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# The Effect of Parental Divorce on the Health of Adult Children[1]

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## Abstract

Decades of research have produced evidence that parental divorce is negatively associated with offspring outcomes from early childhood, through adolescence, and into the adult years. This study adds to the literature on the effects of parental divorce by examining how the timing of a parental divorce influences the total effect on adult health. Furthermore, we look at how this long-term effect of parental divorce depends on mediators such as the family's socioeconomic status, parental involvement, cognitive test scores, behavioural problems, smoking, and the offspring's own experience with divorce. The analyses use data from the National Child Development Study, which includes nine waves of data beginning at birth in 1958 and continuing through age 50. Results from a structural equation model suggest that a parental divorce experienced before age 7 does influence adult health by operating primarily through family socioeconomic status and smoking in adulthood.

### Keywords

parental divorce; health; life course

## Introduction

There are numerous non-clinical determinants of adult health ranging from behaviours, such as smoking, diet and exercise, to social and economic resources that are associated with and alert people to later potential health problems, acquire quality treatment for illnesses and avoid the stressors and toxic environments associated with the onset of health problems. In recent years, increasing attention has focused on early conditions and how they shape the life course trajectories leading towards adult health and mortality. While some have pointed to the role of physical health in early life (Almond & Currie, 2011), others have highlighted the early developmental difficulties with cognitive and social skills (Conti & Heckman, 2010). Much progress has been made on this front, as exemplified by the growing body of research looking at the effects of parental divorce (Troxel &Matthews, 2004), an experience

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associated with a wide range of outcomes indicative of the child's well-being (Amato, 2010). However, questions still remain about the importance of when the parental divorce occurs, as well as the pathways through which parental divorce operates to influence the individual's health in adulthood.

To date, the literature on the negative effects of parental divorce on adult health has provided evidence concerning mortality (Hayward & Gorman, 2004; Martin, Friedman, Clark, & Tucker, 2005; Preston, Hill, & Drevenstedt, 1998; Schwartz et al., 1995; Larson & Halfon, 2013), cancer (Hemminki & Chen, 2006), and the number of health problems experienced by respondents (Maier & Lachman, 2000). Although Schwartz et al. (1995) find an effect of parental divorce on the risk of mortality, the generalizability of this result is in question because the data come from a prospective study of children in California recruited for their high cognitive ability. It is also worth noting the evidence of a negative association between parental divorce and the emotional and mental health of the children when they reach adulthood (Chase-Lansdale, Cherlin & Kiernan, 1995; Cherlin, Chase-Lansdale & McRae 1998).

We build on this previous work by addressing two issues that have yet to be tackled by this growing literature. First, previous work has failed to examine whether the timing of parental divorce influences the effect on the child's adult health. Many aspects of child development reflect a cumulative process where early advantage leads to greater levels of advantage at older ages (Cunha & Heckman, 2008; Heckman, 2007). Insults (or investments) experienced at a young age may be particularly influential, relative to similar exposures at older ages, if they lower the rate of developmental growth. The gap between two trajectories, one growing at a slower rate due to a developmental insult, will increase with age, and the difference will be larger if the exposure occurs earlier in life (Lansford et al., 2006). To the extent that developmental outcomes affect adult health, the timing of influential events will help determine the size of health disparities later in life. Furthermore, developmental outcomes are more vulnerable at some ages than others (Hetherington, Stanley-Hagan, & Anderson, 1989; Lansford et al., 2006; Woodward, Fergusson, & Belsky, 2000). It follows that the pathways connecting parental divorce to adult health may vary depending on when the event occurs and which developmental outcomes are the most vulnerable. This heterogeneity in the accumulation of disadvantage and in the types of vulnerability to parental divorce suggest differences in the long-term effects of parental divorce associated with the age at which the family disruption occurred. We begin to fill this gap by focusing on three different age intervals (from birth to age seven, age seven to 11, and age 11 to 16), and separately assessing the total effect of a parental divorce during each interval on the child's adult health.

Previous studies have considered variables that mediate the relationship between parental divorce and adult health, but do so by sequentially including mediators into a series of regression models. Our contribution moves beyond this approach, specifying a structural equation model that identifies the pathways through which parental divorce influences affects adult health. The list of mediating variables includes family socioeconomic status, parental involvement, cognitive test scores, behavioural problems, smoking, and divorce. Finally, we decompose the total effect into the contributions of each mediator to show that

parental divorce primarily operates through the family's socioeconomic status and the child's smoking behaviour to generate adverse health outcomes.

## Background

The crude divorce rate in Britain began to climb around 1960 and continued to increase before leveling off in the early 1980s in Scotland, and in the mid-1990s in England and Wales. The crude divorce rate then fluctuated before declining in recent years in each of the countries (National Records of Scotland http://www.gro-scotland.gov.uk/statistic; Office for National Statistics 2013). Even with the recent decline, a large fraction of children are exposed to the dissolution of parental relationships and the associated risks for negative outcomes. While parental divorce is not directly tied to adult physical health, numerous mediators create a connection.

Socioeconomic status (Banks, Marmot, Oldfield, & Smith, 2006; Elo, 2009; Meara, Richards, & Cutler, 2008), health behaviours (Cutler & Lleras-Muney, 2010; Pampel, Krueger, & Demney, 2010), and social support (Cutrona, 1996; House, Landis, & Umberson, 1988) all predict adult health outcomes and are associated with parental divorce. Individuals with greater education, wealth, and occupational status tend to be healthier than those with fewer socioeconomic resources (Elo, 2009). Research suggests that socioeconomic attainment depends, at least in part, on the early development of cognitive and non-cognitive skills (Conti & Heckman, 2010; Currie & Almond, 2005; Goodman, Joyce, & Smith, 2011). Moreover, the acquisition of cognitive and non-cognitive skills tends to be hampered by parental divorce (Forehand, Neighbors, Devine, & Armistead, 1994; Kurdek, Fine, & Sinclair, 1994; Potter, 2010; Tillman, 2007), and the associated decrease in economic resources is one of the primary explanations accounting for this result (Carlson & Corcoran, 2001; McLanahan & Sandefur, 1994; Thomson, Hanson, & McLanahan; 1994).

