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## Modeling Exposure to Multiple Childhood Social Risk Factors and Physical Capability and Common Affective Symptoms in Later Life

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### Abstract

**Objective**—This study presents three approaches, that is, cumulative risk, factor analysis, and latent class analysis, to summarize exposure to multiple childhood social risk factors and to compare their utility when examining associations with physical capability and common affective symptoms in adults aged 60 to 64 years.

**Methods**—Data came from the U.K. Medical Research Council (MRC) National Survey of Health and Development, with prospective childhood social risk factor data collected in 1950 to 1957 and retrospectively in 1989. Physical capability and common affective symptom data were collected in 2006 to 2011.

**Results**—The cumulative risk approach and factor analysis provided evidence that children who were exposed to multiple social risk factors had lower levels of physical capability and more symptoms of common affective symptoms in later life.

**Discussion**—The cumulative social risk approach and the use of factor analysis to identify contexts of social risk, may offer viable methods for linking multiple childhood social risk exposure to aging outcomes.

### Keywords

life course; childhood social risk factors; physical capability; common affective symptoms

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## Introduction

Understanding healthy aging is important for informing strategies for reducing societal and individual costs of an aging population, and requires a life course approach (Beard et al., 2016). Recently, evidence has demonstrated that experience of early life social risk factors may compromise health in later life (Kuh, Cooper, Hardy, Richards, & Ben-Shlomo, 2014; Kuh & Shlomo, 2004). Childhood social risk factors are also known to often co-occur (Adler, Bush, & Pantell, 2012; Anda, Butchart, Felitti, & Brown, 2010; Bellis, Hughes, Leckenby, Perkins, & Lowey, 2014; Felitti et al., 1998). For example, children living in low-income families may tend to also live in poor housing which is overcrowded (Evans, 2003). Accounting for co-occurrence rather than focusing on the impact of single childhood social risk factors is important, considering that it is probable that different combinations of childhood social risk factors may account for varying age-related physical and mental functioning decades later (Caleyachetty et al., 2016; Evans, Li, & Whipple, 2013; Green et al., 2010; McLaughlin et al., 2010). The challenge is how to summarize multiple social risk factor exposure during childhood.

Traditionally, the number of dichotomous childhood social risk factors were summed into a score (Evans et al., 2013). For nonbinary exposures, a decision must be made about how to dichotomize the variable, either using a statistical cutoff (e.g., greater than one standard deviation above the mean, upper quarter) or on the basis of a conceptual categorization (e.g., manual vs. nonmanual occupation, exposure vs no exposure to abuse). Dichotomous exposures are then summed (Evans et al., 2013; J. Krieger & Higgins, 2002; Repetti, Taylor, & Seeman, 2002; Rutter, 1979). The cumulative social risk score does not take account of the frequency, duration, or intensity of exposure. The impact of cumulative social risk on children's health was first demonstrated in the Isle of Wight study (Rutter, 1979), in which Rutter et al. assessed six childhood social risk factors: low parental socioeconomic status, large family size, severe marital discord, parental criminality, maternal mental illness, and foster placement, and found that after a certain number of childhood social risk factors are experienced, a dramatic increase in problem behavior outcomes occurs. The Adverse Childhood Experiences Study in the United States initially established that the number of childhood social risk factors were associated with poor health behaviors and outcomes in adulthood (Chapman et al., 2004; Dong et al., 2004; Felitti et al., 1998). However, a conceptual drawback of summing the total number of childhood social risk factors is its insensitivity to the potential importance of particular social risk factors that may co-occur (i.e., domains of childhood social risk; Appleyard, Egeland, van Dulmen, & Sroufe, 2005; Copeland, Shanahan, Costello, & Angold, 2009; Evans et al., 2013), missing the opportunity to empirically classify childhood social risk factors to unique groupings that might be etiologically distinct.

Domains of childhood social risk may be identified by three approaches. First, on a conceptual basis (e.g., distinguishing between socioeconomic and psychosocial risk domains of exposure). Second, using a data-driven approach such as exploratory factor analysis (EFA). This is a variable-centered analysis, grouping childhood social risk factors according to the degree to which they are correlated to each other. The different impact of childhood psychosocial risk factors on mood and anxiety disorders has been demonstrated in the U.S.

