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Parental health and children's cognitive and non-cognitive development: New evidence from the Longitudinal Survey of Australian Children

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Abstract

This paper examines the effects of maternal and paternal health on cognitive and non-cognitive development in Australian children. The underlying nationally representative panel data and a child fixed effects estimator are used to overcome most of the previous cross-sectional study limitation in dealing with unobserved heterogeneity. While previous literature has found evidence supporting the adverse impact of poor parental health on child development our results found little evidence to support this. We also found little differential effect based on the gender of the child, the parent, or household income levels. However, we found a small amount of evidence suggesting that poor parental health may worsen some cognitive and non-cognitive skills of young children only. Our results demonstrate that either failing to account for parent-child fixed effects or using child non-cognitive skills reported by parents could over-estimate the harmful impact of poor parental health on child development.

Keywords: Intergenerational transmission, health, education, panel data, Australia

JEL classifications: I14, J24

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1. Introduction

The extent of intergenerational transmission of human capital has long been of interests of researchers and policy makers because of its important implications for economic development and inequality. Two principal components of human capital are education and health. So far evidence on the degree of intergenerational transmission in education is rich while that in health is growing (d'Addio, 2007; Currie, 2009; Black and Devereux, 2011; Johnston *et al.*, 2013). Recently, researchers have begun to explore the degree to which poor parental health interferes with child education. However, we know little to date about this relationship (Bratti and Mendola, 2014; Senne, 2014). This paper builds on this topic, which is under-researched, by using a recent nationally representative data set from the Longitudinal Survey of Australian Children (LSAC) to estimate the effects of paternal and maternal health on cognitive and non-cognitive development in children.

Our paper makes three important contributions to research into parental health and child education. First, this paper is the only study to date to apply a child fixed effects (FE) estimator[1] to study the impact of parental health on child development in the context of a developed country like Australia. Although it is straight forward to obtain the magnitude of correlations between parental health and child development, identifying the causal impact of parental health is more challenging due to the well-established issue of unobservable individual characteristics (e.g. parent's discount rate or ability of the parent or the child) correlated with both the parental health and child development. So far, a few papers have employed a child FE estimator to deal with unobserved heterogeneity when examining the impact of parental health on child education in the context of developing countries (Bratti and Mendola, 2014; Senne, 2014). Though, socio-economic environments in developed countries are appreciably different from that in developing countries. As such, effects of poor parental health on child development may not be the same in countries with different development levels (Gertler *et al.*, 2004; Wagstaff, 2007).

Second, this paper also contributes to the literature as the first to deal with the possibility of measurement errors in child non-cognitive skills. Following recent literature which emphasises the roles of non-cognitive skills in determining later-life outcomes (Heckman *et al.*, 2006; Cunha and Heckman, 2008), a number of studies have started examining an association between parental health and child non-cognitive development (Frank and Meara,

[1] In our data, we observe only one child per household, so child FE, parent FE and child-parent FE approaches are equivalent.

2009; Morefield, 2010; Yamauchi, 2010; Mühlenweg *et al.*, 2015). All existing studies use child non-cognitive skills evaluated by parents. One concern regarding such measures is that they may be dependent on parental health. A possible consequence of which would be a biased estimate of parental health from the child development equations (Wooldridge, 2010). To tackle this measurement error issue we use child non-cognitive skills reported by teachers, whose evaluations are not subject to parental health status. We compare regression results using evaluations from parents and teachers and examine the implications for estimates of parental health impact on child non-cognitive skill development. Thus, for the first time in this literature, we are able to check for any measurement error bias relating to the use of child non-cognitive skill measures reported by parents.

Third, this paper is also the first to use a child FE method to study the impact of parental health on child non-cognitive development. Possibly due to the nature of data sets used in the previous literature, all studies have not been able to effectively address the unobserved heterogeneity issue with their cross-sectional data methods. In our data, we observe parental health and child non-cognitive development indicators at multiple occasions, enabling us to employ a child FE method to deal with unobserved heterogeneity to identify the causal impact of parental health on child non-cognitive development.

Using the LSAC data and a child FE method, we find little evidence supporting that poor parental health worsens cognitive and non-cognitive development in children. This finding differs significantly from the previous findings of preceding research into harmful effects of poor parental health on child development. Our finding holds irrespective of the gender of the child, or the parent, or household income levels. Our results, however, provide a small amount of evidence suggesting that poor parental mental health may be associated with weakening some development skills of young children aged around 6/7 years old only. Also, our results indicate that either failing to account for parent-child unobserved heterogeneity or using non-cognitive skills reported by parents could over-estimate the adverse effect of poor parental health on child development.

The paper unfolds as follows: Section 2 discusses the related literature, while Section 3 describes our data. Section 4 describes our empirical models, and Section 5 presents the results. Section 6 examines heterogeneous effects and Section 7 presents the robustness checks. Section 8 then concludes.

2. Literature review

This paper studies the effects of parental health on child development. Therefore it relates to a very rich history of literature devoted to examining the intergenerational transmission of a number of factors, such as education, income and health (Black *et al.*, 2005; Black and Devereux, 2011; Holmlund *et al.*, 2011; Cobb-Clark and Nguyen, 2012; Fleury and Gilles, 2015).[2] However, this paper is more closely connected to a small, yet growing area of literature focused on the relationship between parental health and child development. While research is limited studies have provided evidence on a relationship between parental health and child development. This relationship has been identified within a number of countries with different development levels, from developing countries (Gertler *et al.*, 2004; Case and Ardington, 2006; Sun and Yao, 2010; Bratti and Mendola, 2014; Cas *et al.*, 2014; Senne, 2014) to developed countries (Farahati *et al.*, 2003; Propper *et al.*, 2007; Frank and Meara, 2009; Morefield, 2010; Adda *et al.*, 2011; Johnston *et al.*, 2013; Mühlenweg *et al.*, 2015).

Research has also utilised various parental health measures, including subjective general health (Bratti and Mendola, 2014; Mühlenweg *et al.*, 2015), mental health (Farahati *et al.*, 2003; Frank and Meara, 2009; Bratti and Mendola, 2014), negative health events (Morefield, 2010; Johnson and Reynolds, 2013), and deaths (Yamano and Jayne, 2005; Evans and Miguel, 2007; Chen *et al.*, 2009; Adda *et al.*, 2011; Cas *et al.*, 2014; Senne, 2014). Furthermore, a number of child development outcomes have also been studied, including cognitive skills (Frank and Meara, 2009; Morefield, 2010), non-cognitive skills (Frank and Meara, 2009; Morefield, 2010; Mühlenweg *et al.*, 2015), school participation (Farahati *et al.*, 2003; Frank and Meara, 2009; Johnson and Reynolds, 2013), and health (Propper *et al.*, 2007; Johnston *et al.*, 2013).

Due to a complete lack of suitable instruments, studies in this area have used two main strategies to address the possible endogeneity of parental health in the child development equations. The first approach tries to limit the impact of unobservable individual heterogeneity by using a rich set of child and parent characteristics (Morefield, 2010; Johnston *et al.*, 2013; Mühlenweg *et al.*, 2015). The second approach takes advantage of panel data and controls for time-invariant unobservable characteristics using a FE estimator.

[2] See Black and Devereux (2011), for example, for a recent review on the subject. There is also a large collection of literature relating to the effects of parental neonatal health on a wide spectrum of child later-life outcomes, such as human capital development, wages and health (Haveman and Wolfe, 1995; Currie, 2009). The existing literature tends to reach a consensus that poor neonatal health of parents has negative effects on socioeconomic and health outcomes of their children later in life. This current paper differentiates from this literature by examining the effects of parental concurrent health instead of past health.

Following this path, some studies (Chen *et al.*, 2009; Frank and Meara, 2009) have exploited differences in educational outcomes between siblings to remove unobserved differences (such as parental characteristics or family backgrounds) between siblings in a family FE estimator. However this identification approach is challenged by an often observed pattern that children of same parents may differ in observed or unobserved characteristics and parents may adjust their investment in order to compensate or reinforce their effects on child development (Figlio *et al.*, 2014). The child FE approach instead, addresses the above concern by removing differences among individual children. Possibly due to data constraints, so far only a handful of studies (Yamano and Jayne, 2005; Evans and Miguel, 2007; Bratti and Mendola, 2014; Cas *et al.*, 2014; Senne, 2014) have employed a child FE estimator, with all of these studies using data sets from developing countries.

Regardless of the data set and empirical methods used, existing evidence points to harmful effects of poor parental health on almost all child development outcomes considered.[3] Empirical evidence has also suggested that the effects may not be homogenous. For example, while some studies document larger effects on school enrolments of girls than boys (Farahati *et al.*, 2003; Yamano and Jayne, 2005; Sun and Yao, 2010; Senne, 2014), a US study by Morefield (2010) reports poor maternal health has more harmful effects on non-cognitive skills of sons than daughters.[4] Some studies also report a larger effect for younger children (Sun and Yao, 2010; Senne, 2014) or children in poorer families (Yamano and Jayne, 2005; Senne, 2014). Studies into both paternal and maternal health have returned mixed results with some finding maternal health impacts more than paternal health (Case and Ardington, 2006; Evans and Miguel, 2007; Chen *et al.*, 2009; Bratti and Mendola, 2014; Mühlenweg *et al.*, 2015) while another found little difference based on the gender of the child or the parent (Gertler *et al.*, 2004).

Australian studies have also reported an association between maternal health and child development. For example, Yamauchi (2010) and Nghiem *et al.* (2015) both used LSAC-K cohort data. However, Yamauchi (2010) used data from the first wave of the LSAC - K cohort when the children were 4 or 5 years old, finding mothers with better mental health are more likely to have children with better cognitive and non-cognitive outcomes, particularly non-cognitive outcomes. By contrast, Nghiem *et al.* (2015) used data from the first four

[3] Two exceptions are US studies (Frank and Meara, 2009; Morefield, 2010) which find no statistical significant effects of parental poor health on cognitive skills of children.
[4] The study by Morefield (2010) is the only one among all surveyed studies using data from a developed country to examine the heterogeneity by gender of children.

waves, focusing on outcomes of 8/11 year old children. They returned contradictory results to Yamauchi (2010), finding that, in general, maternal health[5] is not statistically significantly associated with child cognitive development. While these two Australian studies use the same LSAC data, earlier waves of the data were used and do not control for the child-parent unobserved heterogeneity as we do in this study.

3. Data

3.1. Data

We use data from the first five waves of the biannually nationally representative LSAC survey. The LSAC initiated in 2004 contains comprehensive information about children's development indicators and other socio-economic and demographic background of children and their parents. The LSAC sampling frame consists of all children born between March 2003 and February 2004 (B-Cohort, infants aged 0–1 year in 2004), and between March 1999 and February 2000 (K-Cohort, children aged 4–5 years in 2004). In this study we focus on 4,983 children of K-cohort because measures on child development are more widely available for this cohort in the first five waves of the survey. Our current data thus allow us to study the subject during key developmental years of children, from pre-school (4/5 year old) to early secondary school (12/13 year old).

3.2. Measures of parental health

Three parental health measures are used in this study. The first measure is based on the K6 scale of psychological distress. The K6 was based on self-reported response to 6 items which ask each parent about symptoms of depression or anxiety experienced in the past four weeks.[6] It uses a five level response scale that ranges from "all of the time" (1) to "none of the time" (5). The 6 questions asked are: "In the past 4 weeks, how often did you feel…": 1. Nervous 2. Hopeless 3. Restless or fidgety 4. Everything was an effort 5. So sad couldn't cheer up 6. Worthless. The sum of scored responses to the six questions is used to generate a single score of psychological distress. The summed score ranges from 6 to 30, with higher scores indicating better mental health. K6 validation studies were carried out in a number of

[5] Particularly, Yamauchi (2010) uses cross sectional data so cannot control for the child FE. Similarly, the empirical approaches employed by Nghiem *et al.* (2015) cannot account for child time invariant unobservable characteristics. In addition, Yamauchi (2010) use Who Am I (WAI) and Peabody Picture Vocabulary Test (PPVT) scores to represent child cognitive skills while Nghiem *et al.* (2015) use a set of child cognitive skills similar to ours. Unfortunately, Nghiem *et al.* (2015) do not report estimates of maternal health on child non-cognitive development.

[6] Questions about K6 are reported from a During Interview Questionnaire for parent 1 (in most cases the mother of the study child) while other health questions are reported from a Leave Behind Questionnaire.

countries throughout the world (Kessler *et al.*, 2010), including Australia (Furukawa *et al.*, 2003). These studies uniformly found the K6 to have very good concordance with independent clinical ratings of mental health. For the sake of interpretation and consistency with other parental health measures used in this study, we use a reversed K6 score with a higher score indicates a worse mental health level.

