to conclude that  
24 social support is not on the explanatory pathway between adult social class and  
25 resilience in this setting. LTPA, however, was shown to mediate part of the  
26 relationship between SEP and resilience. These results suggest that socioeconomic  
27 inequalities in resilience in terms of maintaining wellbeing given low levels of  
28 physical capability may be reduced through the fostering of health behaviours, such  
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3 as LTPA. However, the relationship between LTPA and physical capability is likely  
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5 bidirectional. To some extent, those with greater physical capability may be more  
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7 able to be physically active. We are unable to tell from these analyses whether  
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9 increasing LTPA would lead to greater resilience or whether greater participation in  
10  
11 LTPA is a marker of greater physical capability which is not captured by the  
12  
13 performance measures we have considered.  
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16  
17 These results must be interpreted with the following limitations in mind. As with any  
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19 longitudinal study, attrition via death and dropout may introduce bias and/or  
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21 compromise the generalisability of the findings. To address missing covariate and  
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23 exposure data, full information maximum likelihood estimation (FIML) was conducted  
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25 in linear regression models under a missing at random assumption. However, we did  
26  
27 not include those missing data on physical capability and wellbeing. We know from  
28  
29 earlier work that non-responders at age 60-64 had lower lifetime SEP and had lower  
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31 physical capability at the previous sweep (age 53), though they did not differ from  
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33 responders in mental health (Stafford *et al.*, 2013). We have examined LTPA and  
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35 social support as mediators of SEP and resilience; however, many factors beyond  
36  
37 these variables, e.g. diet and smoking status, may also have had an impact on  
38  
39 individuals' resilience-vulnerability. LTPA is just one domain of physical activity that  
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41 is socioeconomically patterned (Elhakeem *et al.*, 2015), other domains, e.g. active  
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43 transport and occupational activity, were not included in these analyses; further  
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45 investigations are required to examine physical activity beyond LTPA. Participants in  
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47 the present study were aged 60-64; therefore, findings from this study may not be  
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49 generalisable to other age groups. Additionally, we have examined only one form of  
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51 resilience, i.e. the relationship between physical capability and mental wellbeing.  
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57 There are many other forms of resilience that use different adversity and outcome  
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3 dyads, to which the findings from the present study may not be generalisable.

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5 Further investigation is required to examine the relationship between resources in  
6  
7 other resilience operationalisations.  
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10 The MRC National Survey of Health and Development is a socially stratified  
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12 population-representative study of ageing, providing longitudinal data on resilience,  
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14 socioeconomic indicators, and sociobehavioral measures. A strength of these  
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16 analyses is the prospective collection of data from birth to age 60-64; recall bias is,  
17  
18 therefore, minimised. Through the examination of mediators that are the potentially  
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20 modifiable, there is opportunity for intervention; for example, LTPA is a form of  
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22 physical activity that is amenable to change.  
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26 The current study suggests that modifiable aspects of lifestyle, i.e. LTPA, may play a  
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28 role in the mediation of socioeconomic (dis)advantage in the fostering of resilience.  
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30 Age-related declines in physical capability have been associated with increased risk  
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32 of disability (Manton *et al.*, 1997; Wister *et al.*, 2016). However, whilst some  
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34 “vulnerable” individuals experience low wellbeing when facing limited capability  
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36 undertaking the physical tasks of daily living, other “resilient” individuals have  
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38 relatively high wellbeing for their level of physical capability. Socioeconomic  
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40 advantage, LTPA, and social support are positively correlated with this resilience.  
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42 Lower SEP is associated with poorer physical capability (Cooper *et al.*, 2014a;  
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44 Cooper *et al.*, 2014b; Pierce *et al.*, 2012) but these findings provide some preliminary  
45  
46 evidence that interventions to raise LTPA levels among those who are more  
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48 socioeconomically disadvantaged may help promote wellbeing in the face of this kind  
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50 of adversity. Through individual- and policy-level interventions to increase LTPA, it  
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52 may be possible to offset the negative implications of lower SEP, which has the  
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potential to facilitate more positive ageing trajectories and greater wellbeing across the life course.