National Comorbidity Survey Replication (NCS-R; Green et al., 2010; McLaughlin et al., 2010). EFA grouped 12 childhood adversities into two categories: those reflecting “maladaptive family functioning” (sexual abuse, physical abuse, neglect, parental mental illness, parental substance abuse, criminal behavior, and domestic violence) and “other childhood adversities” (parental death, parental divorce, other parental loss, childhood physical illness, and family economic adversity). Childhood psychosocial risk factors reflecting maladaptive family functioning have, in particular, been strongly associated to the first onset and persistence of mood and anxiety disorders (Green et al., 2010; McLaughlin et al., 2010). EFA can be limited as it can omit potentially important exposures because they are uncorrelated with other childhood social risk factors (Evans et al., 2013). A third approach is latent class analysis (LCA). LCA, which is a cluster analysis (or person-centered method), is based on the child’s exposure to social risk factors grouping children into mutually exclusive homogeneous clusters (or classes). From the resultant classes, it becomes apparent which childhood social risk factors co-occur and how they cluster. Recent research has utilized LCA to reveal classes of children exposed to particular patterns of childhood social risk factors (Dunn et al., 2011; Lee et al., 2015; McLafferty et al., 2015). Different childhood social adversity latent classes have been associated with a range of specific psychiatric disorders including depression and anxiety (Dunn et al., 2011).

Three approaches (i.e., conceptual, EFA, and LCA) were used to summarize exposure to multiple childhood social risk factors and to examine whether any were associated with physical capability and common affective disorders in older adults. We chose to focus on these outcomes because maintaining physical capability and avoiding affective disorders are considered essential components of healthy aging (Kuh et al., 2012). Associations of total, domain-specific, and latent classes of childhood social risk with physical capability and common affective symptoms in older age are presented using prospective data from the longest continually running British birth cohort study, the Medical Research Council (MRC) National Survey of Health and Development (NSHD).

## Method

### Study Sample

NSHD is based on a social class stratified sample of 5,362 singleton births that occurred within marriage in a week in March 1946 in England, Scotland and Wales. The outcomes used in this study were obtained between 2006 and 2011 (60–64 years), at the 24th follow-up of the NSHD. All 2,856 eligible study members (known to be alive and with a known address in England, Scotland, or Wales) were invited for an assessment at one of six clinical research facilities or by a research nurse at home. Those who had died ( $n = 778$ ), were living abroad ( $n = 570$ ), had previously withdrawn from the study ( $n = 594$ ), or had been lost to follow-up ( $n = 564$ ) were not invited. Of those invited, 2,229 (78%) were assessed (Stafford et al., 2013). Ethical approval for the study was obtained from the Greater Manchester Local Research Ethics Committee and the Scotland A Research Ethics Committee. All study members provided written informed consent.

## Measures

### Physical Capability at Age 60 to 64 Years

Physical capability, the capacity to undertake the physical tasks of everyday living, was assessed using four performance-based tests (Cooper, Kuh, & Hardy, 2010): grip strength, chair rise time, standing balance time, and timed get-up-and-go (TUG). Trained nurses conducted these tests using standardized protocols as described elsewhere (Kuh, Bassey, Butterworth, Hardy, & Wadsworth, 2005). A composite score of physical capability was created using the method devised by Guralnik, Butterworth, Wadsworth, and Kuh (2006). This involved rescaling each of the test scores to a 0 (low performance) to 1 (high performance) scale; assigning those participants unable to perform each test for health reasons a value of 0 and; summing the four rescaled scores to create a normally distributed aggregate physical capability score with a theoretical range of 0 to 4 (Cooper, Strand, Hardy, Patel, & Kuh, 2014).

### Common Affective Symptoms

Frequency and severity of common affective symptoms were assessed with the 28-item General Health Questionnaire (GHQ). Responses were coded using the Likert-type scale (0-1-2-3). A total symptom score based on all 28 items was calculated (possible range: 0–84).

### Childhood Social Risk Factors

A description of the 17 childhood social risk factors used in analyses is given in Table 1. Thirteen of these were prospectively measured at age 4 years or at 7 or 11 years if missing (1950–1957) and three were recalled when participants were aged 43 years (1989).

### Total Childhood Cumulative Social Risk

Each childhood social risk factor was categorized as indicated in Table 1 as unexposed (assigned a value of 0) or exposed (assigned a value of 1). The individual binary childhood social risk factors were summed to create a total cumulative social risk metric (possible range: 0–17). Higher scores (i.e., those  $\geq 4$ ) were combined in an upper category due to small numbers.