While the K6 has been proven to be a high quality measure of mental health, concerns have been raised that as a subjective measure it may be prone to a self-reporting scale bias.[7] To address such a concern, we use a binary indicator which takes the value of one if the mother (or father) was depressed for two weeks or more in the year prior to the survey time and zero otherwise.[8] In addition to the two above mental health measures, we also use a general health measure reported by each parent to indicate parental health states. Specifically, responses to the question "In general, would you say your own health is: 1 Excellent; 2 Very good; 3 Good; 4 Fair; 5 Poor" are used to construct a general health measure with higher values of this measure indicating worse subjective general health.

3.3. Measures of child cognitive development

Three indicators of the latent cognitive development of children are used in this study.[9] The first indicator is drawn from results of the National Assessment Program – Literacy and Numeracy (NAPLAN) test. The NAPLAN test is required for all Australian students in grades 3, 5, 7 and 9 in the five domains of reading, writing, spelling, grammar and numeracy. The test scores range from 0 to 1000 and are comparable across the nation and over time (ACARA, 2014). The NAPLAN test results of children were collected via data linkage with LSAC data (Daraganova *et al.*, 2013). At the time of this study, the linkage data for LSAC are mainly available for students in grades 3, 5, and 7. We thus focus on test results at these grades and use results of all test subjects in order to measure the cognitive development of children. Since the NAPLAN test dates and LSAC survey dates are not the same, test results

[7] It is understood from the existing literature that individuals may have different scales of reference in answering the same question on the assessment of their health status (Groot, 2000; Bertrand and Mullainathan, 2001; Crossley and Kennedy, 2002; Powdthavee and van den Berg, 2011). Note that our empirical models which control for parent-child time invariant unobservable characteristics also help reduce any scale of reference bias.

[8] This variable is derived from responses to the question "In the past year, have you had two weeks or more during which you felt sad, blue or depressed or lost pleasure in things that you usually cared about or enjoyed?" which was asked separately for each parent. This information is only available from wave 2.

[9] LSAC data also have other measures of students' academic performance assessed by a class teacher and a parent. These assessments are based on a relative comparison with the student's classmates, and therefore might differ across parents, teachers and schools (Daraganova *et al.*, 2013). Because of this we don't use them in our analysis.

and survey data are merged in the way that test results are not pre-dated by survey data.[10] This matching exercise ensures NAPLAN test scores in grades 3, 5, and 7 are merged with survey data in wave 2, 3, and 4, respectively.

Two additional indicators to measure the cognitive development for children are drawn from the Peabody Picture Vocabulary Test (PPVT) and Matrix Reasoning (MR) tests. The PPVT is an interviewer-administered test to assess a child's listening comprehension ability for spoken words in standard English (Dunn and Dunn, 1997). The PPVT test requires a child to show the picture that best represents the meaning of a stimuli word spoken by the examiner. The MR test is also administered by an interviewer using the Wechsler Intelligence Scale for Children, 4th edition (WISC-IV). This test assesses a child's non-verbal intelligence by presenting them with an incomplete set of pictures, which they complete by selecting one picture from 5 different options. The raw MR score is presented as the number of correct answers, ranging from zero to 20. PPVT and MR test scores have been used widely to proxy child cognitive development in economics literature (Fiorini and Keane, 2014; Nghiem *et al.*, 2015). Our current data include PPVT scores in waves 1 to 3 and MR in waves 2 to 4.

3.4. Measures of child non-cognitive development

Measures of child non-cognitive skills are derived from the Strengths and Difficulties Questionnaire (SDQ). The SDQ is a standard psychometric measure of children's behaviour and socio-emotional skills (Goodman, 1997) and is widely used in psychopathological screening (Achenbach *et al.*, 2008; Goodman and Goodman, 2009). The SDQ contains five sub-scales: pro-social behaviour (hereafter called Prosociality), hyperactivity and inattention (Hyperactivity), emotional symptoms (Emotional), conduct problems (Conduct), and peer-relationship problems (Peer). Each SDQ sub-scale is scored as the summation of the item scores on each of the five sub-items, and then rescaled to give values from zero to 10. For ease of interpretation, we have rescaled the SDQ measures so that higher SDQ scores indicate "better" behaviours. We sum the scores of the above five sub-scales to construct an overall SDQ scale with a higher score indicating a greater level of "good" behaviours.

Our measures of child non-cognitive development are similar to those used in studies for Germany (Mühlenweg *et al.*, 2015) and US (Frank and Meara, 2009; Morefield, 2010). Possibly due to the nature of data sets used in international studies, all existing studies use non-cognitive skills reported by parents (most of them are mothers). Australian studies

[10] We address the differences in test dates and survey dates in our empirical models by including dummies for survey months and test and survey years (see Section 4).

(Yamauchi, 2010; Nghiem *et al.*, 2015) using the LSAC data also use non-cognitive skills reported by parents. One concern regarding such measures is that they are subjective and might be influenced by the parents' own health. A possible consequence of using such measures would be a biased estimate of parental health from the child non-cognitive skill equations. Fortunately, our data contain responses to the same set of SDQ identifying child behaviours administered separately to parents and teachers, roughly at the same time and repeatedly for children at school.[11] This allows us to directly compare evaluations from parents and teachers and examine the implications for the estimate of parental health on child behavioural outcomes. Teachers' reports on SDQ are our preferred measures of children non-cognitive skills because their reports may not be subject to the health condition of parents. We therefore focus on SDQ scores reported by teachers. For comparison purposes with previous researches which only use parents' reports of children behaviours, we also report the results using SDQ scores reported by parents. Like cognitive skill measures rather than NAPLAN test scores, in our data, we observe non-cognitive skills by ages of children and up to five observations for each child.

3.5. Sample

In our analysis, we concentrate on K cohort children because child development measures are more widely available for them. Furthermore, because we are interested in the impact of both maternal and paternal health we restrict the sample to children who lived with both parents during the study period. This sample restriction also helps isolate the impact of parental health from that of parental separation and reduces the number of observations with missing information on important characteristics of both parents (mostly fathers). We further restrict our sample to children without missing information on a list of important explanatory variables (as detailed in Section 4). Finally, since we will focus on results estimated using a child FE estimator; we necessarily restrict our sample to children observed at least twice in the data. Our above sample restrictions result in final samples which vary by measures of child development and parental health. As can be seen in Tables from 1 to 3, our final sample sizes range from 3,786 wave-child observations (of 1,893 unique children) to 9,843 wave-child observations (of 2,774 unique children).

[11] Precisely 98 % of the child's teacher's questionnaires were filled in by the child's main teacher. Furthermore, while parents' reports are available for almost all children in our main sample, teachers' reports are available for about 80 % of children. In a robustness check, we test for any possible implication of the missing pattern in the teachers' reports on our results. Unfortunately, data do not contain the teacher's characteristics for us to further control for them in regressions.

4. Empirical framework

4.1. Theoretical backgrounds

Theoretically, this study is motivated by various child development frameworks (Becker and Tomes, 1979; Cunha and Heckman, 2007; Heckman, 2007; Cunha et al., 2010) which link skill formation in children to parental capacities and parental investments in child development. According to these frameworks, one would expect that poor parental health affects child development through several channels. For example, poor parental health may reduce income, reduce household wealth, or reduce the amount or the quality of time parents spend with their children. Poor parental health may also directly worsen health of children or reduce the child's time diverted from study to take care of parents. The above theoretical grounds suggest that poor parental health reduces good development outcomes in children. However, there are some suggestions the impact may originate from the opposite direction. For instance, poor health may cause parents to reduce their labour market working time and hence, increase their time with their children. Furthermore, children of parents with poor health may also try to improve their test scores or behaviours to make their parents happy. The combining effects of those factors thus leave the impact of parental health on child development to be an empirical issue.

4.2. Empirical models

In practice, we lack suitable instruments and data to specifically identify which channel prevails. As such, most empirical studies focus on the estimation of the cumulative impact via all pathways using a reduced form model in which parental health is included as an explanatory variable in the child development equation. We therefore follow the previous literature to estimate the development outcome Y of child i at time t as follows:

$$Y_{it} = \alpha + \beta_m MH_{it} + \beta_f FH_{it} + X_{it}\gamma + \varepsilon_{it} \quad (1)$$

In equation (1), MH (FH) is a measure of maternal (paternal) health which we measure in different ways; X_{it} is a vector of individual characteristics; and ε_{it} represents an error term. α, β and γ are parameters to be estimated. β_m and β_f are our interested parameters. With our above coding of parental health and child development measures, a negative estimate of any parental health measure indicates that worse parental health is associated with lower levels of child development, and *vice versa*.

We include in X_{it} a rich list of factors contributing to the child development such as the child's characteristics (i.e., gender, age, migration status, ethnicity, birth weight, school sectors, and number of siblings), parental characteristics (i.e., age, education, and migration status), and indicators of neighbourhood characteristics.[12] We also control for the differences in the survey time by including dummies for years and quarters of survey time in regressions. We additionally include state dummy variables to control for differences in socio-economic environments by states/territories. We further address the issues of children sitting the NAPLAN test in different years for the same grade by using information both on the age of children at the year they sat the test and dummy variables for test year.

We apply the equation (1) to a pooled sample of all children and use an Ordinary Least Squares (OLS) method to estimate all equations. Results from these regressions are called "OLS" results. As already mentioned in the Introduction, the error term ε_{it} in equation (1) contains child-parent time-invariant unobserved characteristics δ_i. Some of them (such as parental discount factor or ability) may be correlated with both the parental health and child development, causing the OLS estimate to be biased. We employ a child FE estimator to eliminate the role of δ_i in the following regression:

$$Y_{it} = \alpha + \beta_m MH_{it} + \beta_f FH_{it} + X_{it}\gamma + \delta_i + \mu_{it} \qquad (2)$$

where μ_{it} is an idiosyncratic error term. We also apply the OLS method to estimate the regression (2) and name the results as "Fixed Effects" (FE) results.[13] In all regressions, standard errors are clustered at the individual level to account for the fact that each child has up to five observations, one for each age/grade in which he or she was evaluated.

5. Empirical results

5.1. Parental health and child cognitive development

Estimates of parental health from child cognitive development equations are presented in Table 1. In Table 1, we report estimates from two alternative specifications (OLS versus FE), using three alternative measures of parental health and seven child cognitive skill indicators.

[12] Local variables include percentages of individuals completed year 12, working, speaking English, being born in Australia, or having an Aboriginal/Torres Strait Islands origin in linked areas, percentages of households with household income less than AU$1,000/week in linked areas, and a metropolitan dummy.

[13] All time invariant variables such as gender, birth weight and migration status are dropped in the FE estimator. Variable descriptions and summary statistics are detailed in Appendix Table A1. See Appendix Table A2 for correlation structure of parental health and child development outcome variables. Appendix Table A2 shows that parental health measures are highly statistically significantly correlated. Similarly, child development measures are statistically significantly correlated. However, the correlation is not very high in magnitude, suggesting that each measure may capture a different aspect of parental health or child development.

OLS results (odd columns in Table 1) show that estimates for all parental mental health measures are not statistically significantly different from zero, suggesting that parental mental health does not affect child cognitive development. Similarly, estimates of the general health measure of both parents (last panel of Table 1) are not distinguishable from zero, indicating that cognitive development in children is not affected by their parents' general health either. Two exceptions are negative and statistically significant (at least at the 5 % level) estimates of maternal general health on the child's writing and spelling scores, suggesting that children of mothers with poor general health may have lower test scores in these two test domains.

[Table 1 around here]

The FE estimator however turns the estimates of maternal general health on the child's writing and spelling scores to statistically insignificant (see even columns in Table 1). The only negative and statistical significant (at the 5 % level) FE estimate is that of the maternal depression dummy on reading test scores. This estimate suggests that children of mothers who reported having been depressed have reading scores of about 6 points lower than children of mentally healthy mothers. In addition, the p value of a t test for the equality of the estimates of paternal and maternal mental health dummies in the reading score equation suggests that these estimates are statistically different at the 10 % level. By contrast, FE estimates suggest some *positive* and statistically significant (at the 5 % level or lower) association between poor parental health and child cognitive skills: paternal mental (general) health on PPVT (grammar) and all maternal health indicators on MR. Other FE results indicate no detrimental impact of poor parental health (either mental or general health) on child cognitive skills. Above results suggest that failing to account for parent-child FEs would result in an over-estimation of the harmful effects of poor parental health on child cognitive development. Overall, our preferred FE estimates suggest that poor parental health does not impair cognitive skills in children.