The dependence of early skill acquisition on parental divorce also rests upon noneconomic mechanisms. For example, the level and quality of parental involvement in a child's life, particularly with respect to schooling, also facilitates academic performance (Izzo, Weissberg, Kasprow, & Fendrich, 1999; Miedel & Reynolds, 2003), a common indicator of early skills. Parental divorce tends to reduce the amount of contact the child has with their noncustodial parents (Kelly, 2007; Mclanahan & Sandefur, 1994, Tach, Mincy, & Edin, 2010).[1] Previous work also suggests that some children suffer psychologically and/or emotionally as a result of their parents' divorce and, consequently, the child's academic achievement suffers as well (Forehand, Neighbors, Devine, & Armistead, 1994; Kurdek, Fine, & Sinclair, 1994; Potter, 2010; Tillman, 2007).

In addition to socioeconomic pathways leading to adult health, parental divorce may operate to indirectly influence through health behaviours, particularly smoking. Furstenberg and Kiernan (2001) analyze the same data used here and demonstrate that parental divorce is associated with higher odds of smoking at age 33. As previously discussed, one of the mechanisms at work relies on socioeconomic status and the elevated risk of smoking

[1]It should be noted, however, that step-parent investments in non-biological children potentially offset negative outcomes associated with fewer investments from noncustodial, biological parents (Amato, 1993).

associated with lower status (Cutler & Lleras-Muney, 2010; Pampel, Krueger, & Demney, 2010). However, Furstenberg and Kiernan (2001) still find an association after conditioning on measures of the child's cognitive ability, behavioral problems, and family socioeconomic status. This result is also consistent with earlier work by Wolfinger (1998), who concludes that less social control, lower socioeconomic status, and psychological problems associated with a parental divorce do not account for the observed relationship between parental divorce and smoking. While genetic factors or self-medicating delayed onset of psychological problems may be playing a role (Troxel & Matthews, 2004), more work is needed to understand this particular pathway.

Finally, we turn to pathways involving social support, particularly as it is manifested through the child's own experience with divorce. Parents play an important role in shaping the next generation more generally via the modeling of family norms, roles, and relationships observed during childhood and beyond (Barber, 2001; Baumrind, 1986; Bengston, 1975). For example, those who experience their parents' divorce will be more likely to later divorce themselves (McLanahan & Bumpass, 1988) in part because they are socialized to have a lower commitment to the institution of marriage (Amato & DeBoer 2001). It is also the case that offspring of divorced parents are more likely themselves to have lower socioeconomic status, which is strongly associated with both the risk of divorce and poor health (Adams, Hurd, McFadden, Merrill, & Riberio, 2003; Albouy & Lequien, 2009; Amato, 2010). Moreover, divorce has been found to be directly associated with declines in health both men and women report lower self-assessed health following divorce compared to those who remain married (Williams & Umberson 2004). In summary, the intergenerational transmission of divorce is another potential pathway through which a parental divorce can indirectly influence the adult health of the offspring.

While we model the pathways described above, there are additional mediators that may play an important role in generating a total effect of parental divorce on the child's adult health (for an excellent discussion of mediators associated with adult mental health see Maughan & McCarthy, 1997). For example, declines in parenting quality associated with the parent's adjustment to the divorce, stressful life changes (such as family transitions and moving), and inter-parental conflict (Amato, 1993) also link parental divorce to the child well-being. There are also many other sources of social support and types of health behaviours that we neglect. These omissions reflect the limitations in the information available to us in the NCDS as well as our desire to analyze a model that is not bereft of parsimony.

Before moving on to the analysis, it is important to note how the problem of selection may bias estimates of the total effect of parental divorce. Previous research has shown associations between indicators of the child's well-being measured both before and after the parental divorce, and that conditioning on the lagged value of the outcome significantly diminishes the negative effect of parental divorce (Amato, 2010; Cherlin et al., 1991). While it may be that pre-divorce conflict between the parents creates a stressful environment that leads to poorer outcomes for the child, selection may be contributing to the observed associations. It will be shown that we only find convincing evidence of an effect on adult health among those who experience a parental divorce by age 7. The only antecedent

variables that are available are observed at the birth of the child, leaving us with no information to assess the role of selection. [3]

## Research Questions, Data, and Methods

We are interested in how parental divorce relies on mediating variables (described above) to produce a total effect on adult children's health. Our analysis begins by focusing on the timing of the parental divorce and estimating the total effect on the child's adult health for each of the following age intervals when the parental divorce occurred: birth to age 7; age 7 to age 11, and age 11 to age 16. These age intervals are based on the available information rather than important stages of child development. We then assess how mediating variables account for the total effect of parental divorce. The mediators explored here include the family's economic resources, parental investment, cognitive skills, emotional and psychological problems, health behaviours, and the intergenerational transmission of divorce. We only find convincing evidence for an effect of parental divorce that occurs before age 7, thus our analysis of mediating variables is restricted to this group.

To examine the total effect of parental divorce on adult children's health, we use data from the 1958 National Child Development Study (NCDS), a prospective longitudinal study of nearly all (98%) children born in the week of March 3–9, 1958 in England, Scotland, and Wales. Follow-up waves were collected at ages 7, 11, 16, 23, 33, 42, 46, and 50. See Power and Elliott (2006) and Ferri (1993) for detailed descriptions of the NCDS. From the baseline sample (N = 17,415), we select an analytic sample using the following criteria: (1) biological children of couples married at birth (N = 16,662); (2) the cohort member did not experience a parental death or become adopted by age 16 (N = 15,767); and (3) the cohort member was not known to have died (N = 14,637).[2] Thus, the 7,511 males and 7,126 females included in our analyses constitute 84% of the original birth cohort sample. We assume the incomplete data in our analytic sample are missing at random and multiply impute the missing information.[4]

In an effort to be consistent with prior research, while also reducing the limitations of any single health measure, we examine three different health outcomes at age 50. First, we use self-rated health which we treat as an ordered categorical variable with three outcomes: 1=excellent; 2=very good/good; and 3=fair/poor. The categories of fair and poor health are collapsed to obtain a group size large enough for calculating reliable estimates. Although self-rated health is a commonly used measure, it is not without limitations. Thus, we include two additional health measures: (1) adult children's number of health problems[5], which we

[3]We did explore the use of low birth weight, but the inclusion of this variable did not change the results and was not associated with parental divorce.