## Defining Childhood Social Risk

### Conceptual/Researcher-Driven Approach

Childhood social risk factors were divided into two groups either reflecting socioeconomic or psychosocial disadvantage. The socioeconomic group includes the social and economic factors that influence which positions individuals or groups will hold within the structure of a society (Galobardes, Shaw, Lawlor, Lynch, & Davey Smith, 2006a, 2006b; N. Krieger, Williams, & Moss, 1997; Lynch et al., 2001). This also includes housing characteristics and amenities as markers of material circumstances (Galobardes, Shaw, Lawlor, Smith, & Lynch, 2006) and children's living conditions related to parent's financial resources (Evans & Kantrowitz, 2002; Hakovirta & Kallio, 2016; Weinger, 2000). There is no agreed definition of psychosocial risk (Martikainen, Bartley, & Lahelma, 2002); however, a psychosocial risk

factor can be defined as a characteristic that relates psychological phenomena to the social environment and/or to pathophysiological changes (Neylon et al., 2013). This broad definition reflects the wide variety of psychosocial variables, which have been studied in the etiology of adult health (Felitti et al., 1998). The nine binary childhood factors reflecting socioeconomic disadvantage (low maternal education, low father social class, private landlord owned home, poor household amenities, overcrowding, poorly repaired house, unclean child, poorly cleaned house, and poor state of child's clothes and shoes) and eight childhood factors reflecting psychosocial disadvantage (maltreatment, low parental concern for their child's education, parental psychiatric history, parental divorce, mother's affectionless control, father's affectionless control, parent death, and maternal separation) were used to create two domain-specific cumulative social risk indices.

### Factor Analysis Approach

Exploratory tetrachoric factor analysis (EFA) using weighted least squares means and variance (WLSMV) estimation was used to identify subdomains of childhood social risk from the data.<sup>23</sup> The final factor solution and interpretation was based on model fit and model interpretability. Factor loading cutoffs were set at 0.30 for derivation of the factors scores (Hair, Tatham, Anderson, & Black, 1998). The model was considered to fit the data well if any of the following goodness-of-fit indices were satisfied: root mean square error of approximation (RMSEA) 0.06, or root mean square of the residuals (RMSR) 0.08 (McLachlan & Peel, 2000; Muthen & Muthen, 2001).

### LCA Approach

LCA is a multivariate regression model that describes the relations between a set of latent class indicators (in this case, the childhood social risk factors), and an unobserved categorical latent variable, each level of which is referred to as a "latent class." This statistical technique was used to determine the number and nature of subgroups of childhood social risk exposure based on the absence or presence of exposure to each of the 17 factors. The fit of models estimating 1-class through 5-class solutions were compared. Because there is no single accepted statistical index for comparing latent class solutions, several criteria were considered including Bayesian information criteria (BIC) values, exclusion of solutions with rare classes (<5%), and entropy values. Class solutions with lower BIC values typically provide the best fit to the data. However, because the BIC tends to underestimate the number of classes, we assessed both the class solution with the lowest BIC value and the class +1 solution (McLachlan & Peel, 2000). Entropy values approaching 1 indicate clear delineation of classes (Celeux & Soromenho, 1996).

### Statistical Analysis of Associations Between Childhood Risk and Outcomes at Age 60 to 64 Years

Linear regression was used to estimate the associations of the total childhood cumulative social risk metric with physical capability and common affective symptoms at 60 to 64 years. We found no overall evidence of interaction between gender and any of the cumulative childhood risk measures and so results are presented for men and women together with adjustment for gender. Where separate domains of social risk were considered, models were additionally adjusted for other domains. In the regression analyses, data

missingness (Table 1) were handled using multiple imputation by chained equations (MICE) with 10 complete datasets created (Kenward & Carpenter, 2007; Sterne et al., 2009), and in EFA and LCA, by using full information maximum likelihood estimation under the assumption that the data were missing at random. EFA and LCA were conducted using Mplus Version 7.31, and regression analyses were conducted using Stata Version 13.0 (Stata, College Station, Texas). All analyses were conducted in 2015 to 2016.