5.2. Parental health and child non-cognitive development

5.2.1. Child non-cognitive skills reported by parents

We next turn to estimates of parental health on child non-cognitive skills. We first follow the previous literature (Frank and Meara, 2009; Morefield, 2010; Mühlenweg *et al.*, 2015) in using child non-cognitive skill measures reported by parents and present OLS estimates of our three parental health measures from various child non-cognitive skill regressions in odd columns of Table 2.

The OLS estimates reveal two noticeable patterns. First, poor parental health is negatively and highly statistically significantly (at the 1 % level) associated with good behaviours of children. The above pattern holds for all health measures of either mothers or fathers and for all non-cognitive skills in children. This pattern suggests that children of parents with poorer health consistently appear to have less desirable behavioural outcomes, a finding which is in line with that reported in the previous studies for Australia (Yamauchi, 2010), Germany (Mühlenweg *et al.*, 2015), and US (Frank and Meara, 2009; Morefield, 2010). Second, as compared to the estimates of maternal health, those of paternal health are much less pronounced in terms of the magnitude. For example, the first column of Table 2 shows that, depending on parental health measures, the estimates of maternal health on the overall non-cognitive scale are about two or three times greater than that of paternal health. Indeed, the p value of a t test for the equality of the estimates of paternal and maternal health variables (reported at the bottom of each panel in Table 2) confirms that these estimates are statistically different at the 1 % level for a vast majority of child non-cognitive skill measures (exceptions are estimates of the parental depression dummy and general health measure on the Prosociality). Our finding from the OLS estimates of a more detrimental impact of maternal poor health on child behaviours is thus consistent with that reported in the study by Mühlenweg *et al.* (2015) for German children aged 3 to 6 years.[14]

[Table 2 around here]

In Table 2 (even columns), we also report estimation results from our preferred FE specifications. The FE estimates show that controlling for the child FE changes the results noticeably. In particular, the FE estimates are much smaller than OLS estimates in terms of the magnitude and statistical significance level. Specifically, controlling for child heterogeneity at least halves the size of the estimates of parental health measures. Accounting for the child FE also turns the estimates of parental health from highly statistically significant to less statistically significant (such as estimates of maternal depression dummy on Hyperactivity) or statistically insignificant (e.g. estimates of paternal K6 on all child non-cognitive skill measures) for more than a half of combinations between parental health and child non-cognitive skill measures. Overall, the above comparisons between OLS and FE estimates suggest that failing to account for the child FE would over-estimate the detrimental impact of poor parental health on child non-cognitive development. This finding gives

[14] Unfortunately, other studies (Frank and Meara, 2009; Morefield, 2010; Yamauchi, 2010) focus on maternal health so we cannot compare our results with theirs.

support to our empirical approach which effectively controls for child-parent time-invariant unobserved characteristics. One of the unobserved characteristics of parents would be their discount rates (Fuchs, 1982). Parents with lower discount rate have more risky life style and hence a worse health and also invest less in child development. As a result, the simple least squares estimate which fails to account for this unobserved parental characteristic over-estimates the adverse impacts of poor parental health on child development.

Results in Table 2 also indicate that controlling for the child FE while reducing the detrimental effects of maternal and paternal poor health tends to have more pronounced effects on estimates of maternal health. This is evidenced by changes in the results of a t test which now show that differences in estimates of maternal and paternal health measures are no longer statistically significant for nine combinations of estimates of parental health and child non-cognitive skill measures. These include estimates of the K6 on the Peer sub-scale and estimates of the depression dummy and general health on the overall non-cognitive scale and its three sub-scales of Hyperactivity, Conduct and Peer. The above differences between the OLS and FE estimates by the gender of parents suggests that failing to control for the child FE may also result in misleading conclusions about the relative effects of paternal and maternal health on child non-cognitive development. One possible reason for the changes in relative effects of paternal and maternal health is that in our case, as in all prior studies in this literature, almost all (96 %) SDQ are responded by mothers and that maternal health itself may affect the way the mother reports about the child's behaviour. Below, we investigate this prediction using the teacher's evaluation of the child's behaviour. Teacher's evaluations, arguably, do not depend on the health status of parents.

5.2.2. Child non-cognitive skills reported by teachers

Table 3 reports OLS (odd columns) and FE (even columns) estimates of parental health from various separate regressions of child non-cognitive outcomes as reported by teachers. The OLS results indicate that poor parental health is associated with worse behaviours in children. However estimates are statistically significant for some combinations of parental health measures and child non-cognitive outcomes only. In particular, for maternal health, statistical significant estimates are observed for estimates of K6 on all non-cognitive measures, estimates of the depression dummy on all non-cognitive measures (except Prosociality), and estimates of general health on the overall non-cognitive scale, Emotional and Peer. For paternal health, statistical significant estimates include those of K6 on all non-cognitive skill measures, those of the depression dummy on all non-cognitive skill measures (except

Prosociality), and those of general health on all non-cognitive skill measures (except Emotional).

[Table 3 around here]

Comparing the magnitude of OLS estimates of paternal and maternal health variables on child non-cognitive skills using evaluations from parents (Table 2) and teachers (Table 3) reveals an interesting pattern: while estimates of paternal health measures are quite similar in the two tables that of maternal health drop considerably from Table 2 to Table 3. Contrasting the results of a t test for the equality of the OLS estimates of paternal and maternal health variables in the child non-cognitive skill equations from the two tables also uncovers an apparent pattern: while Table 2 shows maternal poor health has more harmful effects than paternal poor health Table 3 suggests that effects are not statistically different from each other.[15] These two patterns when viewed with the fact that the vast majority of SDQ are responded by mothers convey an important implication: mothers with worse health tend to over-report that their children have behavioural problems. As such, using mothers' evaluations of child non-cognitive skills would over-estimate the harmful impact of poor maternal health on child non-cognitive development and result in misleading conclusions about the relative effects of maternal and paternal health on such development outcomes. To our knowledge, these findings are novel to this literature.

Table 3 shows FE estimates are much smaller than OLS estimates in terms of the statistical significance level and magnitude. Specifically, controlling for the child FE, only a handful of estimates of parental health on child non-cognitive skills are statistically significant at the 5 % level or higher. These include estimates of maternal K6 on Hyperactivity, paternal K6 on Hyperactivity and Conduct, and paternal depression dummy on Hyperactivity. In addition, for estimates that remain statistically significant, FE estimates are at least about 25 % smaller than OLS estimates. These findings again suggest that being unable to control for the child FE could over-estimate the harmful effects of poor parental health on child non-cognitive development.

Table 3 also suggests that controlling for the child FE appears to have similar impact on the estimates of paternal and maternal health measures. Indeed, consistent with results of a t test from the OLS regressions, test results from FE regressions also suggest that effects of

[15] An exception is that maternal poor health (as measured by a higher general health score) has a more harmful effect on the Emotional of children than paternal poor health (P value of a t test is 0.02).

maternal and paternal health are not statistically significantly different.[16] The similarity of the test results from the two specifications suggests that teachers' evaluations of their students' behaviours in our data may be truly independent of parental health status. As such, when evaluations from parents and teachers are both available, studies should use evaluations from teachers as they help reduce bias in the estimates of parental health.

5.2.3. Discussion

Above using our preferred FE specifications and measures of child non-cognitive skills, we found little evidence supporting that poor parental health worsens cognitive and non-cognitive development in children. If poor cognitive and non-cognitive development eventually results in early school dropout as found in the literature (De Witte *et al.*, 2013), our findings are in stark contrast to the finding of a negative effect of poor parental health on the child's school participation probability reported in five prior studies which use a similar child FE approach (Yamano and Jayne, 2005; Evans and Miguel, 2007; Bratti and Mendola, 2014; Cas *et al.*, 2014; Senne, 2014).

Differences in parental health measures used among studies could be a possible reason for differences in our findings. Our measures of poor parental health are obviously much less traumatic than parental death as used in four out of five above studies.[17] As such, the impact would be less severe in this study than in the previous ones. However, the following two observations make this prediction less likely to hold. First, using a largely similar set of parental health measures[18] as ours, Bratti and Mendola (2014) do find that poor maternal health statistically significantly reduces the probability of attending school of children from Bosnia and Herzegovina. Second, because child development measures are more continuous in this study than in all above five studies, it is easier to detect an effect in the former. These two observations also suggest that other factors are behind the differences in findings. One such factor would be differences in the socio-economic environment children live in. As compared to the developing countries examined in all five above mentioned studies, Australia, as a high-income country, has a better system of social protection. It has been

[16] An exception is that paternal depression has more harmful effect on Hyperactivity than maternal depression as shown in column 6 - panel 2 of Table 3 (P value of a t test is 0.02).

[17] Parental deaths are very rare events in our data so we do not examine their effects.

[18] Specifically, Bratti and Mendola (2014) also use parental self-reported health status and mental health indicators. Children in our Australian study age from 4 to 13 years so they are younger than the 15–24 year old children in the study from Bosnia and Herzegovina by Bratti and Mendola (2014). Because existing evidence suggests a more harmful effect of poor parental health on outcomes of younger children (Morefield, 2010; Sun and Yao, 2010; Senne, 2014), the differences in ages of children between the two studies may not explain the difference in our findings.

evidenced that in countries with poor systems of social protection, ill health may have significant economic consequences for both current and future generations (Gertler *et al.*, 2004; Wagstaff, 2007). We may therefore expect a less detrimental impact of poor parental health on child education in Australia than in other developing countries. This prediction is supported by evidence from two US studies (Frank and Meara, 2009; Morefield, 2010) reporting no significant impact of poor maternal health on child cognitive development.

Our finding of no significant effect of poor parental health on child non-cognitive development is also different from a universal finding in prior research of a harmful effect (Frank and Meara, 2009; Morefield, 2010; Yamauchi, 2010; Mühlenweg *et al.*, 2015). Because these studies (including the current study) use largely similar measures of parental health and child non-cognitive skills, and data sets from developed countries, factors other than differences in variable measurements or socio-economic environments may explain the difference in our findings. Our analyses in Sub-section 5.2 suggest that the difference in the findings can be mainly attributed to the differences in capacities to control for the child FE and to use more objective measures of child non-cognitive skills. In what follows, we will use child non-cognitive skills evaluated by teachers as well as the FE specification.

6. Heterogeneity

6.1. By the gender of children

Empirical child development literature has often found differing effects on boys and girls (Currie and Hyson, 1999; Balsa, 2008; Currie, 2009). We test whether parental health affects the development of sons and daughters differently by running the FE regressions for sons and daughters separately. Results presented in Table 4a indicate that there is no clear difference in the estimates of parental health on cognitive skills of sons and daughters: most of the estimates are not statistically significant and when they are their differences are minimal. Similarly, estimates on non-cognitive skills presented in Table 4b suggest no differential effects by gender of children. Overall, there is no clear indication that parental health affects the cognitive and non-cognitive development of sons and daughters differently.

[Tables 4a and 4b around here]

A common finding amongst studies on the intergenerational transmission of outcomes is that the transmission is typically strongest between mothers and daughters, and between fathers and sons (Black and Devereux, 2011). We use results from Table 4a and 4b to check the above pattern. Results presented in Table 4a suggest that the above pattern does not hold for

cognitive skills because estimates of maternal and paternal health are not statistically significant from a vast majority of regressions, and when they are, they are not statistically significantly different from each other. For non-cognitive skills, results reported in Table 4b suggest that paternal and maternal health may have different effects on sons and daughters but the pattern is unclear. For instance, estimates of K6 on the overall non-cognitive scale (panel 1 – columns 1 and 2 in Table 4b) suggest that only maternal K6 matters for daughters and only paternal K6 for sons. However, results of a t test indicate that effects of maternal and paternal health are statistically different in the regressions for daughters only. By contrast, estimates of the parental depression dummy on the overall non-cognitive scale (panel 2 – columns 1 and 2 in Table 4b) indicate that only paternal health matters for daughters' non-cognitive development. Overall, results from Table 4a and 4b suggest that there is no "like mothers like daughters" or "like fathers like sons" pattern in the effects of parental health on child development in this study.

