Adversity in childhood and measures of ageing in mid-life: findings from a cohort of British women

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ABSTRACT

Background: Very few studies have assessed whether socioeconomic and psychosocial adversity during childhood are associated with objective measures of ageing later in life. We assessed associations of socioeconomic position (SEP) and total psychosocial adversity during childhood, with objectively measured cognitive and physical capability in women during mid-life.

Methods: Adverse childhood experiences were retrospectively reported at mean ages 28-30 years in women from the Avon Longitudinal Study of Parents And Children (N=2,221). We investigated associations of childhood SEP and total psychosocial adversity, with composite measures of cognitive and physical capability at mean age 51 years.

Results: There was evidence that, compared to participants who’s fathers had ‘professional’ occupations, participants who’s father’s had ‘managerial/technical’, ‘skilled non-manual’, ‘skilled manual’ and ‘partly or unskilled manual’ occupations had, on average, lower physical and cognitive capability. There was a clear trend for increasing magnitudes of association with lowering childhood SEP. There was also evidence that greater total psychosocial adversity in childhood was associated with lower physical capability. Total psychosocial adversity in childhood was not associated with cognitive capability.

Conclusions: Lower SEP in childhood is detrimental to cognitive and physical capability in mid-life, at least in part, independently of subsequent SEP in adulthood. Greater psychosocial adversity in childhood is associated with poorer physical capability, independently of social disadvantage in childhood. Our findings highlight the need for interventions to both identify and support children experiencing socioeconomic or psychosocial of adversity as early as possible.

Key words: Childhood; Adversity; Psychosocial; Socioeconomic position; Ageing; Cognitive; Physical.
INTRODUCTION

Maintaining physical and cognitive capabilities in older age is essential for functional independence (Reed et al., 1998) and lower levels of cognitive and physical capability, even in mid-life, are associated with higher rates of all-cause mortality. (Cooper et al., 2010) Thus, determining factors that are associated with poorer cognitive and physical capability is important and may reduce the associated economic (Callahan, Hendrie, & Tierney, 1995) and care burden. (Garand, Dew, Eazor, DeKosky, & Reynolds, 2005) Studies have previously reported both socioeconomic (e.g. low head of household social class, parental education) and psychosocial (e.g. sexual or physical abuse) adversity to be associated with lower cognitive and physical capability later in life. (Birnie et al., 2011; Fors, Lennartsson, & Lundberg, 2009; Lyu & Burr, 2016; Montez & Hayward, 2014; Richards & Wadsworth, 2004; Schussler-Fiorenza Rose, Xie, & Stineman, 2014; Surtees & Wainwright, 2007; Turrell et al., 2002) There are several plausible mechanisms through which these associations could occur, including psychological (e.g. through greater risk of stress, anxiety and depression (Ege, Messias, Thapa, & Krain, 2015)), behavioural (e.g. through increased smoking or alcohol consumption (Dube, Anda, Felitti, Edwards, & Croft, 2002)) and biological (e.g. through higher levels of stress hormones and systemic inflammation (Danese & McEwen, 2012)).

The association between childhood socioeconomic position (SEP) and cognitive capability in adulthood is now well established. (Dugravot et al., 2009; Fors, et al., 2009; Horvat et al., 2014; Kaplan et al., 2001; Lyu & Burr, 2016; Marengoni, Fratiglioni, Bandinelli, & Ferrucci, 2011) However, much less evidence exists for the impact of childhood SEP on objective (as opposed to self-report) measures of physical capability. (Birnie, et al., 2011; Guralnik &
Ferrucci, 2003) Very few studies have examined whether psychosocial adversity carries additional risks for later cognitive and physical health, over and above socioeconomic disadvantage. Furthermore, few studies have assessed whether these associations are mediated by SEP in adulthood (i.e. whether psychosocial adversity in childhood increases risk of lower SEP in adulthood, for example, by reducing self-confidence and the ability to achieve in school or in later employment) which in turn reduce later cognitive and physical capability. Examining potential mediators may help to highlight possible targets for interventions.

Existing studies assessing associations of psychosocial adversity in childhood and later cognitive and physical health have either not considered possible confounding by childhood SEP, or have focussed on single adverse experiences such as sexual abuse or physical abuse, without considering a possible total effect of multiple adverse experiences.(Feeney, Kamiya, Robertson, & Kenny, 2013) Assessing total psychosocial adversity acknowledges that adverse experiences tend to co-occur and that experiencing multiple forms of adversity may have a greater adverse effect on physical and cognitive ageing than experiencing only one. Very few studies have considered the co-occurrence of multiple forms of psychosocial and/or socioeconomic adversity in relation to impaired cognition in adulthood, and those few existing studies have all used a simple summary adversity scores (i.e. totalling the number of adverse experiences).(Anda et al., 2006; Lovallo et al., 2013; Reuben et al., 2016) This method has important limitations, (Howe, Tilling, & Lawlor, 2015) as it assumes that each adverse experience has the same direction and magnitude of association with the outcome.