[2]There are too few deaths to estimate the effect of parental divorce on mortality with much precision. An alternative approach is to group the deceased with those reporting the worst health outcomes at age 50. We do not adopt this strategy because of the concentration of observed deaths at younger ages and the concomitant lack of information on the intermediate variables leading up to health at age 50. Thus, our results are only generalizable to those who survive to age 50. Unobserved (and thus unknown) deaths are, however, included in our analysis via multiple imputation, which raises some question about our results; although, we have conducted the same analyses using only participants observed at age 50 and reached similar conclusions.

[4]We implement multiple imputation by chained equations using the *ice* command in Stata version 12.1 (Royston & White 2011). All of the variables used in the analysis are included in the imputation equations, along with many other measures related to socioeconomic status, health, divorce, and the likelihood of missing data (e.g., the percent of missing data for each case, and the number of times the cohort member has moved). Additional details are available from the authors upon request.

also treat as an ordered categorical variable with three outcomes: 1=no reported health problems; 2=one or two health problems; and 3=three or more health problems. Finally, our third measure of adult children's health at age 50 is the physical functioning scale drawn from the 36-Item Short Form Survey (Ware, Snow, Kosinski, & Gandek, 1993).[6] The skewed distribution of this variable led us to recode it as a dichotomous indicator where a value of 1 indicates one standard deviation below the gender-specific mean of the observed cohort members.

Father's social class, observed at the start of the age interval when the parental divorce takes place, is an exogenous variable included in our models to adjust for a possible spurious association between parental divorce and adult health (Alwin & Hauser, 1975). Father's social class is measured using the Registrar-General's Social Class schema and is treated as an ordinal measure where higher values indicate higher status: (1) unskilled manual, unemployed, or no male head of household; (2) partly skilled manual; (3) skilled manual; (4) skilled non-manual; (5) managerial and technical; and (6) professional. Unemployed fathers are included with the lowest value for social class (i.e., 1 – unskilled manual or unemployed).

Recall that our analysis of the pathways predicting adult health is restricted to those experiencing a parental divorce by age 7. Our mediators include three measures of family's socioeconomic status (SES) at age 7 following parental divorce. First, we use the social class of the male head of the household. If there is no male head of household, as is more common after a parental divorce, or if the head is unemployed, we assign the lowest value for social class (i.e., 1=unskilled manual, unemployed, or no male head of household). Next, we include an ordered categorical measure for crowding in participant's home: up to 1 person per room=1; between 1 and 1.5 persons per room=2; and over 1.5 persons per room=3. Finally, our analysis includes a dummy indicator for the family experiencing financial difficulties, as reported by the interviewer who visited the participant's home at age 7.

Additional mediators include the following measures of parental involvement observed at age 7: does the mother (or father) read to the child (0=hardly ever; 1=occasionally; 2=every week); does the mother (or father) take the child out – e.g., for walks, outings, picnics, visits, shopping (0=hardly ever; 1=occasionally; 2=most weeks); and maternal reports of the father's role in the management of the child (0=primarily left to the mother; 1=significant role, but less than the mother; 2=equal to the mother). For the first two variables, reading to the child and taking the child out, we sum the values for the mother and father to produce a

[5]The 16 health problems are: asthma or wheezy bronchitis; seasonal or perennial allergic rhinitis; (sugar) diabetes; convulsions, fits, or epileptic seizures; recurrent backache, prolapsed disc, or sciatica; cancer or leukaemia; problems with hearing; problems with eyesight; high blood pressure; migraines; eczema or other skin problems; chronic fatigue syndrome; problems with stomach, bowels, or gall bladder; problems with bladder or kidneys; and cough or bringing up phlegm.

[6]The physical functioning scale is based on ten items inquiring if the cohort member's health has limited them in the following activities: (1) vigorous activities such as running, lifting heavy objects, or participating in strenuous sports; (2) moderate activities such as moving a table, pushing a vacuum cleaner, bowling, or playing golf; (3) lifting or carrying groceries; (4) climbing several flights of stairs; (5) climbing one flight of stairs; (6) bending, kneeling, or stooping; (7) walking more than one mile; (8) walking half a mile; (9) walking 100 yards; and (10) bathing or dressing yourself. Responses to each item are coded with values 0 -- "no, not limited at all"; 50 – "yes, limited a little", and 100 – "yes, limited a lot", then the average taken across the items is calculated to provide the value for the physical functioning scale.

composite score. If the mother (father) did not live in the household, the question refers to the "permanent mother substitute" ("male head of household"). For families where there is either no mother or no father figure, a zero is assigned for that parent figure. With respect to our third measure of parental involvement, if there is no mother figure in the household, the father's role in managing the child is assigned a value of 3, the highest level of involvement.

The total effect of parental divorce may also be mediated by the child's cognitive and emotional development observed at age 11. Cognitive development is measured using the average of standardized test scores for reading comprehension, math, and general tests on verbal and non-verbal skills. Emotional development is measured using the Bristol Social Adjustment Guide (BSAG), a count of the number of behaviours and attitudes indicative of social maladjustment, unsettledness, and emotional problems as identified and reported by participants' teachers (Stott, 1969). The influential work of Ghodsian (1977) has led many researchers to use two underlying factors, internalizing and externalizing problems, in their analysis. We, however, are interested in the total contribution of the social and emotional problems captured by the BSAG measure and, thus, follow the suggestion of Stott (1963) by creating an ordered, categorical measure: 1 – a score of 0–9 (stable); 2 – a score of 10–19 (unsettled); and 3 – a score of 20 or more (maladjusted). Our final two mediators consist of a dummy indicator for whether or not the participant experienced their own divorce by age 50; and a categorical variable constructed by summing the number of times the participant reported being a current smoker at ages 23, 33, 42, 46, and 50 (ranging from 0 to 6). Finally, we include a dummy indicator of parental smoking when the cohort member is 16 years old, which is used as a predictor of participants' smoking behaviour.

We begin by estimating the total effect of parental divorce on adult health using the model depicted in Figure 1. This model includes direct effects of both parental divorce and father's social class on adult health at age 50, and a direct effect of father's social class on parental divorce. For each of the three health outcomes at age 50, we estimate gender-specific versions of the model in Figure 1 for participants who experience a parental divorce between birth and age 7, between age 7 and age 11, and between age 11 and age 16. Participants whose parents were continuously married from birth to age 16 are in the reference group in each model.