We presented descriptive statistics, EFA, and LCA based on the 5,148 study members after excluding participants who had missing information on 12 out of the 16 childhood social risk factors. For the regression analyses, we excluded those with missing information at age 60 to 64 years on assessments of physical capability (yielding  $n = 1,991$  with data) and common affective symptoms ( $n = 2,190$ ), respectively. The prevalence of childhood adversities was greater in those study members with missing outcome data than in the analytical sample, with the exception of parental psychiatric history, parental divorce, parental bonding, and parental death (Table 1).

## Results

### Prevalence and Co-Occurrence of Childhood Social Risk Factors

Thirty-one percent of participants reported exposure to at least four childhood social risk factors (Supplementary Table 1). The most common childhood social risk factors were low maternal education (64%), living in a private landlord owned house (54%), low father's social class (28%), and recalled indicators of maternal and paternal affectionless control (30%). A total of 27% participants were exposed to three or more childhood socioeconomic risk factors, and 10% were exposed to three or more childhood psychosocial risk factors.

### Data-Driven Domains of Childhood Risk

A total of 105 (87.5%) of the 120 tetrachoric correlations between pairs of childhood social risk factors were positive indicating that the childhood social risk factors co-occur (data available on request).

EFA found three meaningful factors (Supplementary Tables 2 and 3). The first factor represented "socioeconomic and material disadvantage" (i.e., low maternal education, low father's social class, private landlord owned house, poor amenities, and poorly repaired house). The second factor represented "overcrowding, physical neglect and low parental concern for child's education" (i.e., low maternal education, overcrowding, unclean child, poorly cleaned house, poor state of child's clothes, and low parental concern for child's education). The third factor represented "maladaptive family functioning" (i.e., maltreatment, mother's affectionless control, father's affection-less control).

### Childhood Social Risk Latent Classes

After comparing several model fit criteria and the interpretability, a best model that fit the data both statistically and substantively was not found (Supplementary Table 4). Although the BIC fit statistics indicated a better, more parsimonious model when more classes were



added, entropy scores were low (<0.8), representing poor classification accuracy. We therefore do not present outcomes by latent classes.

### Associations With Physical Capability at Age 60 to 64 Years

Mean sex-adjusted physical capability scores were lower with more childhood social risk factors ( $p$  for trend < .001; Table 2). Mean physical capability scores were also low with more childhood socioeconomic risk factors, and even after adjustment for exposure to childhood psychosocial risk factors ( $p$  for trend < .001). There was evidence for a trend for lower physical capability scores with more childhood psychosocial risk factors ( $p$  for trend = .008), although this association was weaker than the association with childhood socioeconomic risk factors.

Based on the data-driven factors, mean physical capability scores were lower with more risk factors from the “socioeconomic and material disadvantage” domain ( $p$  for trend < .001; Table 3) even after adjustment for “overcrowding, physical neglect, and low parental concern for child’s education” and “maladaptive family functioning.” In addition, mean physical capability scores were lower with more risk factors from the “Overcrowding, physical neglect and low parental concern for child’s education” domain ( $p$  for trend < .02) even after adjustment for “socioeconomic and material disadvantage” and “maladaptive family functioning.” The other data-driven childhood cumulative social risk domain “maladaptive family functioning” was not independently associated with physical capability. In all regression models (i.e., for researcher-driven and data-driven methods for summarizing childhood adversity), the variance in physical capability explained was low (adjusted  $R^2$  < .03).

### Associations With Common Affective Symptoms at Age 60 to 64 Years

The mean sex-adjusted common affective symptom score was higher with more childhood social risk factors ( $p$  for trend < .001; Table 2). Common affective symptoms were higher with more childhood psychosocial risk factors ( $p$  for trend < .001) even after adjustment for exposure to childhood socioeconomic risk factors. There was no association between cumulative exposure to childhood socioeconomic risk factors and common affective symptoms.

According to data-driven childhood cumulative social risk domains, mean sex-adjusted common affective symptoms were higher with more risk factors from the “maladaptive family functioning” domain ( $p$  for trend < .001; Table 3). The results did not change after mutually adjusting for each of childhood cumulative social risk domains. There was no evidence that the other data-driven childhood cumulative social risk domains were associated with common affective symptoms (Table 3). Adjusted  $R^2$  values were low (<.04 in all regression models relating childhood adversity to common affective symptoms).

## Discussion

We have described three approaches to examining multiple childhood social risk exposures and relating these to physical capability and common affective symptoms in later life. Both the cumulative risk approach and factor analysis provided evidence that children who are



exposed to multiple social risk factors had lower levels of physical capability and more symptoms of common affective symptoms in later life. It was not possible to relate childhood social risk to our outcomes using LCA as no model found was optimal.