In this study, we aimed to investigate associations of retrospectively-reported childhood socioeconomic position (SEP) and psychosocial adversity (both total and individually by
maternal lack of care, maternal overprotection, maladaptive family functioning, parental mental illness, sexual abuse and physical or emotional cruelty or neglect) with cognitive and physical capability in mid-life. We examined (i) whether psychosocial adversity is associated with cognitive and physical capability, over and above childhood SEP (ii) whether any observed associations are mediated by adult SEP and (iii) whether associations of psychosocial adversity with cognitive and physical capability differ in women with high, compared to low childhood SEP and in women with high, compared to low adult SEP.

METHODS

Study population

The Avon Longitudinal Study of Parents and Children (ALSPAC) is a prospective birth cohort study from southwest England that recruited 14,541 pregnant women resident in 3 Bristol-based health districts, with an expected date of delivery between April 1991 and December 1992. Our analysis uses data from the mothers in this cohort.(Fraser et al., 2012) The study website contains details of all available data through a fully searchable data dictionary (www.bris.ac.uk/alspac/researchers/data-access/data-dictionary). Ethical approval for the study was obtained from the ALSPAC Ethics and Law Committee and the Local Research Ethics Committees. Approximately 25 years after recruitment into the cohort, women were invited to attend a follow-up research clinic at which cognitive and physical capability were assessed. A total of 2893 women attended this clinic (mean age 51 years, standard deviation 4.4 years). Eligible participants had data for paternal occupational social class, responded to at least one question about psychosocial adversity in childhood and had data for all measures of cognitive and physical capability (n=2221). One hundred and seventy women were excluded due to missing one or more cognitive or physical capability measures (Figure 1).
Assessing SEP and psychosocial adversity in childhood

Psychosocial adversity

Women retrospectively reported childhood psychosocial adversity in questionnaires administered at the time of enrolment into the study, throughout pregnancy and postnatally (from 12 weeks gestation to 33 months postnatally, mean ages at the time of reporting ranged between 28 to 30 years). A priori, we aimed to examine the same adversity measures as the Adverse Childhood Experiences (ACE) study. However, ALSPAC measured many additional forms of adversity to this study. Thus, we decided to include as many types of psychosocial adversity as possible.

The following forms of psychosocial adversity were assessed in the questionnaires: maternal lack of care and maternal overprotection, maladaptive family functioning, parental mental illness, sexual abuse and non-sexual abuse. Questions about maternal care and overprotection were based on a validated instrument for assessing maternal bonding. (Parker, 1990)

Maladaptive family functioning includes questions that assess the nature of the relationship between the participant’s mother and father (i.e. whether the relationship was, for example, stable and predictable, affectionate, violent, respectful). Parental mental illness includes questions about depression, anxiety, schizophrenia or alcoholism in the participant’s mother or father. Sexual abuse questions assessed experiences of various types of sexual abuse by different people (e.g. family members, friends or strangers). Non-sexual abuse includes questions that capture physical or emotional cruelty and neglect by either parent/guardian. It is important to note that although there may appear to be overlap between ‘maternal lack of care’ and ‘emotional cruelty or neglect’, the questions assessing the latter reflect neglect by either parent/guardian; not just the mother. Details of the exact questions asked about each type of psychosocial adversity are provided in the online supplement.
Childhood SEP

At enrolment to the study, women retrospectively reported their mother’s and father’s occupation during their childhood. Missing data was much higher for mother’s occupation than for fathers, likely due to the high proportion of women who did not work outside the home during that period. Thus, we decided to use father’s occupation where this information was available, and only use mother’s occupation when father’s was not reported and mother’s was. Father’s occupation was coded as ‘professional’, ‘managerial and technical’, ‘skilled non-manual’, ‘skilled manual’ and ‘partly or unskilled manual’ occupations, in line with the Standard Occupational Classification 2000.

Assessing cognitive and physical capability in mid-life

Cognitive and physical capability outcomes were assessed at a follow-up research clinic approximately 23 years after the assessment of childhood SEP and psychosocial adversity. All cognitive and physical capability outcomes measured in this study are associated with mortality. (Cooper, et al., 2010; Cooper, Strand, Hardy, Patel, & Kuh, 2014; Small & Backman, 1997) Physical capability was assessed with a height-adjusted grip strength test, a timed chair rise, a timed one leg standing balance test with eyes closed and a 3-metre timed walk test. Cognitive capability was assessed with verbal fluency, (Lezak, 2004) logical memory, (Wechsler, 1998b) delayed logical memory, (Wechsler, 1998b) digit backwards, (Wechsler, 1998a) digit symbol coding (Wechsler, 1998a) and spot the word tests. (Baddeley, Emslie, & Nimmo-Smith, 1993) Full assessment details of each cognitive and physical capability test is provided in the online supplement.