Figure 2 presents the structural equation model for parental divorce by age 7 and the pathways leading to adult health. Our choice of mediating variables is motivated by previous research described earlier, but we are obviously restricted by the information available in the NCDS. The mediating variables included here are plausibly related to the consequent variables, and thus we adopt an exploratory approach to analyze the unique configuration of variable (and conditional associations) included in the model. More specifically, the model includes all of the direct effects of each variable on the subsequent variables, with the exception of father's social class at birth (an antecedent of parental divorce) and parental smoking (an exogenous variable). This specification undoubtedly will include pathways that are not statistically significant, but protects against excluding those that are relevant to the total effect of parental divorce on the child's adult health.

Our model includes two latent variables that represent the family's SES and the amount of parental involvement at age 7. Family SES is measured using the social class of the male head of the household, crowding in the cohort member's home, and the indicator of the family experiencing financial difficulties (all age 7). Parental involvement is measured by the following manifest variables: reading to the child; taking the child out; and the father's role in managing the child. Separate models are fitted to each of the three health outcomes at age 50, and the total effects are decomposed into the shares associated with each of the mediating variables. Parameter estimates are obtained from M*plus* version 7.11 (Muthén & Muthén 2012) using weighted least squares with categorical outcomes modeled as latent variables with a probit specification. All models are estimated separately for men and women to allow for gender differences in the effects of a parental divorce (Amato, 2001), as well as for differences in smoking, health, and health assessment (Arber & Cooper, 2004; Macintyre, Hunt, & Sweeting; 1996; Peto et al., 2000).

## Results

Descriptive statistics including the observed and imputed means and the percentage of missing data for each variable are presented in Table 1. Several variables are missing for more than forty percent of the cases, and when pooling information across waves to describe smoking and divorce histories in adulthood, the amount of missing information approaches 60%. We follow the advice of White, Royston, and Wood (2010) and impute sixty data sets to guard against the loss of power and to achieve an appropriate level of reproducibility for our results. By comparing the means from the imputed data to those of the observed data, we see that cohort members who experienced a parental divorce are more likely to have missing information, particularly during the youngest age interval.

Similarly, less desirable outcomes (e.g., financial difficulties, low cognitive test scores, exhibiting behavioural problems) are also associated with missingness. Overall, however, the means from the imputed data are similar to those from the observed data.

### Results: Total Effect of Parental Divorce

Estimates of the total effect of parental divorce on adult health are presented in Table 2. Moving across the columns, from left to right, we see gender-specific results for those who experienced a parental divorce by age 7, between ages 7 and 11, and between ages 11 and 16. Results from our models predicting self-rated health at age 50 are presented in the first four rows. For each age interval, higher levels of social class are associated lower chances of reporting poor health for both males and females. Conversely, parental divorce is positively associated with worse health, but the estimates are significantly different from zero only for males and females during the youngest age interval, as well as a marginally significant finding for females between the ages of 11 and 16. The indices of model fit suggest a close replication of the observed covariance matrix, which is the case for all of the models in Table 2. Another finding that holds across all of the models in the table is that father's social class has a negative effect on parental divorce (results not shown). Turning to the middle panel in Table 2, we see that parental divorce is positively associated with the number of health problems reported at age 50, but the estimates are not statistically significant. There

are, however, statistically significant and positive effects of parental divorce experienced by age 7 on low physical functioning (see the bottom panel of Table 2).[7]

## Results: Mediators of the effect of Parental Divorce on the Child's Adult Health

We now turn to the structural model in Figure 2 and the relative importance of different pathways stemming from a parental divorce that occurs by age 7. Estimates from the latent variable model for self-rated health are presented in Tables 3 and 4 for males and females, respectively. Table 5 contains the corresponding estimates from the measurement model for both males and females. Most of the results are similar across the models for the three different health outcomes, thus we only present the results for self-rated health. Later, we present a decomposition of the total effect of parental divorce on each of the three health outcomes at age 50.

Before discussing the effects of parental divorce among males, shown in Table 3, we note that father's social class has a negative and statistically significant effect on parental divorce in all of our models (estimates not shown to save space). The results suggest that, net of father's social class at birth, parental divorce is associated with lower levels of both family SES and parental involvement (measured after the divorce). Conditional on family SES and parental involvement, a parental divorce is not associated with lower cognitive test scores at age 11, but it is predictive of more behavioural problems at that age. Parental divorce also has positive and statistically significant direct effects on smoking and divorce in adulthood. Finally, we see that the mediating variables account for practically all of the total effect. Family SES at age 7, cognition and behavioural problems at age 11, and smoking in adulthood all exert statistically significant, direct effects on self-rated health and thus serve as important mediators in extending the influence of parental divorce to health at age 50.

The results for females (see Table 4) are generally similar to those of males. Notable differences include a more important role of family SES in discouraging women to smoke, relative to men. Similarly, behavioural problems may be more influential on the risk of divorce for females compared to males, and divorce for women appears to have a stronger effect on self-rate health than that of men. With respect to the measurement model (see Table 5), our results are very similar for females and males. We also note that, among both females and males, the model provides a reasonable fit to the data (see model fit statistics at the bottom of Table 3 and 4). The values of the Tucker-Lewis Index (0.893 for women and 0.906 for men) reflect the penalty for model complexity, which is consistent with several of the estimated coefficients being marginally or insignificant in statistical terms. Given the exploratory nature of our model, however, we proceed with the implications of this model.

Decompositions of the total effect of parental divorce by age 7 on the three different health outcomes at age 50 are presented in Tables 6 and 7 for males and females, respectively. The

[7]A related question concerns the need to focus on health at age 50, as opposed to an earlier measure of health. In other words, does all of the total effect of parental divorce on health at age 50 operate through health at a younger age? We examine this hypothesis by estimating models that include self-rated health at age 33 as a mediator between parental divorce and our three health measures at age 50. We find that among males parental divorce has a statistically significantly direct effect on self-rated health age 50, net of self-rated health at age 33. Similar results hold for the direct effect of parental divorce on low physical functioning at age 50, net of self-rated health at age 33, and for males and females.

top row of results in each table consists of the total effect of parental divorce, the indirect effects associated with each of the mediators, and, finally, the direct effect of parental divorce on self-rated health at age 50. The next row contains the proportion of the total effect that is accounted for by the corresponding mediating variable in that column. Finally, in the third row of the tables, we try to illustrate the substantive importance of the effect sizes by showing the change in the predicted probability of fair/poor health that is associated with each component. These changes are calculated by adding the effect size to the mean of the latent variable, and reporting the associated change in the predicted probability. This calculation is a very crude approximation and should only serve as a rough guide in interpreting the results.