6.2. By age groups/school grades of children

Above we presented results that pool child development measures across all ages/school grades. In this sub-section, we investigate the heterogeneity of the impact by ages/school grades by estimating the regression model (2) separately by waves of survey. As explained in Section 3, children in our sample were 4/5 years old at wave 1 of the survey. They were therefore two years older in every subsequent wave of the survey. In terms of school grades, most of children in our sample were at school grade 1 in wave 2 and advanced two school grades in every following wave of the survey. As such, waves of survey also represent the age groups/school grades of children in our sample well.

[Table 5 around here]

Table 5 reports estimated effects of maternal and paternal K6 on various child development outcomes from FE models that are estimated separately from each survey wave, 2-5.[19] For comparison purposes, we also reproduce estimates from FE regressions where we pool all observations across all ages/school grades in the first row of each panel for maternal and paternal health measures. Columns 1 to 7 in Table 5 show that, consistent with the pooled estimates, almost all wave specific estimates from cognitive skill equations are statistically

[19] Note that with the child FE approach which compares outcomes and controls of the same child over time, only regression results for the second earliest wave where a child development outcome is observed are reported. In addition, with the FE regressions by survey waves, data from two consecutive waves are used for each regression. Using other parental health measures reveals no apparent pattern.

insignificant, suggesting that poor parental health does not reduce child cognitive development across all age groups/school levels. An exception is observed where poor paternal mental health statistically significantly (at the 5 % level) reduces numeracy scores of 8/9 year old children (Panel 2 - Wave 3 – Column 6).

Columns 8-13 in Table 5 show that, in line with the pooled regression results, wave specific estimates for non-cognitive skills are not statistically different from zero for most cases, indicating no strong evidence of a harmful effect of poor parental health on non-cognitive skills in children of almost all age groups observed in this study. These columns additionally suggest that any harmful effect of poor parental mental health on child non-cognitive development may occur when the children are young only. Specifically, some wave specific estimates are negative and statistically significant at Wave 2 (e.g. estimates of maternal K6 on Peer, paternal K6 on the overall non-cognitive scale and its three sub-scales of Prosociality, Hyperactivity and Conduct), indicating a detrimental effect of poor parental mental health on some non-cognitive skill measures in 6/7 year old children. Furthermore, estimates of paternal K6 on the overall non-cognitive scale and its two sub-scales of Prosociality and Emotional are positive and statistically significant (at least at the 10 % level) at Wave 4, suggesting that 10/11 year old children of fathers with poorer mental health have more desirable behaviours. Our finding that harmful effects of poor parental mental health on child non-cognitive development only occur when the children are around ages 6/7 years is in line with evidence from the US study by Morefield (2010) who finds that the onset of maternal health conditions is statistically significantly associated with an increase in children's behavioural problems at ages 5-9 years only. This finding is also consistent with evidence of a higher detrimental effect on younger children coming from developing countries such as China (Sun and Yao, 2010) and Madagascar (Senne, 2014).

6.3. By household income

Some studies in this literature report a more detrimental impact of poor parental health on education of children from poorer families (Yamano and Jayne, 2005; Senne, 2014). We test for this pattern by running the regression (2) separately for two sub-samples defined relative to the median of household annual income of all households in the whole sample. Results (reported in Table 6a and 6b) show that the above pattern does not present in our data.

[Tables 6a and 6b around here]

7. Robustness checks

There are a number of issues that challenge our identification assumptions. One such challenge is omission of time-variant factors which are correlated with both parental health and child development. It is hard to pinpoint what these unobservable factors might be. Bratti and Mendola (2014) suggest that the child's health status could be one such unobservable factor. Current child development literature also suggests that parental working status and household income may be two important factors because they are correlated with parental health and child development (Currie, 2009).[20] In this section, we test the robustness of our results to the inclusion of these variables by adding each of them separately to the exiting list of explanatory variables used in our baseline regressions. Results of this robustness check (reported in Table 7a to 7c) show that estimates for parental health measures are unchanged, suggesting that our findings are not sensitive to including further time-variant observable variables.

[Tables 7a to 7e around here]

The second thread to our FE identification is that of reverse causality. One could anticipate that given some negative shocks in child development parental health would worsen. As such, what we estimate as effects of parental health on child development is simply capturing this reverse causality between parental health and child development. One popular method to alleviate some of the concern over reverse causality is to use lags of parental health measures in the regressions of child development (Johnston *et al.*, 2013). In our study, as mentioned in Section 3, parental health is recorded before some of child development outcomes (such as all NAPLAN test scores)[21] are observed. Such time arrangement helps mitigate some of the concern over reverse causality. Additionally, we alleviate some of the concern by testing whether each current child development outcome affects future health status of each parent. The results (reported in Table 7d) do not indicate any significant correlation, suggesting that our results may not be driven by reverse causality.[22]

One of our main purposes is to compare evaluations on the child's behaviours from parents and teachers. In the main analyses, we report results using a sample of children for them we

[20] In our baseline specifications, we purposely did not include these variables because they are reasonably considered to be influenced by parental health.
[21] NAPLAN tests are taken in March each year and test results are announced in around September of the same year.
[22] Two exceptions are negative and statistically significant (at the 5 % level) estimates of lags of Emotional (Conduct) on the current K6 (depression dummy) of mothers.

observe a non-cognitive outcome reported by either parents or teachers to maximize the sample size. As noted in Sub-section 3.4, while parents' reports are available for almost all children in our data, teachers' reports are available for about 80 % of them. Due to the missing information from teachers' reports, 20 % of children included in the regressions using parents' evaluations are thus not included in the regressions using teachers' evaluations. It is possible that these sample size differences could drive our results. It is also likely that missing information on the child's non-cognitive skills reported by teachers may have taken place not randomly by the child's characteristics (including health of the child's parents). We test for any possible implication of the missing pattern in the teachers' reports on our results by rerunning the FE model (2) for a sample of children for them we observe non-cognitive outcomes from both parents and teachers. Results of this robustness check (reported in Table 7e) show that using this new sample restriction does not change the estimates of parental health on child non-cognitive skills as reported by parents (odd columns in Table 7e) and teachers (even columns). This robustness check thus suggests that our findings are not sensitive to missing information in teachers' evaluations of the child non-cognitive skills.

8. Conclusion

Drawing on the recent and nationally representative panel of Australian children, we have examined the effects of maternal and paternal health on cognitive and non-cognitive development of children over 10 years in their early lives. This study improves on most previous research by using a child fixed effects approach to deal with the endogeneity of parental health and better measures of child non-cognitive skills. Results from this paper have highlighted two important methodological implications. First, failing to control for the child-parent unobservable characteristics may result in an over-estimation of the detrimental impact of poor parental health on child development. Second, using non-cognitive skills reported by parents could also over-estimate the harmful effect of poor parental health on child non-cognitive development.

Our preferred results provide little evidence to support that poor parental health worsens cognitive and non-cognitive development in children. This finding contrasts to a common finding in the previous research finding harmful impacts of poor parental health on child development. We also find little differential effects based on the gender of the child or the parent, or the household income levels. However, a small amount of evidence suggested poor

parental mental health may have a harmful effect on some cognitive and non-cognitive skills of children aged around 6/7 years old only.

This work has highlighted the importance of controlling for individual heterogeneity and using more objective measures of child non-cognitive skills when modelling the effects of parental health on child development. Future work should take these important methodological implications into account when extending the topic to other countries' data. Although our results have been proven to be robust to various sensitivity tests, including controlling for some important time-varying characteristics, we cannot rule out that our results are driven by other time-varying unobserved characteristics or reverse causality. Further studies using more robust econometric methods to study the subject are also worthwhile.

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Table 1: Parental health and child cognitive development – OLS versus FE specifications

	PPVT		MR		Reading		Writing		Spelling		Grammar		Numeracy	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Mother K6 (reversed)	-0.05*	0.04	0.02	0.03*	-0.27	0.28	-0.27	-0.39	-0.30	0.29	-0.30	0.35	0.10	0.12
	[0.03]	[0.03]	[0.01]	[0.02]	[0.41]	[0.38]	[0.35]	[0.42]	[0.37]	[0.27]	[0.43]	[0.45]	[0.41]	[0.38]
Father K6 (reversed)	0.02	0.07**	0.00	-0.01	0.46	-0.20	0.39	0.56	0.49	0.18	0.22	0.42	0.20	-0.43
	[0.02]	[0.03]	[0.01]	[0.02]	[0.42]	[0.38]	[0.35]	[0.45]	[0.40]	[0.28]	[0.42]	[0.42]	[0.40]	[0.34]
Number of observations	5,089	5,089	6,474	6,474	5,172	5,172	5,152	5,152	5,163	5,163	5,161	5,161	5,134	5,134
R squared	0.54	0.72	0.07	0.02	0.42	0.69	0.38	0.54	0.45	0.83	0.40	0.65	0.46	0.76
P t test	0.10	0.48	0.36	0.14	0.25	0.38	0.21	0.11	0.17	0.79	0.42	0.91	0.87	0.28
Number of individuals		2,211		2,430		2,095		2,090		2,093		2,092		2,081
Mother depressed	-0.17	-0.16	0.03	0.17*	0.08	-5.18**	-0.47	-2.74	-0.47	0.33	0.21	0.38	0.33	-0.69
	[0.19]	[0.22]	[0.09]	[0.10]	[2.75]	[2.17]	[2.37]	[2.67]	[2.57]	[1.66]	[2.80]	[2.42]	[2.63]	[2.11]
Father depressed	-0.03	0.17	-0.03	0.09	1.04	0.25	0.33	-0.12	-0.16	1.83	-1.05	-0.07	-1.34	-1.56
	[0.19]	[0.22]	[0.09]	[0.10]	[2.63]	[2.10]	[2.35]	[2.44]	[2.53]	[1.45]	[2.73]	[2.42]	[2.54]	[1.99]
Number of observations	3,786	3,786	6,418	6,418	5,119	5,119	5,099	5,099	5,110	5,110	5,108	5,108	5,080	5,080
R squared	0.29	0.49	0.07	0.02	0.42	0.69	0.38	0.54	0.45	0.83	0.40	0.65	0.46	0.76
P t test	0.63	0.28	0.63	0.56	0.81	0.07	0.82	0.48	0.93	0.50	0.75	0.90	0.66	0.76
Number of individuals		1,893		2,420		2,078		2,073		2,076		2,075		2,063
Mother general health	0.02	-0.05	0.05	0.10*	-1.10	0.49	-2.46**	-0.16	-3.65***	0.53	-2.04	2.09	-0.96	0.32
	[0.09]	[0.12]	[0.05]	[0.06]	[1.51]	[1.32]	[1.22]	[1.51]	[1.35]	[0.91]	[1.57]	[1.48]	[1.44]	[1.18]
Father general health	0.01	-0.01	0.02	0.01	1.18	-0.68	0.67	0.67	-0.19	0.15	1.53	3.26**	0.20	-0.55
	[0.09]	[0.12]	[0.05]	[0.06]	[1.45]	[1.36]	[1.29]	[1.60]	[1.38]	[0.96]	[1.48]	[1.54]	[1.40]	[1.21]
Number of observations	5,089	5,089	6,474	6,474	5,172	5,172	5,152	5,152	5,163	5,163	5,161	5,161	5,134	5,134
R squared	0.54	0.71	0.07	0.02	0.42	0.69	0.38	0.54	0.45	0.83	0.40	0.65	0.46	0.76
P t test	0.90	0.85	0.69	0.31	0.32	0.53	0.09	0.72	0.09	0.77	0.12	0.60	0.58	0.61
Number of individuals		2,211		2,430		2,095		2,090		2,093		2,092		2,081

Notes: OLS results are from the regression (1) while FE results are from the regression (2). Other explanatory variables include the child's characteristics (gender, age, migration status, Aboriginal status, birth weight, school sectors, and number of siblings), both parents' characteristics (age, education, and immigration status), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. NAPLAN test regressions also include test age and test years. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 2: Parental health and child non-cognitive development – OLS versus FE specifications – Parents' reports