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28 Conflict of Interest:  
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30 All authors declare no conflict of interest.  
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34 Author contributions:  
35

36  
37 TDC, MS, RC, and DK conceived of the study. TDC conducted the analysis and  
38 wrote the first draft. MS, RC, and DK aided in the analysis and interpretation of the  
39 results. All authors contributed to editing and revising the manuscript.  
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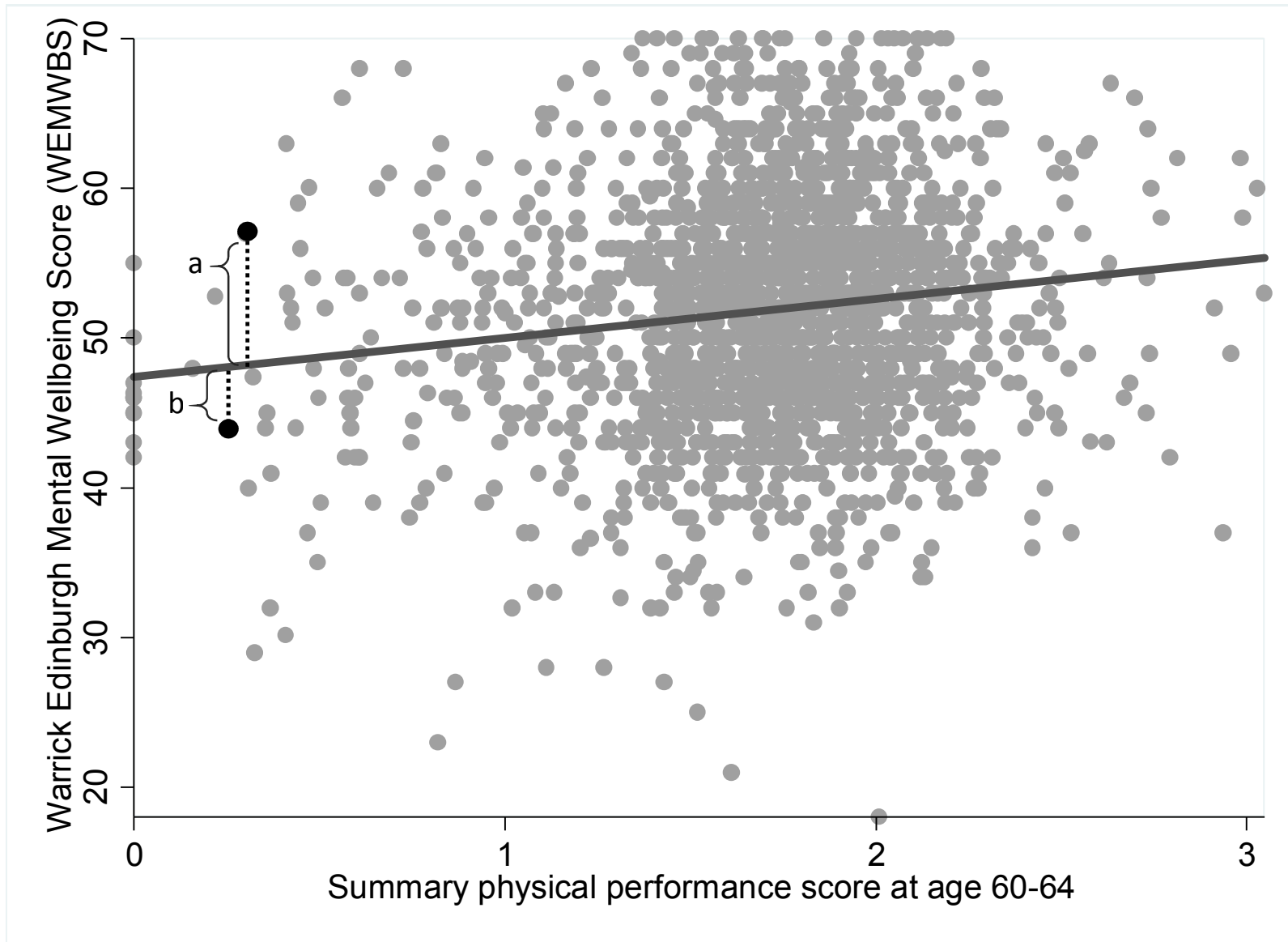


Figure 1: Wellbeing linearly regressed on summary objective physical performance at age 60-64 (standardised regression coefficient  $\beta=2.68$ ,  $p<0.001$ , 95% CI 1.82, 3.54).