The findings suggest that, among males, smoking in adulthood and family SES each account for over 30% of the total effect of parental divorce, corresponding to a one or two percentage point change in the probability of reporting fair/poor health. We find a similar pattern among females, but the decline in family SES associated with a parental divorce accounts for over half of the total effect of parental divorce and a two percentage point increase in reporting fair/poor health, while smoking in adulthood contributes an additional 30%, or roughly a one percentage point increase in reporting fair/poor health. Before moving on, we wish to comment briefly on the role of cognition. While it does not play on important role on its own, cognition is involved with some of the most powerful explanatory pathways running through family SES. In other words, pathways that include both family SES and cognition account for 10% (males) and 15% (females) of the total effect of parental divorce.

Turning briefly now to the results for the number of health problems reported at age 50, found in the fourth row of results in Tables 6 and 7, we are reminded that the total effect of parental divorce is not statistically significant. It may be worth noting that behavioural problems may provide some link between characteristics early in life and subsequent health problems in adulthood, but the results provide, at best, only very weak support for this claim. Finally, the bottom three rows of results in Tables 6 and 7 correspond to the effects of parental divorce on low physical functioning at age 50. The results suggest that, for both males and females, nearly half of the total effect depends on the decline in family SES that occurs after a parental divorce. Our crude approximation suggests that this change is associated with 1.5 percentage point increase in the probability of males being one standard deviation below the mean score for males on the physical functioning scale. The corresponding increase for females is roughly two percentage points. Again, smoking and behavioural problems also account for a significant portion of the total effect, but the contributions are each less than 20% of the total effect.

## Discussion

The growing literature on the early origins of adult health is uncovering a wide array of conditions and experiences that can slant the life course trajectory towards less desirable outcomes later in life. We add to this literature by providing evidence of a total effect of parental divorce on adult health, and by identifying the most important mediators that transmit the total effect. Among individuals in the 1958 NCDS, it is primarily the cohort

members who experience a parental divorce before age 7 that experience a long-lasting effect on their adult health. The evidence suggests that a decline in family SES experienced after a parental divorce is the most important change in the early environment that perpetuates negative outcomes. Subsequent declines in the accumulation of cognitive skills help complete the link to poorer health at age 50. This finding is consistent with the idea that SES allows parents to make investments via economic, social, and cultural capital, which have important returns for cognitive ability and, ultimately, adult health (Conti & Heckman, 2010; Farkas, 2003). Pathways stemming from a parental divorce and directly running through smoking in adulthood generally make the second largest contribution to the total effect. Parental divorce also operates through behavioural problems to influence adult health, although the relative size of this contribution is smaller. These final two pathways are connected, suggesting that smoking may be a behavior adopted by children to deal with psychological and emotional stresses associated with a parental divorce (although, see Wolfinger, 1998).

We conducted separate analyses for women and men, and found that the story was very similar. One notable exception is that the relative importance of smoking is much larger among males, relative to females, in our models of self-rated health. This difference is primarily due to the finding that family SES exerts a strong, negative effect on the smoking behaviour of female cohort members in adulthood. Among men, however, there is no direct link, thus family SES and smoking do not work in tandem to produce worse health at age 50, which is the case for females.

Despite the meager effect size supported by our analysis, further study of the role of parental divorce on adult health is warranted because our analysis may understate the importance of this early experience. A major limitation of our study is that the measures of parental divorce lack precise information on timing and the number of family transitions experienced. A reasonable hypothesis is that the negative effects of a parental divorce are exacerbated if the event occurs during a critical period of child development, most likely at a relatively early age. The windows of time we are looking through (i.e., before age 7, and between ages 7 and 16) are potentially too broad for us to identify the most vulnerable or influential periods. Furthermore, experiencing multiple parental divorces or changes in family structure may also strengthen the total effect on the child’s adult health (Fomby & Cherlin, 2007). That said, we were unable to assess the problem of selection biases (Amato, 2010; Cherlin et al., 1991), and thus our estimates of the total effect of parental divorce may be overstated.

As discussed earlier, our analysis also suffers from the lack of information on potentially important mediators, such as parenting quality, interparental conflict, and the number of stressful life events associated with a parental divorce (Amato 1993). Furthermore, our measurement of parental involvement could be improved by including additional types of investments made by parents, such as helping with school work or hiring tutors. Neglecting some mediators and measuring others with insufficient information biases the assessment of the relative contribution of the mediators. Future research should move in this direction and extend our analysis of how parental divorce influences child health in adulthood. Such

efforts will be useful for developing strategies to intervene and offset the negative consequences of early life stressors.

Finally, we return to our finding that the long-term effect of parental divorce on the child's adult health pertains only to those in the youngest age group. This result points to the conceptualization of child development as a cumulative process where early experiences with the disadvantages associated with parental divorce bend life course trajectories toward less desirable outcomes. More research is need to understand how parental divorce alters the developmental trajectories of children (e.g., Lansford et al., 2006), particularly with respect to long-term effects, such as adult health. A natural extension is to view adult health as a dynamic process, where both the intercept and slope of health trajectories are functions of early life experiences, such as parental divorce. We believe this to be a useful way forward for strengthening our understanding of the long-term effects of parental divorce.