	Overall		Prosociality		Hyperactivity (reversed)		Emotional (reversed)		Conduct (reversed)		Peer (reversed)	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mother K6 (reversed)	-0.52***	-0.20***	-0.07***	-0.03***	-0.13***	-0.06***	-0.14***	-0.06***	-0.10***	-0.03***	-0.09***	-0.02***
	[0.03]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Father K6 (reversed)	-0.15***	-0.02	-0.03***	-0.00	-0.04***	0.00	-0.03***	-0.01	-0.03***	-0.01	-0.03***	-0.01*
	[0.03]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Number of observations	9,842	9,842	9,844	9,844	9,844	9,844	9,843	9,843	9,844	9,844	9,843	9,843
R squared	0.19	0.07	0.09	0.05	0.16	0.03	0.11	0.04	0.16	0.15	0.08	0.01
P t test	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32
Number of individuals		2,774		2,774		2,774		2,774		2,774		2,774
Mother depressed	-2.19***	-0.39***	-0.16***	0.05	-0.52***	-0.12**	-0.61***	-0.18***	-0.43***	-0.07**	-0.47***	-0.08*
	[0.20]	[0.13]	[0.05]	[0.04]	[0.07]	[0.05]	[0.06]	[0.05]	[0.04]	[0.03]	[0.05]	[0.04]
Father depressed	-0.96***	-0.16	-0.14***	-0.03	-0.28***	-0.11**	-0.20***	0.01	-0.17***	-0.01	-0.17***	-0.02
	[0.19]	[0.12]	[0.05]	[0.04]	[0.07]	[0.05]	[0.05]	[0.04]	[0.04]	[0.03]	[0.05]	[0.04]
Number of observations	8,501	8,501	8,503	8,503	8,503	8,503	8,502	8,502	8,503	8,503	8,502	8,502
R squared	0.12	0.02	0.07	0.02	0.13	0.02	0.06	0.03	0.08	0.05	0.06	0.01
P t test	0.00	0.20	0.74	0.21	0.02	0.97	0.00	0.00	0.00	0.17	0.00	0.34
Number of individuals		2,602		2,602		2,602		2,602		2,602		2,602
Mother general health	-1.14***	-0.23***	-0.15***	-0.04*	-0.26***	-0.02	-0.30***	-0.11***	-0.19***	-0.01	-0.24***	-0.05**
	[0.09]	[0.07]	[0.03]	[0.02]	[0.04]	[0.03]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]	[0.02]
Father general health	-0.55***	-0.16**	-0.11***	-0.06***	-0.15***	-0.04	-0.10***	-0.02	-0.09***	-0.02	-0.09***	-0.01
	[0.10]	[0.07]	[0.03]	[0.02]	[0.03]	[0.03]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]	[0.02]
Number of observations	9,842	9,842	9,844	9,844	9,844	9,844	9,843	9,843	9,844	9,844	9,843	9,843
R squared	0.14	0.05	0.08	0.05	0.13	0.02	0.06	0.03	0.13	0.15	0.07	0.01
P t test	0.00	0.46	0.35	0.49	0.05	0.54	0.00	0.02	0.00	0.90	0.00	0.26
Number of individuals		2,774		2,774		2,774		2,774		2,774		2,774

Notes: OLS results are from the regression (1) while FE results are from the regression (2). Other explanatory variables include the child's characteristics (gender, age, migration status, Aboriginal status, birth weight, school sectors, and number of siblings), both parents' characteristics (age, education, and immigration status), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 3: Parental health and child non-cognitive development – OLS versus FE specifications – Teachers' reports

	Overall		Prosociality		Hyperactivity (reversed)		Emotional (reversed)		Conduct (reversed)		Peer (reversed)	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mother K6 (reversed)	-0.14***	-0.06*	-0.02*	-0.01	-0.04***	-0.03**	-0.03***	-0.02*	-0.02**	-0.01	-0.03***	-0.00
	[0.03]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Father K6 (reversed)	-0.14***	-0.04	-0.02**	0.00	-0.04***	-0.03**	-0.02***	-0.01	-0.03***	-0.02**	-0.02***	0.00
	[0.03]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Number of observations	7,994	7,994	8,008	8,008	8,030	8,030	8,018	8,018	8,028	8,028	8,013	8,013
R squared	0.11	0.02	0.11	0.03	0.14	0.02	0.03	0.01	0.08	0.03	0.03	0.01
P t test	0.95	0.74	0.76	0.51	0.88	0.96	0.38	0.43	0.39	0.21	0.36	0.86
Number of individuals		2,507		2,510		2,514		2,511		2,515		2,509
Mother depressed	-0.79***	0.05	-0.11	0.03	-0.17**	0.03	-0.22***	-0.02	-0.08**	0.06	-0.24***	-0.07
	[0.22]	[0.20]	[0.07]	[0.08]	[0.08]	[0.08]	[0.05]	[0.06]	[0.04]	[0.04]	[0.05]	[0.06]
Father depressed	-0.73***	-0.36*	-0.06	-0.02	-0.26***	-0.22***	-0.14***	-0.07	-0.13***	-0.01	-0.13**	-0.03
	[0.22]	[0.20]	[0.07]	[0.07]	[0.08]	[0.08]	[0.05]	[0.06]	[0.04]	[0.04]	[0.05]	[0.05]
Number of observations	7,025	7,025	7,041	7,041	7,064	7,064	7,050	7,050	7,061	7,061	7,045	7,045
R squared	0.11	0.02	0.10	0.02	0.14	0.02	0.03	0.01	0.07	0.02	0.03	0.01
P t test	0.87	0.15	0.65	0.64	0.42	0.02	0.27	0.57	0.44	0.23	0.18	0.56
Number of individuals		2,357		2,362		2,367		2,362		2,367		2,360
Mother general health	-0.30***	-0.10	-0.03	-0.03	-0.04	-0.02	-0.12***	-0.06*	-0.00	0.01	-0.11***	-0.00
	[0.11]	[0.11]	[0.03]	[0.04]	[0.04]	[0.04]	[0.02]	[0.03]	[0.02]	[0.02]	[0.03]	[0.03]
Father general health	-0.36***	-0.05	-0.06**	0.03	-0.12***	-0.06	-0.03	-0.00	-0.06***	-0.01	-0.07***	0.01
	[0.11]	[0.12]	[0.03]	[0.04]	[0.04]	[0.04]	[0.02]	[0.04]	[0.02]	[0.02]	[0.03]	[0.03]
Number of observations	7,994	7,994	8,008	8,008	8,030	8,030	8,018	8,018	8,028	8,028	8,013	8,013
R squared	0.11	0.02	0.11	0.03	0.14	0.02	0.03	0.01	0.07	0.03	0.03	0.01
P t test	0.70	0.75	0.52	0.35	0.20	0.50	0.02	0.21	0.06	0.47	0.28	0.75
Number of individuals		2,507		2,510		2,514		2,511		2,515		2,509

Notes: OLS results are from the regression (1) while FE results are from the regression (2). Other explanatory variables include the child's characteristics (gender, age, migration status, Aboriginal status, birth weight, school sectors, and number of siblings), both parents' characteristics (age, education, and immigration status), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 4a: Parental health and child cognitive development – Heterogeneity by gender of the child

	PPVT		MR		Reading		Writing		Spelling		Grammar		Numeracy	
	Daughter	Son	Daughter	Son	Daughter	Son	Daughter	Son	Daughter	Son	Daughter	Son	Daughter	Son
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Mother K6 (reversed)	0.02	0.05	-0.00	0.05**	0.31	0.18	-0.33	-0.31	0.20	0.33	-0.25	0.77	-0.16	0.29
	[0.05]	[0.05]	[0.02]	[0.02]	[0.49]	[0.57]	[0.58]	[0.62]	[0.36]	[0.41]	[0.61]	[0.65]	[0.44]	[0.61]
Father K6 (reversed)	0.09**	0.05	-0.02	0.01	-0.40	-0.07	-0.11	1.28*	-0.32	0.71*	0.12	0.57	-0.90**	0.24
	[0.05]	[0.04]	[0.02]	[0.03]	[0.54]	[0.53]	[0.59]	[0.66]	[0.37]	[0.41]	[0.56]	[0.63]	[0.46]	[0.52]
Number of observations	2,541	2,548	3,201	3,273	2,594	2,578	2,585	2,567	2,589	2,574	2,590	2,571	2,577	2,557
R squared	0.71	0.73	0.04	0.03	0.71	0.69	0.61	0.48	0.84	0.83	0.67	0.63	0.76	0.77
P t test	0.27	0.94	0.53	0.22	0.35	0.75	0.76	0.09	0.32	0.53	0.67	0.83	0.25	0.95
Number of individuals	1,097	1,114	1,195	1,235	1,047	1,048	1,044	1,046	1,045	1,048	1,045	1,047	1,042	1,039
Mother depressed	-0.44	0.03	0.23	0.11	-4.94*	-6.44**	-1.57	-4.10	1.29	-1.11	-3.08	3.75	-2.16	0.85
	[0.28]	[0.34]	[0.14]	[0.13]	[2.90]	[3.23]	[3.64]	[3.84]	[2.43]	[2.29]	[3.64]	[3.21]	[2.91]	[3.05]
Father depressed	0.46	-0.02	0.07	0.13	2.01	-1.45	-3.69	3.21	0.98	2.47	2.06	-1.88	-3.04	-0.63
	[0.31]	[0.30]	[0.14]	[0.14]	[3.06]	[2.90]	[3.24]	[3.66]	[2.21]	[1.95]	[3.27]	[3.55]	[2.75]	[2.88]
Number of observations	1,876	1,910	3,178	3,240	2,570	2,549	2,561	2,538	2,565	2,545	2,566	2,542	2,552	2,528
R squared	0.52	0.48	0.04	0.03	0.71	0.69	0.61	0.48	0.84	0.83	0.67	0.63	0.76	0.77
P t test	0.03	0.92	0.43	0.88	0.11	0.26	0.67	0.18	0.93	0.24	0.30	0.24	0.83	0.72
Number of individuals	938	955	1,193	1,227	1,039	1,039	1,036	1,037	1,037	1,039	1,037	1,038	1,033	1,030
Mother general health	-0.02	-0.15	0.11	0.11	0.59	-0.25	0.04	-0.54	1.46	-0.71	-0.15	4.24*	-0.56	1.60
	[0.17]	[0.16]	[0.09]	[0.08]	[1.87]	[1.83]	[2.04]	[2.24]	[1.28]	[1.29]	[2.02]	[2.21]	[1.63]	[1.71]
Father general health	0.17	-0.17	0.01	0.02	0.82	-1.75	4.57**	-3.50	0.55	-0.27	3.29	3.21	-2.75	1.75
	[0.16]	[0.18]	[0.09]	[0.08]	[1.80]	[2.02]	[2.24]	[2.32]	[1.33]	[1.38]	[2.10]	[2.23]	[1.71]	[1.73]
Number of observations	2,541	2,548	3,201	3,273	2,594	2,578	2,585	2,567	2,589	2,574	2,590	2,571	2,577	2,557
R squared	0.71	0.73	0.04	0.03	0.71	0.69	0.61	0.48	0.84	0.83	0.67	0.63	0.76	0.77
P t test	0.43	0.94	0.42	0.50	0.93	0.58	0.15	0.37	0.63	0.81	0.26	0.75	0.37	0.95
Number of individuals	1,097	1,114	1,195	1,235	1,047	1,048	1,044	1,046	1,045	1,048	1,045	1,047	1,042	1,039

Notes: FE results are from the regression (2). Other explanatory variables include the child's characteristics (age, school sectors, and number of siblings), both parents' characteristics (age and education), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. NAPLAN test regressions also include test age and test years. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 4b: Parental health and child non-cognitive development – Heterogeneity by gender of the child