Very little information exists on the association between exposure to multiple childhood social risk factors and physical capability in later life. The 2009–2010 Behavioral Risk Factor Surveillance System (BRFSS; Schussler-Fiorenza Rose, Xie, & Stineman, 2014) reported a strong-graded association between childhood psychosocial risk factors and self-reported disability (self-reported activity limitation and/or assistive device use) in adulthood, but did not control for childhood socioeconomic risk factors. In contrast, we were able to jointly examine cumulative exposure to childhood socioeconomic and psychosocial risk factors, as well as incorporate a performance-based measure of physical capability, which has been shown to be associated with all-cause mortality (Cooper et al., 2014). We found some evidence of an association between psychosocial risk factors and poorer physical capability, independently of socioeconomic risk factors, though effect sizes for the latter were considerably larger. This was confirmed in the EFA approach, which did not group the risk factors in an identical way to the researcher-driven approach but nevertheless identified that socioeconomic and psychosocial risk factors in the “socioeconomic and material disadvantage” and the “overcrowding/ physical neglect/low parental concern for child’s education” domains contributed to explaining differences in physical capability in later life. This builds on evidence from this cohort and others (Birnie et al., 2011; Murray et al., 2011; Strand, Cooper, Hardy, Kuh, & Guralnik, 2011) showing that lower childhood social class is strongly associated with poorer performance-based physical capability and self-reported functional limitations as we were able to distinguish different components of childhood disadvantage. Future work might consider the distinct performance tests which make up the composite physical capability score used here.

Several studies from the United States have demonstrated that exposure to multiple childhood social risk factors are associated with an increased risk of mood disorder in a graded manner (Chapman et al., 2004; Kessler, Davis, & Kendler, 1997; McLaughlin et al., 2010; Raposo, Mackenzie, Henriksen, & Afifi, 2014): the higher the number of childhood social risk factors, the higher the probability of mood disorder. These studies used retrospective measures of childhood psychosocial risk factors and were not able to examine the co-occurrence of both childhood socioeconomic and psychosocial risk factors. Our study suggests that the association between affective symptoms and psychosocial adversity are not confounded by socioeconomic disadvantage and that it is primarily “maladaptive family functioning” which is linked to more common affective symptoms. This aligns with evidence from the NCS-R showing that individuals in the “maladaptive family functioning” group were most vulnerable to develop and persist in depression (Green et al., 2010; McLaughlin et al., 2010).

Childhood social risk factors associated with maladaptive family functioning (e.g., child maltreatment, mother affectionless control, and father affectionless control) were recalled when participants were age 43 years. The validity of retrospective reports about maltreatment, child rearing, and family conflicts has been questioned due to the quality of a participant’s memory, how participants evaluated the experience when looking back on it,

and whether they choose to disclose these experiences (Susser & Widom, 2012). Participants could have been more likely to report these adverse experiences due to a search for potential causes of their common affective symptoms experience by age 43 years, with the net effect of this recall bias to inflate the regression coefficients. However, such an upward bias would be less likely to influence the interpretation of our results as common affective symptoms were measured between 60 and 64 years.

Examining cumulative risk on the basis of exposure to the sum of individual childhood social risk factors acknowledges that childhood social risk factors tend to accumulate and increases the statistical power when some exposures to specific childhood social risk factors are not common. Formulating metrics of multiple childhood social risk factor exposures into a composite metric may also reduce measurement error. Further challenges exist to construct different domains of risk that children confront in their daily lives (Evans et al., 2013). For example, the term child maltreatment has a broad definition including physical abuse, sexual abuse, emotional abuse, exploitation, and neglect and negligent treatment. An unclean child, poorly cleaned house, or poor state of child's clothes and shoes may therefore reflect neglectful parenting but it may also reflect living in poverty or unsuitable housing. Given that these risk factors may overlap attempting to separate these into distinct conceptual groups is challenging. The total cumulative risk approach assumes that different types of social risk exposures have an equivalent impact on the risk of physical or mental capability. This misses the opportunity to examine what happens when children are exposed to social risk factors in different domains of risk within the family environment. Factor analysis partly addresses this issue by allowing the identification of a smaller number of empirically derived, grouped social risk factors thus helping to understand the separate or unique contributions of different kinds of social risk factors on different aging outcomes. Although LCA can be used to summarize key combinations of social risk that children are exposed to, and examine which of those combinations or risk profiles are most strongly predictive of later functioning, the resulting classes are analysis specific and may not be generalizable across studies. Second, cases with complete data were small in number. We retained study members with missing childhood exposures under the (untestable) assumption that these items were missing at random. The imputation model was based on a large number of childhood exposures but we acknowledge that missingness was larger for some of the psychosocial measures. Despite a clinical assessment response rate of almost 80% at age 60 to 64 years, a substantial proportion of study members were not included in the regression analysis of childhood adversity with age 60 to 64 years outcomes. These had a higher prevalence of childhood adversity and, from previous work,<sup>24</sup> are known to have poorer physical performance and more functional limitations though did not differ in mental health profiles through adulthood or in mood disorder at the previous sweep. Put together, this indicates that those missing from the regression analyses were more deprived (in socioeconomic and psychosocial aspects) in childhood and had poor physical performance but we do not have reason to think that the association between these would be materially different in the analytical and excluded samples.