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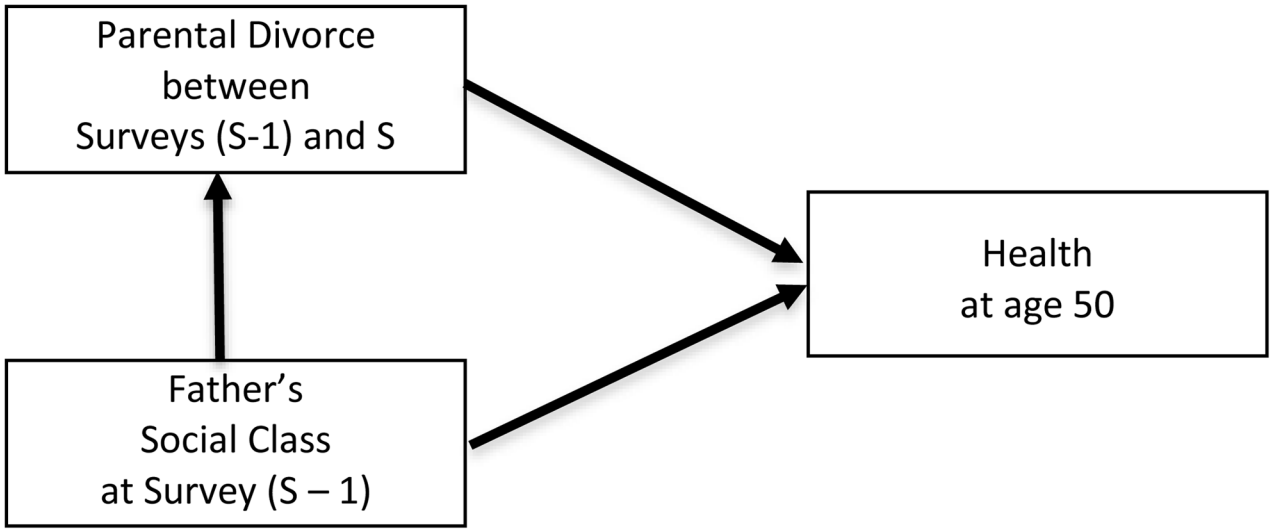


**Figure 1.**
Path model for the total effect of a parental divorce on health at age 50.

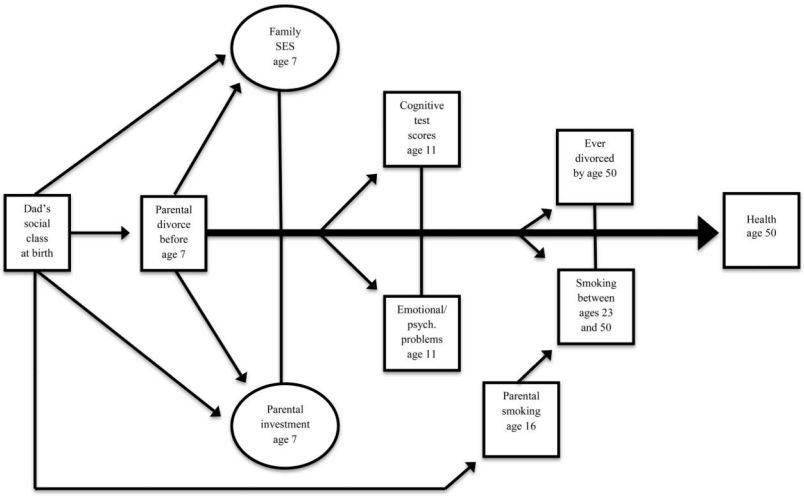


**Figure 2.**

Structural model of the pathways linking parental divorce to health at age 50.

Notes. Latent variables indicated with circles (see text for a description of the measurement model). Correlations between variables measured during the same wave are included in the model (arrows left out to avoid clutter). With the exception of parental smoking at age 16, the model includes direct effects of each variable on subsequent variables observed at older ages (as indicated by the connection to the bold path in the middle of the figure).

## Table 1

Means for observed and ten multiply imputed (MI) data sets. N = 14,637

| | Observed Data | | MI Mean |
|---|---|---|---|
| | Mean | % Missing | |
| Male (0 = no, 1 = yes) | 0.513 | 0% | 0.513 |
| Parental divorce by age 7 (0–1) | 0.036 | 33% | 0.054 |
| Parental divorce between ages 7 & 11 (0–1) | 0.022 | 33% | 0.024 |
| Parental divorce between ages 11 & 16 (0–1) | 0.029 | 33% | 0.034 |
| Male head of households social class at birth (1 – 6) | 3.157 | 0% | 3.157 |
| Male head of households social class at age 7 (1 – 6) | 3.234 | 16% | 3.243 |
| Male head of households social class at age 11 (1 – 6) | 3.241 | 21% | 3.217 |
| Financial difficulties for family at age 7 (0–1) | 0.073 | 23% | 0.086 |
| Measure of crowding in the household at age 7 (1 – 3) | 1.562 | 18% | 1.572 |
| Mother/father reads to the child at age 7 (0 – 4) | 2.403 | 17% | 2.402 |
| Mother's report of father involvement at age 7 (0–2) | 1.470 | 15% | 1.460 |
| Mother/father take child out at age 7 (0 – 2) | 1.525 | 16% | 1.517 |
| Test scores at age 11 (standardized) | 0.034 | 19% | −0.003 |
| Social maladjustment at age 11 (1 – 3) | 1.448 | 19% | 1.478 |
| Parents smoke when child is age 16 (0–1) | 0.730 | 34% | 0.736 |
| Cohort member smokes in adulthood (0 – 6) | 0.962 | 57% | 1.123 |
| Cohort member divorces by age 50 (0–1) | 0.393 | 46% | 0.468 |
| Self-rated health at age 50 (1 – 3) | 2.037 | 43% | 2.102 |
| Number of health problems at age 50 (1 – 3) | 1.558 | 43% | 1.558 |
| Low physical functioning at age 50 (0–1) | 0.117 | 48% | 0.151 |

Notes: The numbers in parentheses indicate the range for the categorical variables. Multiple imputation estimates are averaged across 60 multiply imputed data sets. See the text for more details.