	Overall		Prosociality		Hyperactivity (reversed)		Emotional (reversed)		Conduct (reversed)		Peer (reversed)	
	Daughter	Son	Daughter	Son	Daughter	Son	Daughter	Son	Daughter	Son	Daughter	Son
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mother K6 (reversed)	-0.11***	-0.01	-0.03*	0.01	-0.03**	-0.02	-0.02	-0.01	-0.01	-0.00	-0.02	0.01
	[0.04]	[0.05]	[0.02]	[0.02]	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Father K6 (reversed)	0.01	-0.10*	0.00	0.00	-0.01	-0.04**	0.02	-0.03*	-0.02	-0.02	0.02	-0.02
	[0.04]	[0.05]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Number of observations	4,002	3,991	4,010	3,997	4,022	4,007	4,014	4,003	4,022	4,005	4,009	4,003
R squared	0.05	0.03	0.06	0.03	0.04	0.02	0.03	0.02	0.03	0.04	0.01	0.02
P t test	0.04	0.23	0.18	0.78	0.34	0.47	0.04	0.60	0.68	0.25	0.04	0.13
Number of individuals	1,249	1,258	1,251	1,259	1,254	1,260	1,252	1,259	1,255	1,260	1,249	1,260
Mother depressed	0.15	-0.05	-0.01	0.06	0.14	-0.08	0.01	-0.05	0.09*	0.04	-0.08	-0.06
	[0.26]	[0.30]	[0.10]	[0.12]	[0.09]	[0.12]	[0.09]	[0.08]	[0.05]	[0.07]	[0.08]	[0.08]
Father depressed	-0.58**	-0.17	-0.13	0.07	-0.20**	-0.26**	-0.05	-0.08	-0.10**	0.08	-0.07	0.01
	[0.26]	[0.29]	[0.10]	[0.11]	[0.09]	[0.12]	[0.08]	[0.08]	[0.05]	[0.06]	[0.08]	[0.08]
Number of observations	3,494	3,530	3,504	3,536	3,517	3,546	3,507	3,542	3,516	3,544	3,502	3,542
R squared	0.04	0.02	0.04	0.02	0.04	0.02	0.03	0.02	0.02	0.03	0.02	0.02
P t test	0.05	0.78	0.39	0.94	0.01	0.31	0.65	0.76	0.01	0.70	0.90	0.50
Number of individuals	1,165	1,192	1,169	1,193	1,173	1,194	1,169	1,193	1,173	1,194	1,166	1,194
Mother general health	-0.24*	0.05	-0.04	-0.01	-0.10**	0.06	-0.06	-0.06	-0.02	0.04	-0.03	0.02
	[0.14]	[0.16]	[0.05]	[0.06]	[0.05]	[0.07]	[0.05]	[0.05]	[0.03]	[0.04]	[0.04]	[0.04]
Father general health	0.11	-0.23	0.09*	-0.04	0.02	-0.15**	0.00	-0.01	0.01	-0.03	0.01	0.01
	[0.15]	[0.17]	[0.06]	[0.06]	[0.05]	[0.07]	[0.05]	[0.05]	[0.03]	[0.04]	[0.05]	[0.04]
Number of observations	4,002	3,991	4,010	3,997	4,022	4,007	4,014	4,003	4,022	4,005	4,009	4,003
R squared	0.04	0.03	0.06	0.03	0.04	0.02	0.03	0.02	0.03	0.04	0.01	0.02
P t test	0.11	0.22	0.10	0.69	0.11	0.03	0.34	0.49	0.62	0.16	0.52	0.87
Number of individuals	1,249	1,258	1,251	1,259	1,254	1,260	1,252	1,259	1,255	1,260	1,249	1,260

Notes: FE results are from the regression (2). Teachers' evaluations of child non-cognitive skills are used as dependent variables. Other explanatory variables include the child's characteristics (age, school sectors, and number of siblings), both parents' characteristics (age and education), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 5: Heterogeneity of parental mental health effects by survey waves

		PPVT	MR	Reading	Writing	Spelling	Grammar	Numeracy	Overall	Prosociality	Hyperactivity (reversed)	Emotional (reversed)	Conduct (reversed)	Peer (reversed)
	Estimates from	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Maternal K6 (reversed)	Pooled sample (age 6/13)	0.04	0.03*	0.28	-0.39	0.29	0.35	0.12	-0.06*	-0.01	-0.03**	-0.02*	-0.01	-0.00
		[0.03]	[0.02]	[0.38]	[0.42]	[0.27]	[0.45]	[0.37]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
	Wave 2 (age 6/7)	0.00							-0.15	-0.04	-0.02	0.00	-0.03	-0.06**
		[0.06]							[0.11]	[0.04]	[0.03]	[0.03]	[0.02]	[0.03]
	Wave 3 (age 8/9)	0.01	0.04	0.25	-0.37	0.34	0.34	0.04	-0.01	0.00	-0.03	0.00	-0.00	0.01
		[0.04]	[0.03]	[0.74]	[0.69]	[0.45]	[0.80]	[0.67]	[0.06]	[0.02]	[0.02]	[0.02]	[0.01]	[0.02]
	Wave 4 (age 10/11)		0.02	0.54	-0.87	0.51*	0.63	0.54	-0.05	-0.01	-0.02	-0.03	0.01	0.01
			[0.02]	[0.43]	[0.53]	[0.28]	[0.54]	[0.37]	[0.06]	[0.02]	[0.02]	[0.02]	[0.01]	[0.02]
	Wave 5 (age 12/13)								0.05	0.02	-0.00	-0.01	0.02	0.02
									[0.07]	[0.03]	[0.03]	[0.02]	[0.01]	[0.02]
Paternal K6 (reversed)	Pooled (age 6/13)	0.07**	-0.01	-0.20	0.56	0.18	0.42	-0.43	-0.04	0.00	-0.03**	-0.01	-0.02**	0.00
		[0.03]	[0.02]	[0.38]	[0.45]	[0.28]	[0.42]	[0.34]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
	Wave 2 (age 6/7)	0.17**							-0.29**	-0.08**	-0.12**	-0.03	-0.06*	0.00
		[0.07]							[0.12]	[0.04]	[0.05]	[0.03]	[0.03]	[0.03]
	Wave 3 (age 8/9)	0.04	-0.02	-0.17	0.36	-0.08	-0.28	-1.14**	-0.00	0.02	0.01	-0.01	-0.03**	0.00
		[0.03]	[0.02]	[0.57]	[0.67]	[0.40]	[0.65]	[0.56]	[0.05]	[0.02]	[0.02]	[0.02]	[0.01]	[0.02]
	Wave 4 (age 10/11)		0.03	0.12	0.38	0.28	0.77	0.35	0.13**	0.05**	0.01	0.04*	0.01	0.02
			[0.03]	[0.52]	[0.59]	[0.39]	[0.59]	[0.42]	[0.07]	[0.03]	[0.02]	[0.02]	[0.01]	[0.02]
	Wave 5 (age 12/13)								-0.08	-0.01	-0.05	-0.02	-0.02	0.02
									[0.08]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]

Notes: FE results are from the regression (2). Respective estimates for maternal and paternal K6 are from the same regressions. Teachers' evaluations of child non-cognitive skills are used as dependent variables. Other explanatory variables include the child's characteristics (age, school sectors, and number of siblings), both parents' characteristics (age and education), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. NAPLAN test regressions also include test age and test years. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 6a: Parental health and child cognitive development – Heterogeneity by household annual income

	PPVT		MR		Reading		Writing		Spelling		Grammar		Numeracy	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Mother K6 (reversed)	0.04	0.01	0.03	0.03	0.07	0.48	-0.64	-0.68	-0.39	0.93**	0.65	0.59	0.05	0.26
	[0.05]	[0.06]	[0.02]	[0.03]	[0.62]	[0.59]	[0.66]	[0.64]	[0.44]	[0.43]	[0.70]	[0.79]	[0.53]	[0.59]
Father K6 (reversed)	0.11**	0.05	-0.03	-0.01	-0.18	-0.26	0.14	0.76	-0.31	0.43	0.22	0.12	-0.57	-0.66
	[0.05]	[0.05]	[0.02]	[0.03]	[0.60]	[0.63]	[0.77]	[0.65]	[0.47]	[0.40]	[0.65]	[0.71]	[0.50]	[0.60]
Number of observations	2,421	2,422	3,109	3,110	2,454	2,504	2,445	2,492	2,449	2,499	2,449	2,497	2,437	2,485
R squared	0.72	0.71	0.03	0.05	0.69	0.68	0.53	0.55	0.82	0.84	0.65	0.65	0.77	0.74
P t test	0.32	0.50	0.15	0.45	0.78	0.37	0.43	0.11	0.91	0.39	0.67	0.66	0.40	0.27
Number of individuals	1,344	1,335	1,542	1,503	1,281	1,268	1,278	1,262	1,279	1,264	1,278	1,263	1,274	1,258
Mother depressed	-0.01	-0.57	0.08	0.27	-8.73**	-1.95	-5.20	-1.72	0.22	1.36	1.55	-2.46	-2.66	-0.65
	[0.34]	[0.37]	[0.15]	[0.17]	[3.71]	[3.36]	[4.58]	[3.99]	[2.84]	[2.51]	[3.90]	[4.06]	[3.42]	[3.49]
Father depressed	0.17	0.44	0.02	0.02	0.95	-0.12	3.44	-0.62	2.06	3.28	3.42	-0.02	-1.97	1.34
	[0.36]	[0.34]	[0.14]	[0.18]	[3.38]	[3.56]	[3.86]	[3.85]	[2.26]	[2.35]	[3.76]	[3.90]	[3.40]	[3.23]
Number of observations	1,821	1,827	3,079	3,084	2,430	2,479	2,421	2,467	2,425	2,474	2,425	2,472	2,412	2,460
R squared	0.50	0.52	0.03	0.04	0.70	0.68	0.53	0.55	0.82	0.84	0.65	0.65	0.77	0.74
P t test	0.73	0.04	0.76	0.34	0.04	0.72	0.14	0.85	0.60	0.58	0.73	0.67	0.88	0.69
Number of individuals	1,097	1,100	1,533	1,494	1,271	1,257	1,268	1,251	1,269	1,253	1,268	1,252	1,263	1,247
Mother general health	-0.03	0.03	0.12	0.08	-0.06	1.56	-1.62	0.70	-0.62	1.89	3.94*	4.22*	1.94	-0.36
	[0.19]	[0.19]	[0.09]	[0.10]	[2.12]	[2.15]	[2.60]	[2.09]	[1.54]	[1.38]	[2.13]	[2.50]	[1.79]	[1.95]
Father general health	-0.16	0.27	0.03	0.01	-0.06	-0.92	4.90*	-4.82**	0.40	1.14	2.19	3.32	0.17	-1.47
	[0.21]	[0.17]	[0.09]	[0.10]	[2.10]	[2.30]	[2.67]	[2.44]	[1.66]	[1.46]	[2.50]	[2.55]	[1.97]	[2.01]
Number of observations	2,421	2,422	3,109	3,110	2,454	2,504	2,445	2,492	2,449	2,499	2,449	2,497	2,437	2,485
R squared	0.72	0.71	0.03	0.05	0.69	0.68	0.53	0.55	0.82	0.84	0.65	0.65	0.77	0.74
P t test	0.67	0.34	0.49	0.65	1.00	0.40	0.09	0.09	0.66	0.69	0.62	0.80	0.52	0.69
Number of individuals	1,344	1,335	1,542	1,503	1,281	1,268	1,278	1,262	1,279	1,264	1,278	1,263	1,274	1,258

Notes: FE results are from the regression (2). "Low" ("High") refers to a sub-sample of children from households with annual income below (not below) the median. Other explanatory variables include the child's characteristics (age, school sectors, and number of siblings), both parents' characteristics (age and education), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. NAPLAN test regressions also include test age and test years. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 6b: Parental health and child non-cognitive development – Heterogeneity by household annual income

	Overall		Prosociality		Hyperactivity (reversed)		Emotional (reversed)		Conduct (reversed)		Peer (reversed)	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mother K6 (reversed)	-0.04	-0.05	-0.00	-0.03	-0.01	-0.04*	-0.03**	0.01	-0.00	-0.01	0.01	0.01
	[0.05]	[0.05]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]	[0.01]	[0.01]	[0.02]
Father K6 (reversed)	-0.05	-0.01	0.01	0.01	-0.03	-0.01	-0.01	-0.01	-0.02*	-0.02	-0.01	0.00
	[0.05]	[0.06]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.02]
Number of observations	3,807	3,821	3,819	3,820	3,825	3,836	3,822	3,829	3,823	3,835	3,816	3,828
R squared	0.03	0.03	0.04	0.04	0.03	0.03	0.02	0.02	0.03	0.04	0.03	0.02
P t test	0.88	0.61	0.71	0.20	0.61	0.35	0.27	0.49	0.22	0.63	0.54	0.76
Number of individuals	1,695	1,614	1,701	1,615	1,702	1,619	1,701	1,617	1,702	1,617	1,697	1,614
Mother depressed	-0.06	0.10	-0.06	0.15	0.06	-0.08	-0.05	0.05	0.03	0.07	-0.05	-0.12
	[0.33]	[0.32]	[0.12]	[0.12]	[0.12]	[0.12]	[0.09]	[0.09]	[0.08]	[0.06]	[0.09]	[0.09]
Father depressed	-0.18	-0.50	0.03	0.04	-0.20*	-0.25**	0.03	-0.19**	-0.00	-0.04	-0.06	-0.00
	[0.33]	[0.31]	[0.12]	[0.12]	[0.12]	[0.11]	[0.10]	[0.08]	[0.07]	[0.07]	[0.09]	[0.08]
Number of observations	3,363	3,363	3,368	3,371	3,333	3,429	3,330	3,420	3,379	3,379	3,371	3,372
R squared	0.03	0.03	0.04	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.02	0.03
P t test	0.81	0.17	0.60	0.55	0.14	0.28	0.57	0.06	0.72	0.25	0.90	0.36
Number of individuals	1,563	1,476	1,566	1,480	1,547	1,491	1,546	1,487	1,571	1,481	1,565	1,477
Mother general health	-0.11	-0.13	0.02	-0.05	-0.03	-0.05	-0.10*	-0.08	0.01	0.02	-0.02	0.03
	[0.16]	[0.18]	[0.06]	[0.07]	[0.06]	[0.07]	[0.05]	[0.05]	[0.03]	[0.04]	[0.05]	[0.05]
Father general health	0.06	0.19	0.05	0.11	-0.04	-0.02	0.01	0.02	0.01	0.03	0.06	0.04
	[0.18]	[0.19]	[0.06]	[0.07]	[0.06]	[0.07]	[0.06]	[0.06]	[0.04]	[0.04]	[0.05]	[0.05]
Number of observations	3,807	3,821	3,819	3,820	3,825	3,836	3,822	3,829	3,823	3,835	3,816	3,828
R squared	0.03	0.03	0.04	0.04	0.03	0.03	0.02	0.02	0.03	0.04	0.03	0.02
P t test	0.48	0.21	0.78	0.12	0.91	0.78	0.17	0.16	0.92	0.85	0.22	0.94
Number of individuals	1,695	1,614	1,701	1,615	1,702	1,619	1,701	1,617	1,702	1,617	1,697	1,614