## Conclusion

Domains of social risk based on researcher-driven and data-driven criteria can be identified and provide further insight into the elements of childhood environments that are linked to aging outcomes. Greater total childhood cumulative social risk is associated with poorer physical capability and common affective symptoms in older age. Both socioeconomic and psychosocial exposures are relevant for physical capability, though with larger effect sizes for socioeconomic exposures. Greater exposure to psychosocial risk factors in childhood was associated with common affective symptoms in older age, and this was not explained by childhood socioeconomic risk factors. The cumulative social risk metric approach is simple and generalizable and, in terms of associations with indicators of healthy aging, aligned with results from the use of factor analysis, though the latter is study specific and not so easily generalizable. Both approaches identify contexts of social risk that children confront in their daily lives and offer viable methods for characterizing the complex combinations of childhood social risk factors and their associations to later life physical and mental capability.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**Table 1**  
Childhood Social Risk Factors in the MRC National Survey of Health and Development.

Individual indicator used	Description	Age collected	Categories used	Missing data on indicator, % <sup>a</sup>	Prevalence, %	Prevalence in those with age 60–64 years outcomes, %	Prevalence in those missing age 60–64 years outcomes, %	<i>p</i> value <sup>b</sup>
Conceptualized as socioeconomic risk factors								
Low maternal education	Highest education attained	4 years	Low maternal education (only primary school education, typically up to and including age 10 vs. education beyond primary school)	19.0	63.6	58.6	67.8	<.001
Low father social class	Father's occupation (U.K. Registrar General's Classification)	4 years (or 7 or 11 years if missing)	Low social class (semiskilled and unskilled manual) vs. high social class (professional, intermediate, skilled nonmanual and skilled manual)	12.8	27.7	25.3	29.9	<.01
Private landlord owned house	Housing tenure	2 years (or 11 or 15 years if missing)	Private landlord owned home vs. Nonprivate landlord owned home (council, charitable trust and home owner)	12.4	54.0	51.3	56.4	<.01
Poor household amenities	Running hot water, sole use of a kitchen, and sole use of a bathroom	2 years (or 11 or 15 years if missing)	Lacks 3 amenities vs. 0–2 amenities	6.3	4.3	4.0	4.7	>.1
Overcrowding	Number of people living in rooms	2 years (or 4, 6, 8, 11, or 15 years if missing)	Overcrowded ( 2 people per room) vs. not crowded (<2 persons per room)	0.2	12.6	10.1	14.3	<.0001
Poorly repaired house	Health visitor's assessment of state of repairs of house compared to other houses visited	4 years (or 6 or 11 years if missing)	Bad vs. average to very good	11.1	8.1	6.4	9.4	<.001
Unclean child	Health visitor's assessment of cleanliness of survey member in comparison with other children visited	4 years (or 6, 9 or 11 years if missing)	Least clean vs. average to most clean	11.3	2.3	1.6	2.9	<.01
Poorly cleaned house	Health visitor's comparison with other houses visited	4 years (or 6, 9, or 11 years if missing)	Least clean vs. average to most clean	11.5	3.8	2.7	4.7	<.001
Poor state of child's clothes and shoes	Health visitor's comparison with other children under their care	4 years (or 6, 9, or 11 years if missing)	Unsatisfactory vs. satisfactory	11.3	3.1	1.8	4.2	<.001
Conceptualized as psychosocial risk factors								