**Table 2**

Total effects of parental divorce, conditional on father's social class, estimated from gender-specific structural equation models of three health outcomes at age 50: self-rated health (SRH), # of health problems (NHP), and a measure of low physical functioning (PHF) – higher values for the dependent variable indicate worse health.

| | Parental Divorce between ages 0 and 7 | | Parental Divorce between ages 7 and 11 | | Parental Divorce between ages 11 and 16 | |
|---|---|---|---|---|---|---|
| **SRH** | **Males** | **Females** | **Males** | **Females** | **Males** | **Females** |
| *Father's Social* | | | | | | |
| *Class* | −0.208*** | −0.241*** | −0.202*** | −0.251*** | −0.207*** | −0.263*** |
| *Parental divorce* | 0.139** | 0.103** | 0.056 | 0.043 | 0.025 | 0.088* |
| **CFI/TLI** | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 |
| **RMSEA** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **NHP** | **Males** | **Females** | **Males** | **Females** | **Males** | **Females** |
| *Father's Social* | | | | | | |
| *Class* | −0.050* | −0.104*** | −0.044 | −0.112*** | −0.031 | −0.089*** |
| *Parental divorce* | 0.076 | 0.076 | 0.058 | 0.045 | 0.003 | 0.052 |
| **CFI/TLI** | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 |
| **RMSEA** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **PHF** | **Males** | **Females** | **Males** | **Females** | **Males** | **Females** |
| *Father's Social* | | | | | | |
| *Class* | −0.238*** | −0.227*** | −0.272*** | −0.277*** | −0.256*** | −0.260*** |
| *Parental divorce* | 0.147** | 0.150** | 0.103 | 0.093 | 0.002 | 0.058 |
| **CFI/TLI** | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 | 1.00/1.00 |
| **RMSEA** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Smallest N** | 7,024 | 6,611 | 6,756 | 6,458 | 6,860 | 6,515 |

Notes: Children of continuously married parents up to age 16 serve as the reference group for the parental divorce variable. P-values (two-tailed): * p < .10; ** p < .05; *** p < .01. Direct effects of Father's social class on parental divorce not shown (all estimates are negative and statistically significant). Estimates are averaged across 60 multiply imputed data sets with standard errors corrected for variance within and between the data sets. CFI is the comparative fit index, TLI is the Tucker-Lewis index, and RMSEA is the root mean squared error of approximation. Results were obtained using the Mplus statistical software (version 7.11).

**Table 3**

Estimates from the latent variable model for the effects of a parental divorce by age 7 on self-rated health at age 50 for males.

| | Family SES age 7 | Parental Involvement age 7 | Cognition age 11 | Outcomes Behavioral problems age 11 | Smoking Adulthood | Divorce by age 50 | Self-rated health age 50 |
|---|---|---|---|---|---|---|---|
| Father's SC at birth | 0.674*** (0.026) | 0.112*** (0.018) | | | | | |
| Parental divorce by age 7 | −0.352*** (0.021) | −0.481*** (0.053) | 0.002 (0.034) | 0.147** (0.055) | 0.240*** (0.063) | 0.156* (0.080) | 0.034 (0.069) |
| Family SES age 7 | | | 0.337*** (0.017) | −0.206*** (0.021) | −0.007 (0.026) | −0.091*** (0.026) | −0.069** (0.023) |
| Parental involvement age 7 | | | 0.032 (0.028) | 0.017 (0.043) | 0.066 (0.051) | 0.034 (0.052) | −0.008 (0.046) |
| Cognition age 11 | | | | | −0.113*** (0.027) | −0.086** (0.032) | −0.111*** (0.026) |
| Behavioral problems age 11 | | | | | 0.121*** (0.026) | 0.050 (0.033) | 0.078** (0.027) |
| Smoking in adulthood | | | | | | | 0.229*** (0.024) |
| Parental Smoking | | | | | 0.215*** (0.033) | | |
| Divorce by age 50 | | | | | | | 0.006 (0.026) |

Notes: Direct effects of Father's social class on parental divorce not shown (all estimates are negative and statistically significant). Standard errors in parentheses. P-values: * p < .05; ** p < .01. Estimates are averaged across 60 multiply imputed data sets with standard errors corrected for variance within and between the data sets. The smallest sample size across the 60 imputed data sets is N = 7,024. Root mean square error of approximation = 0.058. Comparative fit index = 0.953. Tucker-Lewis index = 0.906. Results were obtained using the Mplus statistical software (version 7.11).

**Table 4**

Estimates from the latent variable model for the effects of a parental divorce by age 7 on self-rated health at age 50 for females.

| | Family SES age 7 | Parental Involvement age 7 | Cognition age 11 | Outcomes Behavioral problems age 11 | Smoking Adulthood | Divorce by age 50 | Self-rated health age 50 |
|---|---|---|---|---|---|---|---|
| Father's SC at birth | 0.654*** (0.022) | 0.062*** (0.014) | | | | | |
| Parental divorce by age 7 | −0.407*** (0.046) | −0.372*** (0.038) | −0.017 (0.040) | 0.157** (0.069) | 0.208*** (0.067) | 0.161** (0.081) | 0.004 (0.067) |
| Family SES age 7 | | | 0.359*** (0.017) | −0.203*** (0.023) | −0.114*** (0.027) | −0.072** (0.028) | −0.097*** (0.023) |
| Parental involvement age 7 | | | −0.013 (0.047) | 0.012 (0.079) | 0.129 (0.082) | 0.095 (0.085) | −0.003 (0.077) |
| Cognition age 11 | | | | | −0.062** (0.028) | −0.077** (0.035) | −0.123*** (0.029) |
| Behavioral problems age 11 | | | | | 0.149*** (0.029) | 0.086** (0.033) | 0.078** (0.027) |
| Smoking in adulthood | | | | | | | 0.201*** (0.023) |
| Parental Smoking | | | | | 0.183*** (0.033) | | |
| Divorce by age 50 | | | | | | | 0.049* (0.027) |

Notes: Direct effects of Father's social class on parental divorce not shown (all estimates are negative and statistically significant). Standard errors in parentheses. P-values: * p < .05; ** p < .01. Estimates are averaged across 60 multiply imputed data sets with standard errors corrected for variance within and between the data sets. The smallest sample size across the 60 imputed data sets is N = 6,611. Root mean square error of approximation = 0.060. Comparative fit index = 0.946. Tucker-Lewis index = 0.893. Results were obtained using the Mplus statistical software (version 7.11).