Notes: FE results are from the regression (2). "Low" ("High") refers to a sub-sample of children from households with annual income below (not below) the median. Teachers' evaluations of child non-cognitive skills are used as dependent variables. Other explanatory variables include the child's characteristics (age, school sectors, and number of siblings), both parents' characteristics (age and education), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 7a: Robustness checks - with inclusion of child health

	PPVT	MR	Reading	Writing	Spelling	Grammar	Numeracy	Overall	Prosociality	Hyperactivity (reversed)	Emotional (reversed)	Conduct (reversed)	Peer (reversed)
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Mother K6 (reversed)	0.04	0.03*	0.28	-0.39	0.27	0.34	0.13	-0.06*	-0.01	-0.03**	-0.02	-0.01	-0.00
	[0.03]	[0.02]	[0.38]	[0.42]	[0.27]	[0.45]	[0.37]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Father K6 (reversed)	0.07**	-0.01	-0.20	0.56	0.18	0.42	-0.43	-0.04	0.00	-0.03**	-0.01	-0.02**	0.00
	[0.03]	[0.02]	[0.38]	[0.45]	[0.28]	[0.42]	[0.34]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Number of observations	5,089	6,473	5,172	5,152	5,163	5,161	5,134	7,993	8,007	8,029	8,017	8,027	8,012
R squared	0.72	0.02	0.69	0.54	0.83	0.65	0.76	0.02	0.03	0.02	0.02	0.03	0.01
P t test	0.49	0.14	0.38	0.11	0.82	0.90	0.26	0.78	0.53	0.95	0.50	0.22	0.90
Number of individuals	2,211	2,430	2,095	2,090	2,093	2,092	2,081	2,507	2,510	2,514	2,511	2,515	2,509
Mother depressed	-0.16	0.16*	-5.18**	-2.73	0.30	0.37	-0.67	0.05	0.03	0.03	-0.02	0.06	-0.07
	[0.22]	[0.10]	[2.17]	[2.67]	[1.66]	[2.42]	[2.11]	[0.20]	[0.08]	[0.08]	[0.06]	[0.04]	[0.06]
Father depressed	0.17	0.09	0.24	-0.11	1.80	-0.08	-1.54	-0.35*	-0.02	-0.22***	-0.06	-0.01	-0.02
	[0.22]	[0.10]	[2.10]	[2.45]	[1.46]	[2.42]	[1.99]	[0.20]	[0.07]	[0.08]	[0.06]	[0.04]	[0.05]
Number of observations	3,786	6,417	5,119	5,099	5,110	5,108	5,080	7,024	7,040	7,063	7,049	7,060	7,044
R squared	0.49	0.02	0.69	0.54	0.83	0.65	0.76	0.02	0.02	0.02	0.02	0.02	0.01
P t test	0.28	0.57	0.07	0.48	0.50	0.90	0.76	0.16	0.65	0.02	0.63	0.22	0.52
Number of individuals	1,893	2,420	2,078	2,073	2,076	2,075	2,063	2,357	2,362	2,367	2,362	2,367	2,360
Mother general health	-0.04	0.09	0.48	-0.10	0.39	2.05	0.46	-0.08	-0.02	-0.02	-0.05	0.01	-0.00
	[0.12]	[0.06]	[1.32]	[1.53]	[0.91]	[1.49]	[1.19]	[0.11]	[0.04]	[0.04]	[0.03]	[0.02]	[0.03]
Father general health	-0.02	0.01	-0.68	0.66	0.17	3.27**	-0.57	-0.05	0.03	-0.06	-0.00	-0.01	0.01
	[0.12]	[0.06]	[1.36]	[1.60]	[0.96]	[1.54]	[1.21]	[0.12]	[0.04]	[0.04]	[0.04]	[0.02]	[0.03]
Number of observations	5,089	6,473	5,172	5,152	5,163	5,161	5,134	7,993	8,007	8,029	8,017	8,027	8,012
R squared	0.71	0.02	0.69	0.54	0.83	0.65	0.76	0.02	0.03	0.02	0.02	0.03	0.01
P t test	0.88	0.36	0.54	0.74	0.87	0.59	0.55	0.86	0.39	0.50	0.36	0.51	0.83
Number of individuals	2,211	2,430	2,095	2,090	2,093	2,092	2,081	2,507	2,510	2,514	2,511	2,515	2,509

Notes: FE results are from the regression (2). Teachers' evaluations of child non-cognitive skills are used as dependent variables. Other explanatory variables include the child's characteristics (age, school sectors, number of siblings, and general health), both parents' characteristics (age and education), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. NAPLAN test regressions also include test age and test years. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 7b: Robustness checks - with inclusion of household annual income

	PPVT	MR	Reading	Writing	Spelling	Grammar	Numeracy	Overall	Prosociality	Hyperactivity (reversed)	Emotional (reversed)	Conduct (reversed)	Peer (reversed)
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Mother K6 (reversed)	0.04	0.03*	0.22	-0.40	0.16	0.30	0.02	-0.07**	-0.01	-0.03**	-0.02*	-0.01	-0.00
	[0.03]	[0.02]	[0.39]	[0.42]	[0.28]	[0.47]	[0.39]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Father K6 (reversed)	0.08**	-0.01	-0.12	0.56	0.12	0.41	-0.44	-0.04	0.00	-0.03**	-0.01	-0.02**	0.00
	[0.03]	[0.02]	[0.39]	[0.45]	[0.28]	[0.43]	[0.35]	[0.04]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Number of observations	4,842	6,219	4,958	4,937	4,948	4,946	4,922	7,627	7,638	7,660	7,650	7,657	7,643
R squared	0.72	0.02	0.69	0.54	0.83	0.64	0.76	0.02	0.03	0.02	0.01	0.03	0.01
P t test	0.41	0.10	0.55	0.11	0.92	0.88	0.37	0.58	0.35	0.87	0.42	0.29	0.83
Number of individuals	2,120	2,360	2,020	2,014	2,017	2,016	2,007	2,432	2,434	2,438	2,436	2,438	2,433
Mother depressed	-0.20	0.17*	-5.96***	-2.81	0.18	0.55	-1.77	-0.02	0.01	0.02	-0.02	0.05	-0.10*
	[0.22]	[0.10]	[2.24]	[2.73]	[1.73]	[2.48]	[2.17]	[0.21]	[0.08]	[0.08]	[0.06]	[0.04]	[0.06]
Father depressed	0.23	0.06	0.70	0.72	1.50	0.71	-0.88	-0.41**	-0.04	-0.25***	-0.06	-0.01	-0.04
	[0.22]	[0.10]	[2.19]	[2.50]	[1.49]	[2.49]	[2.05]	[0.20]	[0.08]	[0.08]	[0.06]	[0.04]	[0.05]
Number of observations	3,648	6,163	4,909	4,888	4,899	4,897	4,872	6,726	6,739	6,762	6,750	6,758	6,743
R squared	0.49	0.02	0.69	0.54	0.83	0.64	0.76	0.02	0.02	0.02	0.02	0.01	0.01
P t test	0.17	0.42	0.03	0.35	0.56	0.96	0.76	0.18	0.63	0.02	0.61	0.34	0.50
Number of individuals	1,824	2,348	2,004	1,998	2,001	2,000	1,990	2,289	2,293	2,298	2,294	2,297	2,291
Mother general health	-0.04	0.10	0.47	-0.00	0.67	2.45	0.21	-0.16	-0.04	-0.05	-0.07**	-0.00	-0.00
	[0.12]	[0.06]	[1.35]	[1.54]	[0.94]	[1.52]	[1.21]	[0.11]	[0.04]	[0.04]	[0.03]	[0.02]	[0.03]
Father general health	-0.05	0.00	-1.01	0.95	0.34	3.04*	-0.14	-0.04	0.03	-0.06	-0.00	-0.00	0.01
	[0.12]	[0.06]	[1.41]	[1.65]	[1.00]	[1.59]	[1.26]	[0.12]	[0.04]	[0.04]	[0.04]	[0.02]	[0.03]
Number of observations	4,842	6,219	4,958	4,937	4,948	4,946	4,922	7,627	7,638	7,660	7,650	7,657	7,643
R squared	0.71	0.02	0.69	0.54	0.83	0.65	0.76	0.02	0.03	0.02	0.01	0.03	0.01
P t test	0.99	0.28	0.44	0.68	0.81	0.80	0.84	0.45	0.27	0.81	0.19	0.99	0.68
Number of individuals	2,120	2,360	2,020	2,014	2,017	2,016	2,007	2,432	2,434	2,438	2,436	2,438	2,433

Notes: FE results are from the regression (2). Teachers' evaluations of child non-cognitive skills are used as dependent variables. Other explanatory variables include the child's characteristics (age, school sectors, and number of siblings), both parents' characteristics (age and education), log (real household yearly income), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. NAPLAN test regressions also include test age and test years. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 7c: Robustness checks - with inclusion of parental weekly working hours

	PPVT	MR	Reading	Writing	Spelling	Grammar	Numeracy	Overall	Prosociality	Hyperactivity (reversed)	Emotional (reversed)	Conduct (reversed)	Peer (reversed)
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Mother K6 (reversed)	0.04	0.03*	0.28	-0.38	0.29	0.38	0.12	-0.06*	-0.01	-0.03**	-0.02*	-0.01	-0.00
	[0.03]	[0.02]	[0.38]	[0.42]	[0.27]	[0.45]	[0.38]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Father K6 (reversed)	0.07**	-0.01	-0.21	0.57	0.18	0.44	-0.43	-0.04	0.00	-0.03**	-0.01	-0.02**	0.00
	[0.03]	[0.02]	[0.38]	[0.45]	[0.28]	[0.42]	[0.34]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Number of observations	5,077	6,474	5,172	5,152	5,163	5,161	5,134	7,988	8,002	8,024	8,012	8,022	8,007
R squared	0.71	0.02	0.69	0.54	0.83	0.65	0.76	0.02	0.03	0.02	0.01	0.03	0.01
P t test	0.48	0.13	0.38	0.11	0.79	0.92	0.27	0.73	0.52	0.93	0.43	0.22	0.85
Number of individuals	2,207	2,430	2,095	2,090	2,093	2,092	2,081	2,507	2,510	2,514	2,511	2,515	2,509
Mother depressed	-0.17	0.16*	-5.22**	-2.66	0.33	0.54	-0.67	0.04	0.02	0.03	-0.02	0.06	-0.07
	[0.22]	[0.10]	[2.17]	[2.67]	[1.67]	[2.43]	[2.11]	[0.20]	[0.08]	[0.08]	[0.06]	[0.04]	[0.06]
Father depressed	0.16	0.08	0.21	-0.07	1.83	-0.01	-1.55	-0.36*	-0.02	-0.22***	-0.07	-0.01	-0.03
	[0.22]	[0.10]	[2.10]	[2.45]	[1.45]	[2.42]	[1.99]	[0.20]	[0.07]	[0.07]	[0.06]	[0.04]	[0.05]
Number of observations	3,786	6,418	5,119	5,099	5,110	5,108	5,080	7,025	7,041	7,064	7,050	7,061	7,045
R squared	0.49	0.02	0.69	0.54	0.83	0.65	0.76	0.02	0.02	0.02	0.02	0.02	0.01
P t test	0.29	0.58	0.07	0.48	0.50	0.87	0.76	0.15	0.65	0.02	0.56	0.23	0.56
Number of individuals	1,893	2,420	2,078	2,073	2,076	2,075	2,063	2,357	2,362	2,367	2,362	2,367	2,360
Mother general health	-0.06	0.10*	0.50	-0.16	0.53	2.13	0.33	-0.10	-0.02	-0.02	-0.06*	0.01	-0.00
	[0.12]	[0.06]	[1.32]	[1.51]	[0.91]	[1.48]	[1.18]	[0.11]	[0.04]	[0.04]	[0.03]	[0.02]	[0.03]
Father general health	-0.02	0.01	-0.70	0.70	0.14	3.32**	-0.54	-0.06	0.02	-0.07	-0.00	-0.01	0.01
	[0.12]	[0.06]	[1.36]	[1.61]	[0.96]	[1.54]	[1.21]	[0.12]	[0.04]	[0.04]	[0.04]	[0.02]	[0.03]
Number of observations	5,077	6,474	5,172	5,152	5,163	5,161	5,134	7,988	8,002	8,024	8,012	8,022	8,007
R squared	0.71	0.02	0.69	0.54	0.83	0.65	0.76	0.02	0.03	0.02	0.01	0.03	0.01
P t test	0.83	0.30	0.52	0.70	0.77	0.59	0.61	0.83	0.42	0.46	0.21	0.44	0.78
Number of individuals	2,207	2,430	2,095	2,090	2,093	2,092	2,081	2,507	2,510	2,514	2,511	2,515	2,509