Covariables

Participants’ SEP in adulthood was reported at enrolment into the study (during years 1991-1992) as the highest of own and partner’s occupational class groups using the 1991 British
Office of Population and Census Statistics (OPCS) classification. It was coded as ‘professional’, ‘managerial and technical’, ‘skilled non-manual’, ‘skilled manual’ and ‘partly or unskilled manual’. Women reported their ethnicity in questionnaires administered at enrolment. Age at the time of outcome assessment was recorded.

**STATISTICAL ANALYSIS**

**Generating composite scores of cognitive and physical capability**

In addition to assessing individual cognitive and physical capability tests which reflect different underlying systems (e.g. fluid vs crystallised intelligence, physical strength vs balance), composite scores of cognitive and physical capability were also created using the method devised by Guralnik et al. (Guralnik, Butterworth, Wadsworth, & Kuh, 2006)

Combining measures into a composite score may identify a much higher risk group (i.e. participants doing very badly on all tests), thus allowing us to assess the extremes of physical and cognitive performance, which may be more revealing in a middle-aged population that is generally functioning well. Grip strength was adjusted for body size by dividing it by height. Each cognitive and physical capability test score was rescaled to lie between 0 and 1, giving all measures equal weight in the final composite scores (see online supplement for further details of the rescaling procedure). Chair rise speed and 3-metre timed walk scores were reversed so that all scores were coded in the same direction, with 0 reflecting poorest and 1 reflecting highest performance. Participants unable to perform a test were assigned a value of 0. Rescaled cognitive and physical capability measures were summed to create normally distributed aggregate cognitive and physical capability scores, with ranges of 0 to 4 and 0 to 6, respectively.

**Total psychosocial adversity in childhood**
Most existing studies that have assessed total psychosocial adversity in childhood have used simple summary scores (i.e. totalling the number of adverse experiences) (Crowell et al., 2015; Halonen et al., 2015; Su et al., 2015). Summary scores, arguably unrealistically, assume each adverse exposure to have the same direction and magnitude of association with the outcome. We used a data-driven approach to create a total psychosocial adversity score that weights each adversity exposure based on how strongly it correlates with other adversity exposures (i.e. allocating exposures that tend to co-occur with others a higher weight, so that they contribute more to the total adversity score).

As there were multiple questions assessing each specific type of adversity, we first sought to combine all available questions into single variables. Thus, we used confirmatory factor analysis to create single latent constructs for maternal lack of care, maternal overprotection, parental mental illness, household dysfunction, sexual abuse and non-sexual abuse (Figure 2 and Supplemental Table S1). We then estimated a latent construct of total psychosocial adversity in childhood, which was informed by each of these single latent constructs. Latent constructs are variables that are not directly observed, but are inferred from other variables that are observed or measured (i.e. responses to the adversity questions). Higher latent trait values are indicative of greater levels of adversity. Full methods and model fit statistics for the confirmatory factor analyses are provided in the online supplement.

Analyses were conducted using Mplus version 7.31 (Muthén & Muthén, 2008).

Structural equation models (Figure S1 of the online supplement) were used to simultaneously conduct the factor analyses and estimate associations of total psychosocial adversity in childhood with cognitive and physical capability, in the following regression models: (1) unadjusted, (2) adjusted for age at outcome assessment and ethnicity, (3) additionally
adjusted for concurrent forms of adversity (i.e. associations of childhood psychosocial adversity are adjusted for SEP and vice versa) (4) additionally adjusted for potential mediation by adult SEP.

**Missing data and additional analyses**

Our main analysis dealt with missing data using the weighted least squares means and variance adjusted (WLSMV) estimator, which permits the inclusion of women with incomplete data, assuming data are missing at random conditional on all other exogenous variables in the model. (Edwards, Holden, Felitti, & Anda, 2003) As a sensitivity analysis, we repeated analysis in the sample with no missing data for any variable. We also assessed associations of each specific form of psychosocial adversity with cognitive and physical capability. We examined whether associations between total psychosocial adversity and the outcomes differ in (i) women who have a high (professional, managerial and technical occupations) childhood SEP compared to low (skilled, partly skilled and unskilled occupations), (ii) women who have a high (professional, managerial and technical occupations) adult SEP compared to low (skilled, partly skilled and unskilled occupations). We used binary childhood and adulthood SEP variables to assess these interactions as we do not have a large enough sample size (and thus, statistical power) to investigate interactions between the 5 different SEP categories used for the main analyses. We examined associations of SEP and total psychosocial adversity with each individual cognitive and physical capability measure. Finally, we compared findings from our main analyses to those where we used a more traditional approach of assessing total psychosocial adversity; a simple additive score. The additive score was created for participants with complete data for all the adversity measures, and physical and cognitive outcome data (n=1,535). Full details of the additive score are in the online supplement (Table S2).
RESULTS