## Table 5

Estimates from the measurement model for the effects of a parental divorce by age 7 on self-rated health at age 50 for males and females.

| | Latent Variables | | | |
|---|---|---|---|---|
| | Family SES at age 7 | | Parental involvement at age 7 | |
| | Males | Females | Males | Females |
| Father's social class measured at age 7 | 1.00 | 1.00 | | |
| | -- | -- | | |
| Family has financial difficulty | −1.025*** (0.099) | −0.991*** (0.089) | | |
| Crowding in the household measured at age 7 | −0.540*** (0.027) | −0.541*** (0.027) | | |
| Parents read to child measured at age 7 | | | 1.00 | 1.00 |
| | | | -- | -- |
| Parents take child out with them most weeks measured at age 7 | | | 2.204*** (0.358) | 2.783*** (0.437) |
| Mother's report of father involvement measured at age 7 | | | 0.620*** (0.074) | 0.897*** (0.109) |

Standard errors in parentheses. P-values: * p < .05; ** p < .01. Estimates are averaged across 10 multiply imputed data sets with standard errors corrected for variance within and between the data sets. The smallest sample size across the 60 multiply imputed data sets is N = 7,024 and 6,611 for males and females (respectively). For males, the root mean square error of approximation = 0.058. Comparative fit index = 0.946. Tucker-Lewis index = 0.893. For females, the root mean square error of approximation = 0.060. Comparative fit index = 0.953. Tucker-Lewis index = 0.906. Results were obtained using the Mplus statistical software (version 7.11).

**Table 6**

Total, direct, and indirect effects of parental divorce by age 7 on three health outcomes at age 50 for males: self-rated health (SRH), # of health problems (NHP), and physical functioning (PHF) – higher values for the dependent variable indicate worse health.

| | | Indirect effects of parental divorce by age 7 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Dependent variable** | **Total effect of parental divorce** | **Parental involvement** | **Family SES** | **Cognitive test scores** | **Emotional problems** | **Smoking in adulthood** | **Divorce by age 50** | **Direct effect of parental divorce** |
| **Self-rated health** | 0.151** | −0.003 | 0.049*** | 0.000 | 0.015** | 0.055*** | 0.001 | 0.034 |
| **% of total effect** | 100% | −2% | 32% | 0% | 10% | 36% | 1% | 23% |
| **Expected change in predicted probability of fair/poor health** | 0.043 | −0.001 | 0.013 | 0.000 | 0.004 | 0.015 | 0.000 | 0.010 |
| **# of health problems** | 0.072 | −0.010 | 0.011 | 0.001 | 0.012* | 0.006 | −0.001 | 0.055 |
| **% of total effect** | 100% | −14% | 15% | 1% | 17% | 8% | −1% | 76% |
| **Expected change in predicted probability of 3+ health problems** | 0.022 | −0.003 | 0.003 | 0.000 | 0.003 | 0.002 | 0.000 | 0.017 |
| **Physical functioning** | 0.166** | −0.018 | 0.074*** | −0.001 | 0.019** | 0.031** | 0.001 | 0.059 |
| **% of total effect** | 100% | −11% | 45% | −1% | 11% | 19% | 1% | 35% |
| **Expected change in the predicted probability of low physical functioning**[a] | 0.036 | −0.003 | 0.015 | 0.000 | 0.004 | 0.006 | 0.000 | 0.008 |

Notes:

[a] Physical functioning is defined by being one standard deviation below the gender-specific mean of the observed cohort members.

P-values: * p < .05; ** p < .01. Estimates are averaged across 60 multiply imputed data sets with standard errors corrected for variance within and between the data sets. The smallest sample size across the 60 multiply imputed data sets is N = 7,024. Root mean squared approximation = 0.061 (SRH); 0.059 (NHP); and 0.061 (PHF). Comparative fit index = 0.949 (SRH); 0.948 (NHP); and 0.949 (PHF). Tucker-Lewis index = 0.898 (SRH); 0.901 (NHP); and 0.898 (PHF). Results were obtained using the MPlus statistical software (version 7.11).

**Table 7**

Total, direct, and indirect effects of parental divorce by age 7 on three health outcomes at age 50 for females: self-rated health (SRH), # of health problems (NHP), and physical functioning (PHF) – higher values for the dependent variable indicate worse health.

| | | Indirect effects of parental divorce by age 7 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Dependent variable** | **Total effect of parental divorce** | **Parental involvement** | **Family SES** | **Cognitive test scores** | **Emotional problems** | **Smoking in adulthood** | **Divorce by age 50** | **Direct effect of parental divorce** |
| **Self-rated health** | 0.142*** | −0.012 | 0.080*** | 0.002 | 0.018** | 0.042** | 0.008 | 0.004 |
| **% of total effect** | 100% | −8% | 56% | 1% | 13% | 30% | 6% | 3% |
| **Expected change in predicted probability of fair/poor health** | 0.041 | −0.003 | 0.022 | 0.001 | 0.005 | 0.012 | 0.002 | 0.002 |
| **# of health problems** | 0.081 | −0.010 | 0.035 | 0.000 | 0.012* | 0.012** | 0.007 | 0.024 |
| **% of total effect** | 100% | −12% | 43% | 0% | 15% | 15% | 9% | 30% |
| **Expected change in predicted probability of 3+ health problems** | 0.026 | −0.003 | 0.011 | 0.000 | 0.004 | 0.004 | 0.002 | 0.008 |
| **Physical functioning** | 0.190** | −0.030 | 0.091*** | 0.004 | 0.017* | 0.022** | 0.003 | 0.083 |
| **% of total effect** | 100% | −16% | 48% | 2% | 9% | 12% | 2% | 44% |
| **Expected change in the predicted probability of low physical functioning**[a] | 0.046 | −0.006 | 0.021 | 0.001 | 0.004 | 0.005 | 0.001 | 0.021 |

Notes:

[a] Physical functioning is defined by being one standard deviation below the gender-specific mean of the observed cohort members.

P-values: * p < .05; ** p < .01. Estimates are averaged across 60 multiply imputed data sets with standard errors corrected for variance within and between the data sets. The smallest sample size across the 60 multiply imputed data sets is N = 6,611. Root mean squared approximation = 0.060 (SRH); 0.060 (NHP); and 0.060 (PHF). Comparative fit index = 0.946 (SRH); 0.945 (NHP); and 0.945 (PHF). Tucker-Lewis index = 0.893 (SRH); 0.891 (NHP); and 0.892 (PHF). Results were obtained using the MPlus statistical software (version 7.11).