Individual indicator used	Description	Age collected	Categories used	Missing data on indicator, % <sup>a</sup>	Prevalence, %	Prevalence in those with age 60–64 years outcomes, %	Prevalence in those missing age 60–64 years outcomes, %	p value <sup>b</sup>
Maltreatment	Participants asked, "As a child do you feel you were mistreated by your parents in any way?"	43 years	Yes vs. no	43.3	6.4	5.4	7.8	<.01
Low parental concern for their child's education	Information on visiting teachers and headmasters for conferences, attending parent teacher association meetings derived from interviews with mothers and from information from school records	Through primary and secondary school	Little interest vs. average to very interested	28.9	15.8	12.0	19.4	<.001
Parental Psychiatric history	Mother's asked if they or their partner had a psychiatric illness during the first 15 years of their child's life	0–15 years	Present vs. not present Divorced vs. not	0	2.2	2.2	2.1	>.1
Parental divorce	Experience of parental divorce	0–16 years	divorced	0	6.1	6.0	5.7	>.1
Mother affectionless control	Based on the PBI <sup>26</sup> . The PBI measured participants (at age 43 y) retrospective perceptions of their parents' style of affection and attachment to them before the age of 16 y. To define affectionless control <sup>26</sup> the following cut-points were used: mothers care score of <27.0 and overprotection score of >13.5; and for fathers care score of <24.0 and overprotection score of >12.5.	43 years	Affectionless control vs. not affectionless control parenting	45.1	30.5	30.1	30.7	>.1
Father affectionless control	See above	See above	See above	45.7	30.5	29.8	31.1	>.1
Parent death	Experience of parental death	0–16 years	Death of any parent vs. both parents still alive at 16 years	1.6	5.9	6.5	4.9	<.05
Maternal separation	Longest time separated from mother	0–6 years	Separation vs. no separation	17.0	5.9	5.1	6.6	<.05

Note. MRC = Medical Research Council; PBI = Parental Bonding Instrument.

<sup>a</sup> Across childhood (0–16 years).

<sup>b</sup> Based on chi-square test for difference between sample with a valid outcome and sample with missing outcome at age 60–64 years.

**Table 2**  
 Association Between Researcher-Driven Childhood Cumulative Social Risk Metrics and Physical Capability and Common Affective Symptoms at Age 60 to 64 Years.

	Physical capability score $\beta$ (95% CI) (n = 1,991)		Common affective symptoms $B$ (95% CI) (n = 2,190)	
	Model 1 <sup>a</sup>	Model 2 <sup>b</sup>	Model 1 <sup>a</sup>	Model 2 <sup>b</sup>
Total childhood cumulative social risk <sup>c</sup>				
0	0.00	—	0.00	—
1	-0.05 [-0.13, 0.03]	—	1.28 [-0.18, 2.73]	—
2	-0.07 [-0.15, 0.00]	—	1.86 [0.55, 3.17]	—
3	-0.13 [-0.21, -0.05]	—	2.14 [0.67, 3.61]	—
4	-0.17 [-0.25, -0.10]	—	2.31 [1.00, 3.62]	—
<i>p</i> for trend	<.001	—	<.001	—
Childhood cumulative socioeconomic risk <sup>d</sup>				
0	0.00	0.00	0.00	0.00
1	-0.06 [-0.12, 0.00]	-0.06 [-0.12, -0.00]	0.35 [-0.72, 1.42]	0.24 [-0.83, 1.31]
2	-0.12 [-0.17, -0.06]	-0.11 [-0.17, -0.05]	0.26 [-0.88, 1.39]	0.05 [-1.10, 1.19]
3	-0.16 [-0.22, -0.10]	-0.15 [-0.21, -0.09]	0.17 [-0.95, 1.29]	-0.14 [-1.26, 0.98]
<i>p</i> for trend	<.001	<.001	.866	.676
Childhood cumulative psychosocial risk <sup>e</sup>				
0	0.00	0.00	0.00	0.00
1	-0.02 [-0.07, 0.02]	-0.02 [-0.06, 0.03]	0.89 [-0.05, 1.72]	0.90 [-0.03, 1.82]
2	-0.05 [-0.11, 0.00]	-0.04 [-0.10, 0.01]	2.01 [1.04, 2.98]	2.02 [1.04, 3.00]
3	-0.09 [-0.17, -0.01]	-0.07 [-0.15, 0.01]	3.10 [1.78, 4.42]	3.13 [1.80, 4.45]
<i>p</i> for trend	.008	.04	<.001	<.001

Note. CI = confidence interval.