There was evidence that women included in these analysis, on average, had a higher 3-metre timed walk speed and higher cognitive capability scores, were more likely to be white and have a higher SEP compared with women excluded due to missing data (Table 1). However, the magnitude of the differences was small. Correlations between each of the cognitive and physical capability measures (supplemental tables S3 and S4) were weak to moderate:

Pearson’s $r$ ranges 0.07 to 0.25, and 0.15 to 0.41 for cognitive and physical capability measures, respectively. Logical memory and delayed logical memory were strongly correlated ($r=0.84$). Women with a low childhood SEP were more likely to have experienced physical neglect, emotional neglect, parental separation or absence and a dysfunctional household compared to women with a high childhood SEP (supplemental Table S5). Of women who had a low childhood SEP, 23% went on to have a high adulthood SEP. Of women with a high childhood SEP, 58% of went on to have a low adulthood SEP.

Associations of childhood SEP with cognitive and physical capability

There was evidence that, compared to participants who’s fathers had ‘professional’ occupations, participants who’s father’s had ‘managerial/technical’, ‘skilled non-manual’, ‘skilled manual’ and ‘partly or unskilled manual’ occupations had, on average, lower physical (Table 2) and cognitive (Table 3) capability. There was evidence of increasing magnitudes of association with lowering childhood SEP, and associations remained even after adjustment for potential confounding my age, ethnicity and total psychosocial adversity in childhood, and for potential mediation by adult SEP.

Associations of total psychosocial adversity with composite cognitive and physical capability scores
There was no evidence of an association between total psychosocial adversity and cognitive capability in any of the models (Table S6 of the online supplement). There was evidence that greater total psychosocial adversity in childhood was associated with lower physical capability, after adjusting for age at outcome assessment and ethnicity (standardised \( \beta = -0.05 \), 95% CI: -0.1 to 0.0004, \( p=0.05 \), Figure 2, Table S7 of the online supplement). The point estimate attenuated very little (from -0.05 to -0.04) after adjusting for potential confounding by SEP in childhood, but confidence intervals widened to include the null (\( p=0.10 \)). There was no evidence of an association after adjusting for potential mediation by adult SEP.

**Additional analyses**

There was evidence that having an overprotective or absent parent, being emotionally neglected, being adopted or spending time in local authority care were associated with poorer cognitive capability in mid-life. In contrast, having a physically ill parent was associated with better cognitive capability (Table S8 of the online supplement). Parental lack of care or having a parent be physically cruel during childhood were associated with poorer physical capability. Low childhood SEP was associated with poorer scores for all individual cognitive capability measures (compared to high) and with poorer grip strength and standing balance (Supplemental Table S9). Greater total psychosocial adversity was associated with a slower 3-meter timed walk and a lower digit symbol coding score. Associations of total psychosocial adversity with physical and cognitive capability were similar in women who had a high, compared to low childhood SEP (interaction P values>0.1, Table S10 of the online supplement), and in women with high compared to low adult SEP (interaction p-values >0.1, Table S11 in online supplement). Associations were similar in the sample with no missing data (Supplemental Table S12). Associations were very similar when using an additive score of psychosocial adversity rather than a latent construct, except that confidence intervals were slightly wider due to the reduction in sample size (\( n=2221 \) in the main analysis of the latent
construct compared to n=1535 in the additive score analysis, Table S13 of the online supplement).

**DISCUSSION**

We found evidence that lower SEP in childhood is associated with poorer cognitive capability and objectively measured physical capability in mid-life, at least in part independently of SEP in adulthood. We also found evidence that greater total psychosocial adversity in childhood is associated with poorer physical capability, independently of socioeconomic disadvantage in childhood. There was no evidence on an association between total psychosocial adversity and childhood SEP. There was no evidence that associations of total psychosocial adversity in childhood with cognitive and physical capability differed in participants with high, compared to low childhood SEP or high, compared to low SEP in adulthood. Overall our findings imply that consequences of childhood SEP on both physical and cognitive capability, and consequences of childhood psychosocial adversity on physical capability in women are likely to persist across the life course.