<sup>a</sup> Positive residual value indicating greater observed wellbeing score than would be expected by the fitted regression line;

<sup>b</sup> Negative residual value indicating lower observed wellbeing score than would be expected by the fitted regression line

Table 1 Characteristics of the MRC NSHD (sample restricted to those with complete data on wellbeing and physical capability at age 60-64)

			n	Mean(SD) / %
		Warwick-Edinburgh Mental Wellbeing Score	1756	51.8 (8.0)
		Composite Physical Capability Score	1756	1.7 (0.4)
		Men	822	46.8%
		Women	934	53.2%
Adulthood	Education	None/Sub-GCE	601	36.3%
		O-level	351	21.2%
		A level or equivalent	502	30.3%
		Degree or higher	203	12.3%
		V Unskilled	50	2.9%
	Social class	IV Partly skilled	129	7.4%
		IIM Skilled (Manual)	371	21.4%
		IIINM Skilled (Non-manual)	224	12.9%
		II Intermediate	747	43.0%
		I Professional	215	12.4%
Childhood	Father's Education	V Unskilled	77	4.8%
		IV Partly skilled	300	18.6%
		IIM Skilled (Manual)	458	28.4%
		IIINM Skilled (Non-manual)	352	21.8%
		II Intermediate	297	18.4%
	Mother's Education	I Professional	128	7.9%
		Primary only	796	51.5%
		Primary and further education (no qualifications)	208	13.5%
		Secondary only or primary and further education	242	15.7%
		Secondary and higher	299	19.4%
Intergenerational Social Mobility	Social class	Primary only	870	55.7%
		Primary and further education (no qualifications)	245	15.7%
		Secondary only or primary and further education	212	13.6%
		Secondary and higher	235	15.0%
Leisure Time Physical Activity (in last 4 weeks)	1999	Downward	148	9.3%
		Manual/Manual	348	21.8%
		Non-manual/Non-manual	621	38.9%
	2009	Upward	478	30.0%
		None	709	42.6%
		1-4 times	340	20.4%
		≥5 times	614	36.9%
		None	1093	63.1%
		1-4 times	241	13.9%

		≥5 times	398	23.0%
		Married	1347	81.0%
	1999	Not-married	316	19.0%
Marital Status		Married	1246	79.0%
	2009	Not-married	331	21.0%

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Table 2: Resilience linearly regressed on socioeconomic indicators in sex-adjusted models

		$\beta$	95% Confidence Interval	
Adult Socioeconomic Position	Education <sup>a</sup>	0.28	-0.52	0.97
	Social Class <sup>b</sup>	0.46	0.17	0.75
Childhood Socioeconomic Position	Father's Education <sup>c</sup>	-0.06	-0.39	0.26
	Mother's Education <sup>c</sup>	-0.16	-0.50	0.19
	Father's Social Class <sup>b</sup>	0.01	-0.28	0.31
Social Mobility	Downward	Referent		
	Manual/Manual	1.20	-0.31	2.72
	Non-manual/Non-manual	1.81	0.40	3.22
	Upward	1.99	0.54	3.44
Physical Activity	Cumulative Score <sup>d</sup>	0.58	0.31	0.85
Social Support	Cumulative Score <sup>e</sup>	3.27	2.90	3.63

Regression coefficients represent the standardised difference in mean residual scores per 1 category/unit change in specified socioeconomic indicator

<sup>a</sup> Categorized as: 0 "No education or Sub-GCE"; 1 "O-Level or equivalent" (typically obtained at age 16); 2 "A-Level or equivalent" (typically obtained at age 18); 3 "Degree or higher"

<sup>b</sup> Categorized as: 0 "Unskilled"; 1 "Partly skilled"; 2 "Skilled (Manual)"; 3 "Skilled (Non-manual)"; 4 "Intermediate"; 5 "Professional"

<sup>c</sup> Categorized as: 0 "Primary only"; 1 "Primary and further education (no qualifications attained)"; 2 "Secondary only or primary and further education or higher"; 3 "Secondary and higher"

<sup>d</sup> Higher scores indicate greater physical activity

<sup>e</sup> Higher scores indicate greater social support