<sup>a</sup>Model 1 adjusted for sex.

<sup>b</sup>Model 2 adjusted for sex and other childhood cumulative social risk metric.

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Total Childhood cumulative social risk was created from the sum of 17 dichotomous childhood social risk factors including low maternal education, low father social class, private landlord owned house, poor household amenities, overcrowding, poorly repaired house, unclean child, poorly cleaned house, poor state of child's clothes and shoes, maltreatment, low parental concern for their child's education, parental psychiatric history, parental divorce, mother affectionless control, father affectionless control, parent death, and maternal separation.

Childhood cumulative socioeconomic risk was created from the sum of nine dichotomous childhood socioeconomic risk factors including low maternal education, low father social class, private landlord owned house, poor household amenities, overcrowding, poorly repaired house, unclean child, poorly cleaned house, and poor state of child's clothes and shoes.

Childhood cumulative psychosocial risk was created from the sum of eight dichotomous childhood psychosocial risk factors including maltreatment, low parental concern for their child's education, parental psychiatric history, parental divorce, mother affectionless control, father affectionless control, parent death, and maternal separation.

Table 3

Association Between Data-Driven Childhood Cumulative Social Risk Domains and Physical Capability and Common Affective Symptoms.

	Physical capability score		Common affective symptoms	
	$\beta$ (95% CI) (n = 1,991)		$B$ (95% CI) (n = 2,190)	
	Model 1 <sup>a</sup>	Model 2 <sup>b</sup>	Model 1 <sup>a</sup>	Model 2 <sup>b</sup>
Socioeconomic and material disadvantage <sup>c</sup>				
0	0.00	0.00	0.00	0.00
1	-0.07 [-0.13, 0.01]	-0.04 [-0.11, -0.03]	0.34 [-0.69, 1.37]	0.42 [-0.68, 1.53]
2	-0.10 [-0.16, 0.04]	-0.04 [-0.12, 0.04]	0.12 [-0.97, 1.21]	0.24 [-1.11, 1.59]
3	-0.16 [-0.23, -0.10]	-0.91 [-0.18, -0.00]	0.29 [-0.88, 1.46]	0.36 [-1.12, 1.84]
<i>p</i> for trend	<.001	.038	.775	.891
Overcrowding, physical neglect and low parental concern for child's education <sup>d</sup>				
0	0.00	0.00	0.00	0.00
1	-0.09 [-0.13, -0.04]	-0.05 [-0.11, 0.01]	0.24 [-1.05, 0.57]	-0.34 [-1.37, 0.68]
2	-0.13 [-0.19, -0.07]	-0.10 [-0.17, 0.02]	0.33 [-0.82, 1.50]	-0.15 [-1.21, 1.52]
3	-0.22 [-0.32, -0.11]	-0.16 [-0.28, -0.04]	0.97 [-0.93, 2.86]	0.57 [-1.56, 2.70]
<i>p</i> for trend	.01	.02	.409	.563
Maladaptive family functioning <sup>e</sup>				
0	0.00	0.00	0.00	0.00
1	0.01 [-0.04, 0.06]	0.01 [-0.04, 0.06]	0.94 [0.02, 1.87]	0.92 [-0.01, 1.85]
2	-0.05 [-0.10, 0.01]	-0.04 [-0.10, 0.01]	2.19 [1.15, 3.23]	2.15 [1.10, 3.20]
<i>p</i> for trend	.17	.22	<.001	<.001

Note. CI = confidence interval.

<sup>a</sup>Model 1 adjusted for sex.<sup>b</sup>Model 2 adjusted for sex and all other childhood cumulative social risk domains.<sup>c</sup>Socioeconomic and material disadvantage risk domain included low maternal education, low father's social class, private landlord owned house, poor amenities, and poorly repaired house.<sup>d</sup>Overcrowding, physical neglect, and low parental concern for child's education risk domain included low maternal education, overcrowding, unclean child, poorly cleaned house, poor state of child's clothes, and low parental concern for child's education.<sup>e</sup>Maladaptive family functioning included maltreatment, mother's affectionless control, and father's affectionless control.