We did not observe that any particular type of psychosocial adversity was associated with cognitive or physical function more strongly than the other types. This potentially highlights that our study has insufficient power to detect associations with individual types of psychosocial adversity, particularly for those with low prevalences, such as sexual abuse. Importantly, our main analysis using an overall score of psychosocial adversity in childhood incorporates the widely recognised fact that different forms of psychosocial adversity often co-occur,(Vachon, Krueger, Rogosch, & Cicchetti, 2015) and their effects may accumulate to influence cognitive and physical capability.(Edwards, et al., 2003)
In our study we assessed associations between childhood SEP and psychosocial adversity with each cognitive and physical capability test, as well as the composite scores. Different cognitive and physical capability measures reflect different underlying systems (e.g. fluid vs crystallised intelligence, physical strength vs balance) and assessing them individually as opposed to using composite scores may help inform possible underlying pathways of association. Combining measures into a composite score may, however, increase power as summing them together identifies a much higher risk group (i.e. those performing very badly on all tests), which may drive associations. In our study, low childhood SEP (compared to high) was associated with poorer scores for all individual cognitive capability measures, suggesting that there is not one particular aspect of cognition that is largely affected by childhood SEP.

**Comparisons with other studies**

Several studies have assessed associations of SEP in childhood with cognitive (Fors, et al., 2009; Horvat, et al., 2014; Kobrosly et al., 2011; Lyu & Burr, 2016) and physical capability in mid-life (Birnie, et al., 2011). Similar to our findings, these studies consistently report lower childhood SEP to be associated with poorer cognitive and physical capabilities in adulthood. However, few studies have assessed associations of psychosocial adversity in childhood with cognitive capability later in life. (Anda, et al., 2006; Feeney, et al., 2013; Lovallo, et al., 2013; Navalta, Polcari, Webster, Boghossian, & Teicher, 2006; Reuben, et al., 2016; Richards & Wadsworth, 2004) Most existing studies have found various types of psychosocial adversity (mainly abuse and neglect) to be associated with poorer cognitive capability in later life. (Lovallo, et al., 2013; Navalta, et al., 2006; Richards & Wadsworth, 2004) Only three studies consider the co-occurrence of multiple forms of psychosocial and/or socioeconomic adversity. (Anda, et al., 2006; Lovallo, et al., 2013; Reuben, et al., 2016) All of those studies used a simple additive summary score (i.e. totalled the number of adverse
experiences) and found that greater adversity in childhood and adolescence was associated with poorer cognitive outcomes. We are unaware of any studies that have assessed associations of psychosocial adversity in childhood with objectively measured physical capability later in life; only those using self-reported measures of physical capability (Montez & Hayward, 2014; Schussler-Fiorenza Rose, et al., 2014; Surtees & Wainwright, 2007).

These studies reported psychosocial adversity (maltreatment, abuse and household dysfunction) to be associated with greater risk of physical disability in later life.

**Strengths and limitations**

To the best of our knowledge, this is the first study to assess associations between psychosocial adversity in childhood and objective measures of physical capability in adulthood. Our analytical approach for assessing the effects of total psychosocial adversity improves on existing studies that either assess the relationship between a single type of adversity (since this ignores co-occurrence and likely total effects), or simply add up the number of adverse experiences into a score (since this weights each form of adversity equally). Alternative weighting methods based on theory would also be possible, but it requires making assumptions about the relative severity of each type of adversity for a particular outcome. We had data for a variety of cognitive and physical capability tests which allowed us to assess the effect of childhood adversity on different aspects of cognition and physical capability, and also on overall cognitive and physical functioning.

One limitation of our study is the possibility of selection bias; outcomes were assessed approximately 25 years after recruitment into the cohort. The sample included in this analysis represents approximately 16% of the original ALSPAC mothers’ cohort, thus, as in all longitudinal cohort studies, selection bias due to loss to follow-up possible. Our study sample also includes a larger proportion of ‘high SEP’ participants than were initially recruited into
ALSPAC. Although this means the prevalence of childhood socioeconomic and psychosocial adversity in our sample may not be representative of the general population, there is evidence that such non-generalisability often does not result in bias in exposure-outcome associations. (Nohr, Frydenberg, Henriksen, & Olsen, 2006) It is also likely that any bias would be towards the null (Howe, Tilling, Galobardes, & Lawlor, 2013) which may, at least in part, explain the lack of an observed association between total psychosocial adversity and cognitive capability.

Psychosocial adversity data were retrospectively self-reported in adulthood, meaning there is potential for recall bias. There is currently no gold standard method for collecting data on adverse experiences in childhood, and a previous review reported retrospective recall in adult life of exposure to adverse experiences in childhood to be sufficiently valid. (Hardt & Rutter, 2004) Two existing studies have compared associations of prospectively and retrospectively assessed childhood adversity measures, with various health outcomes in adulthood. The first study (Patten et al., 2015) concluded that associations between childhood adversities and health outcomes during adulthood are not merely artefacts of recall bias, and that retrospective and prospective assessment strategies produced very similar results. The second study (Reuben, et al., 2016) reported that retrospective and prospective measures of adversity showed moderate agreement ($r = 0.47, p < 0.001$) and that both associated with all midlife outcomes. They also noted that retrospective childhood adversity measures may biased toward underestimating the impact of adversity on objectively measured life outcomes.

Despite reports of childhood adversity being retrospectively reported, reverse causation is extremely unlikely in this study. Childhood adversity was retrospectively reported an average of 23 years prior to the assessment of physical and cognitive capability (childhood adversity
was retrospectively reported at mean age 29 years, physical and cognitive capability was assessed at mean age 51 years). Thus, we are able to draw some conclusions about temporality of events because cognitive and physical capability at average age 51 years is extremely unlikely to affect (1) whether participants experienced psychosocial adversity (such as sexual abuse or parental divorce) during childhood and (2) whether participants accurately reported experiencing adversity in childhood, 23 years prior to the cognitive and physical capability assessment. The model fit for the non-sexual abuse factor was slightly poorer than the other models (i.e. RMSEA and CFI were greater). That said, the factor loadings for all items were relatively high, and modifications to this factor did not substantially improve model fit. Non-sexual abuse has been identified as a potentially important form of psychosocial adversity to consider from a theoretical perspective, (Edwards, et al., 2003; Lindert et al., 2014; Rich-Edwards et al., 2012) thus, we decided to keep this factor in the analyses despite its slightly lower model fit, particularly given that the overall total psychosocial adversity factor had very good model fit, even with non-sexual abuse included. Our mediation analysis assumes no measurement error in the mediator and, given our single measure of adult SEP (occupational social class), we are unable to rule this out. Finally, we only studied British women, thus we cannot assume that our results would generalise to men or women from different ethnic backgrounds. The UK is has low social mobility, (Social Mobility Commision, 2016) with women in particular facing challenges in trying to mobilise upwards from a low SEP. That said, in our study of women, we do observe social mobility in both directions; 23% of women with low childhood SEP went on to have high adulthood SEP, and 58% of those women with high childhood SEP went on to have a low adulthood SEP.

**Conclusions**

In conclusion, our results suggest that lower SEP in childhood is detrimental to both
cognitive and physical capability in women in mid-life. Greater psychosocial adversity in
women is also associated with poorer physical capability, independently of social
disadvantage. We found no evidence of an association between psychosocial adversity in
childhood and cognitive capability in women, which may, at least in part, be explained by
selection bias. Thus, further studies are needed to clarify this association. Our findings
suggest that the adverse effects of psychosocial adversity during childhood on objective
measures of physical ageing in women, are independent of social disadvantage in childhood,
and are also not completely mediated through SEP attained in adulthood. Thus, interventions
to both identify and provide support to children experiencing socioeconomic or psychosocial
adversity as early as possible, may help to minimise the adverse consequences on cognitive
and physical health later in life.
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Figure Legends

Figure 1: Participant flow through the study

Figure 2: Scatter plot and regression line of standardised physical capability scores by standardised levels of total psychosocial adversity (n=2221). More psychosocial adversity in childhood was associated with lower physical capability in midlife.
Table 1. Characteristics of participants included in the study (n=2221), and excluded due to missing data

| Outcomes                                      | Included participants (n=2221) Mean (SD)/Median(IQR) | N with available data | Excluded participants Mean (SD)/Median(IQR) | P value for difference |
|-----------------------------------------------|------------------------------------------------------|----------------------|---------------------------------------------|------------------------|
| Grip strength (kg)                            | 26.1 (6.6)                                           | 527                  | 25.8 (7.2)                                 | 0.32                   |
| Chair rise time (seconds)                     | 23.4 (5.4)                                           | 479                  | 23.8 (5.8)                                 | 0.14                   |
| Standing balance test with eyes closed (seconds)a | 4.8 (3.0, 9.9)                                      | 506                  | 5.0 (2.9, 9.4)                             | 0.82                   |
| 3-metre timed walk speed (metres/second)      | 1.25 (1.07, 1.36)                                    | 522                  | 1.20 (1.07, 1.25)                          | 0.01                   |
| Logical memory test scorea                    | 16 (13, 18)                                          | 487                  | 15 (13, 17)                                | <0.01                  |
| Digit backwards test scorea                   | 7 (5, 9)                                             | 485                  | 7 (5, 9)                                   | 0.04                   |
| Spot the word test scorea                     | 45 (39, 50)                                          | 480                  | 44 (37, 49)                                | 0.01                   |
| Digit symbol coding test scorea               | 82 (72, 90)                                          | 464                  | 80 (69, 88)                                | <0.01                  |
| Verbal fluency test scorea                    | 43 (35, 51)                                          | 464                  | 40 (32, 51)                                | <0.01                  |
| Delayed logical memory test scorea            | 15 (12, 17)                                          | 469                  | 14 (11, 16)                                | <0.01                  |
| Covariables                                   |                                                      |                      |                                             |                        |
| Age at outcome assessmenta                    | 50.6 (48, 53.6)                                      | 550                  | 50.4 (47.6, 53.7)                          | 0.65                   |
| Ethnicity                                     |                                                      |                      |                                             |                        |
| White                                         | 98.0%                                                | 10,027               | 97.2%                                      | 0.04                   |
| Non-white                                     | 2.0%                                                 |                      | 2.8%                                       |                        |
| Father’s (childhood) SEP                      |                                                      |                      |                                             |                        |
| Non-manual                                    | 57.3%                                                | 8,093                | 44.6%                                      | <0.001                 |
| Manual                                        | 42.7%                                                |                      | 55.4%                                      |                        |
| Adulthood SEP                                  |                                                      |                      |                                             |                        |
| High                                           | 68.8%                                                | 9,199                | 51.8%                                      | <0.001                 |
| Low                                            | 31.2%                                                |                      | 48.2%                                      |                        |

SEP – Socioeconomic position. SD – Standard deviation. IQR – Interquartile range.

For continuous variables the difference between the means of those included and excluded from the analysis was tested using an unpaired t-test.
For categorical variables the difference between those included and excluded from the analysis was tested using Pearson’s chi-squared test. For non-normally distributed variables, differences between those included and excluded from the analysis were tested using a Mann-Whitney U-test.

For ease of interpretation of the average values, we present grip strength here. In the analyses, however, we use height-adjusted grip strength.

Excluded participants are ALSPAC participants that were missing data for all psychosocial adversity variables, at least one of the physical and cognitive outcomes and/or potential confounders.

The ‘N with available data column’ shows the number of excluded participants with data for that particular variable.
Table 2. Associations of childhood SEP with composite scores of cognitive capability at mean age 51 years (N=2221)

| Childhood SEP                                   | Unadjusted Standardised β (95% CI) | P     | Adjusted for age at outcome assessment and ethnicity Standardised β (95% CI) | P     | Adjusted for age at outcome assessment, ethnicity and cumulative psychosocial adversity Standardised β (95% CI) | P     | Adjusted for age at outcome assessment, ethnicity and cumulative psychosocial adversity and adult SEP Standardised β (95% CI) | P     |
|-------------------------------------------------|------------------------------------|-------|-------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------------------|-------|
| Managerial and technical vs professional         | -0.21 (-0.35, -0.06)               | 0.005 | -0.20 (-0.34, -0.06)                                                          | 0.006 | -0.20 (-0.34, -0.06)                                                            | 0.006 | -0.16 (-0.30, -0.03)                                                                               | 0.02  |
| Skilled non-manual vs professional               | -0.28 (-0.46, -0.13)               | 0.001 | -0.27 (-0.44, -0.11)                                                          | 0.001 | -0.27 (-0.44, -0.11)                                                            | 0.001 | -0.19 (-0.34, -0.03)                                                                               | 0.02  |
| Skilled manual vs professional                   | -0.66 (-0.80, -0.52)               | <0.001| -0.64 (-0.78, -0.50)                                                          | <0.001| -0.64 (-0.78, -0.50)                                                            | <0.001| -0.50 (-0.64, -0.37)                                                                               | <0.001|
| Partly or unskilled manual vs professional       | -0.76 (-0.95, -0.57)               | <0.001| -0.74 (-0.92, -0.55)                                                          | <0.001| -0.73 (-0.92, -0.55)                                                            | <0.001| -0.57 (-0.75, -0.39)                                                                               | <0.001|

Covariables

| Covariables                                  | Standardised β (95% CI) | P     | Standardised β (95% CI) | P     | Standardised β (95% CI) | P     | Standardised β (95% CI) | P     |
|-----------------------------------------------|-------------------------|-------|-------------------------|-------|-------------------------|-------|-------------------------|-------|
| Age at outcome assessment                     | 0.01 (0.003, 0.02)      | 0.01  | 0.01 (0.003, 0.02)      | 0.01  | -0.001 (-0.01, 0.008)   | 0.76  |
| Ethnicity (non-white vs white)                | -0.27 (-0.55, 0.02)     | 0.07  | -0.26 (-0.55, 0.03)     | 0.08  | -0.18 (-0.46, 0.10)     | 0.163 |
| Cumulative psychosocial adversity            | -0.01 (-0.07, 0.04)     | 0.63  | 0.005 (-0.05, 0.06)     | 0.86  |
| Adult SEP                                    | -0.29 (-0.34, -0.25)    | <0.001|

SEP – socioeconomic position. CI – confidence interval.
Standardised beta coefficients are interpreted as a standardised mean difference in the outcome in each childhood SEP group when compared, ‘Professional SEP’. Results are adjusted for potential confounding by age at outcome assessment, ethnicity and psychosocial adversity. The final model is adjusted for potential mediation by adult SEP, which is a categorical variable with the same categories as childhood SEP but entered as a linear term (i.e. per category increase in adult SEP).
Table 3. Associations of childhood SEP with composite scores of physical capability at mean age 51 years (N=2221)

| Childhood SEP                          | Unadjusted | Adjusted for age at outcome assessment and ethnicity | Adjusted for age at outcome assessment, ethnicity and cumulative psychosocial adversity | Adjusted for age at outcome assessment, ethnicity and cumulative psychosocial adversity and adult SEP |
|---------------------------------------|------------|------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                                       | Standardised β (95% CI) | P | Standardised β (95% CI) | P | Standardised β (95% CI) | P | Standardised β (95% CI) | P |
| Managerial and technical vs professional | -0.09 (-0.24, 0.05)    | 0.22 | -0.11 (-0.26, 0.03)   | 0.13 | -0.11 (-0.26, 0.03)   | 0.13 | -0.10 (-0.24, 0.05)    | 0.19 |
| Skilled non-manual vs professional     | -0.19 (-0.35, -0.02)   | 0.03 | -0.23 (-0.39, -0.06)  | 0.006 | -0.23 (-0.39, -0.07)  | 0.006 | -0.19 (-0.36, -0.03)   | 0.02 |
| Skilled manual vs professional         | -0.26 (-0.40, -0.11)   | 0.001 | -0.33 (-0.47, -0.19)  | <0.001 | -0.33 (-0.47, -0.18)  | <0.001 | -0.27 (-0.41, -0.12)   | <0.001 |
| Partly or unskilled manual vs professional | -0.34 (-0.53, -0.15) | <0.001 | -0.40 (-0.59, -0.21)  | <0.001 | -0.40 (-0.59, -0.21)  | <0.001 | -0.33 (-0.52, -0.14)   | 0.001 |

| Covariables                          | Standardised β (95% CI) | P | Standardised β (95% CI) | P | Standardised β (95% CI) | P | Standardised β (95% CI) | P |
|--------------------------------------|------------------------|---|------------------------|---|------------------------|---|------------------------|---|
| Age at outcome assessment            | -0.04 (-0.05, -0.03)   | <0.001 | -0.04 (-0.05, -0.03)   | <0.001 | -0.04 (-0.05, -0.03)   | <0.001 | -0.05 (-0.06, -0.04)   | <0.001 |
| Ethnicity (non-white vs white)       | -0.17 (-0.46, 0.12)    | 0.25 | -0.15 (-0.45, 0.14)    | 0.31 | 0.12 (-0.41, 0.17)     | 0.43 |
| Cumulative psychosocial adversity    | -0.04 (-0.09, 0.01)    | 0.15 | -0.03 (-0.08, 0.02)    | 0.24 |
| Adult SEP                            | -0.13 (-0.18, -0.08)   | <0.001 |

SEP – socioeconomic position. CI – confidence interval.
Standardised beta coefficients are interpreted as a standardised mean difference in the outcome in each childhood SEP group when compared, ‘Professional SEP’.
Results are adjusted for potential confounding by age at outcome assessment, ethnicity and psychosocial adversity. The final model is adjusted for potential
mediation by adult SEP, which is a categorical variable with the same categories as childhood SEP but entered as a linear term (i.e. per category increase in adult SEP).
Figure 1:

| Recruited pregnancy cohort | n=14,541 |
|----------------------------|----------|
| Included pregnancy cohort  | n=13,887 |
| Included individual women  | n=13,701 |

Clinical assessment:
- 6834 invited to FOCUS on Mothers 1
- 2803 attended (41% of those invited)

Clinical assessment:
- 6834 invited to FOCUS on Mothers 2
- 2733 attended (40% of those invited)

2733 had all measures of cognitive and physical capability
N=2221 also had at least one measure of early life adversity

Of which 474 excluded:
- 404 no live birth
- 9 unknown outcomes
1 live birth only from a twin pregnancy

100 ab-norms

Figure 2:

![Scatter plot showing relationship between physical capability score (standard deviations) and total psychosocial adversity (standard deviations) with a best-fitting line.](chart2.png)