Notes: FE results are from the regression (2). Teachers' evaluations of child non-cognitive skills are used as dependent variables. Other explanatory variables include the child's characteristics (age, school sectors, and number of siblings), both parents' characteristics (age, education, weekly working hours), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. NAPLAN test regressions also include test age and test years. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 7d: Robustness checks - Missing information from teachers' evaluations of child non-cognitive skills

	Overall		Prosociality		Hyperactivity (reversed)		Emotional (reversed)		Conduct (reversed)		Peer (reversed)	
	Parents	Teachers	Parents	Teachers	Parents	Teachers	Parents	Teachers	Parents	Teachers	Parents	Teachers
Parental health measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mother K6 (reversed)	-0.19***	-0.06*	-0.03***	-0.01	-0.05***	-0.03**	-0.06***	-0.02*	-0.03***	-0.01	-0.02**	-0.00
	[0.02]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Father K6 (reversed)	-0.03	-0.05	-0.00	0.00	0.00	-0.03**	-0.00	-0.01	-0.01*	-0.02**	-0.01	0.00
	[0.02]	[0.03]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Number of observations	7,982	7,982	7,998	7,998	8,020	8,020	8,007	8,007	8,018	8,018	8,002	8,002
R squared	0.06	0.02	0.05	0.03	0.03	0.02	0.04	0.01	0.14	0.03	0.01	0.01
P t test	0.00	0.80	0.02	0.54	0.00	0.98	0.00	0.44	0.01	0.20	0.69	0.89
Number of individuals	2,505	2,505	2,508	2,508	2,512	2,512	2,509	2,509	2,513	2,513	2,507	2,507
Mother depressed	-0.27*	0.05	0.05	0.03	-0.07	0.03	-0.13**	-0.02	-0.05	0.06	-0.09*	-0.07
	[0.14]	[0.20]	[0.05]	[0.08]	[0.05]	[0.08]	[0.05]	[0.06]	[0.04]	[0.04]	[0.05]	[0.06]
Father depressed	-0.10	-0.36*	-0.02	-0.02	-0.09	-0.22***	0.04	-0.07	0.00	-0.01	-0.02	-0.02
	[0.13]	[0.20]	[0.05]	[0.07]	[0.05]	[0.08]	[0.05]	[0.06]	[0.04]	[0.04]	[0.04]	[0.05]
Number of observations	7,014	7,014	7,032	7,032	7,055	7,055	7,040	7,040	7,052	7,052	7,035	7,035
R squared	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.01	0.06	0.02	0.01	0.01
P t test	0.41	0.15	0.32	0.63	0.80	0.02	0.02	0.59	0.29	0.22	0.31	0.56
Number of individuals	2,355	2,355	2,360	2,360	2,365	2,365	2,360	2,360	2,365	2,365	2,358	2,358
Mother general health	-0.23***	-0.10	-0.05*	-0.02	-0.00	-0.02	-0.11***	-0.06*	-0.02	0.01	-0.05**	-0.00
	[0.08]	[0.11]	[0.03]	[0.04]	[0.03]	[0.04]	[0.03]	[0.03]	[0.02]	[0.02]	[0.03]	[0.03]
Father general health	-0.18**	-0.06	-0.06**	0.03	-0.04	-0.07	-0.05	-0.00	-0.03	-0.01	-0.02	0.01
	[0.08]	[0.12]	[0.03]	[0.04]	[0.03]	[0.04]	[0.03]	[0.04]	[0.02]	[0.02]	[0.03]	[0.03]
Number of observations	7,982	7,982	7,998	7,998	8,020	8,020	8,007	8,007	8,018	8,018	8,002	8,002
R squared	0.05	0.02	0.04	0.03	0.02	0.02	0.03	0.01	0.14	0.03	0.01	0.01
P t test	0.70	0.80	0.89	0.39	0.43	0.48	0.13	0.21	0.93	0.45	0.29	0.79
Number of individuals	2,505	2,505	2,508	2,508	2,512	2,512	2,509	2,509	2,513	2,513	2,507	2,507

Notes: FE results are from the regression (2). Parents' and teachers' evaluations of non-cognitive outcomes are used as dependent variables. Other explanatory variables include the child's characteristics (age, school sectors, and number of siblings), both parents' characteristics (age and education), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. P t test: P value of a t test for equality of maternal and paternal health estimates. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Table 7e: Robustness checks - Reverse causality

	K6 (reversed)		Depressed		General health	
	Mother	Father	Mother	Father	Mother	Father
Lag one wave of	(1)	(2)	(3)	(4)	(5)	(6)
PPVT	0.00	-0.01	-0.00	0.00	-0.00	0.00
	[0.01]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
MR	0.01	-0.01	0.00	-0.00	0.01	0.00
	[0.02]	[0.02]	[0.00]	[0.00]	[0.00]	[0.00]
Reading	0.00	-0.00	0.00	-0.00	0.00	0.00
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Writing	0.00	0.00	-0.00	-0.00	-0.00	-0.00
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Spelling	-0.00	0.00	0.00	0.00	-0.00	0.00
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Grammar	-0.00*	0.00	-0.00	-0.00	0.00	-0.00
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Numeracy	-0.00	0.00	-0.00	-0.00	0.00	-0.00*
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Overall	-0.00	0.00	-0.00	-0.00	-0.00	-0.00
	[0.01]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
Prosociality	0.02	-0.01	0.00*	-0.00	0.00	-0.00
	[0.02]	[0.02]	[0.00]	[0.00]	[0.00]	[0.00]
Hyperactivity (reversed)	-0.00	-0.00	-0.01	-0.00	0.00	-0.01
	[0.02]	[0.02]	[0.00]	[0.00]	[0.00]	[0.00]
Emotional (reversed)	-0.05**	0.02	-0.01*	-0.00	-0.01	0.00
	[0.02]	[0.02]	[0.00]	[0.00]	[0.01]	[0.01]
Conduct (reversed)	-0.01	0.00	-0.01**	0.00	-0.01*	-0.01
	[0.03]	[0.03]	[0.00]	[0.01]	[0.01]	[0.01]
Peer (reversed)	0.01	-0.01	0.00	-0.00	0.00	-0.01
	[0.02]	[0.02]	[0.00]	[0.00]	[0.01]	[0.01]

Notes: Each estimate is from a separate FE regression of each of parental health measures on one wave lag of each of child development outcomes. Teachers' evaluations of child non-cognitive skills are used as independent variables. Other explanatory variables include the child's characteristics (age, school sectors, and number of siblings), both parents' characteristics (age and education), local socio-economic background variables, state/territory dummies, year dummies, and survey quarters. NAPLAN test regressions also include test age and test years. Robust standard errors clustered at the individual level in parentheses. The symbol *denotes significance at the 10% level, **at the 5% level, and ***at the 1% level.

Appendix Table A1: Summary statistics

Variable	Description	Mean	S.D.
Maternal K6 (rev.)	As in the text	8.94	3.17
Paternal K6 (rev.)	As in the text	8.78	3.03
Mother depressed	Dummy: = 1 if mother was depressed for two weeks or more in the year prior to the survey time, = 0 otherwise	0.24	0.43
Father depressed	Dummy: = 1 if father was depressed for two weeks or more in the year prior to the survey time , = 0 otherwise	0.26	0.44
Maternal general health	As in the text	2.21	0.87
Paternal general health	As in the text	2.3	0.89
PPVT	Peabody Picture Vocabulary Test score	74.7	6.91
MR	Matrix Reasoning score	10.93	2.97
Reading	NAPLAN reading score	513.63	93.31
Writing	NAPLAN writing score	500.57	81.53
Spelling	NAPLAN spelling score	500.98	86.12
Grammar	NAPLAN grammar score	519.56	95.04
Numeracy	NAPLAN numeracy score	508.59	90.56
Overall non-cognitive scale [(a)]	As in the text	41.19	5.84
Prosociality [(a)]	As in the text	8.32	1.69
Hyperactivity (rev.) [(a)]	As in the text	7.02	2.27
Emotional (rev.) [(a)]	As in the text	8.43	1.7
Conduct (rev.) [(a)]	As in the text	8.75	1.45
Peer (rev.) [(a)]	As in the text	8.67	1.56
Overall non-cognitive scale [(b)]	As in the text	42.51	6.69
Prosociality [(b)]	As in the text	7.74	2.2
Hyperactivity (rev.) [(b)]	As in the text	7.66	2.57
Emotional (rev.) [(b)]	As in the text	8.91	1.63
Conduct (rev.) [(b)]	As in the text	9.37	1.32
Peer (rev.) [(b)]	As in the text	8.82	1.62
Male	Dummy: = 1 if child is male, = 0 otherwise	0.50	
Child age	Child age (months)	109.62	31.44
Native	Dummy: = if child was born in Australia, = 0 otherwise	0.96	
Aboriginal	Dummy: = 1 if child has Aboriginal/Torres Strait Islander origin, = 0 otherwise	0.01	
Low birth weight	Dummy: = 1 if child's birth weight is 2500 grams or less, = 0 otherwise	0.06	
Mother age	Mother age (years)	40.03	5.28
Mother NESB	Dummy: = 1 if mother was born in a Non-English Speaking Background (NESB) country, = 0 otherwise	0.21	
Mother ESB	Dummy: = 1 if mother was born in an English Speaking Background (ESB) country, = 0 otherwise	0.16	
Mother education: Certificate	Dummy: = 1 if mother has a certificate, = 0 otherwise	0.27	0.44
Mother education: Diploma	Dummy: = 1 if mother has advanced diploma/diploma, = 0 otherwise	0.10	0.31
Mother education: Bachelor	Dummy: = 1 if mother has a bachelor degree, = 0 otherwise	0.21	0.41
Mother education: Graduate	Dummy: = 1 if mother has graduate diploma/certificate, = 0 otherwise	0.09	0.29
Mother education: Postgraduate	Dummy: = 1 if mother has a postgraduate degree, = 0 otherwise	0.09	0.29
Father age	Father age (years)	42.37	6.2
Father NESB	Dummy: = 1 if father was born in a NESB country, = 0 otherwise	0.24	
Father ESB	Dummy: = 1 if father was born in an ESB country, = 0 otherwise	0.17	
Father education: Certificate	Dummy: = 1 if father has a certificate, = 0 otherwise	0.36	0.48
Father education: Diploma	Dummy: = 1 if father has advanced diploma/diploma, = 0 otherwise	0.10	0.30
Father education: Bachelor	Dummy: = 1 if father has a bachelor degree, = 0 otherwise	0.17	0.38
Father education: Graduate	Dummy: = 1 if father has graduate diploma/certificate, = 0 otherwise	0.07	0.26
Father education: Postgraduate	Dummy: = 1 if father has a postgraduate degree, = 0 otherwise	0.11	0.31
Catholic school	Dummy: = 1 if child attends a Catholic school, = 0 otherwise	0.23	0.42
Independent school	Dummy: = 1 if child attends an Independent school, = 0 otherwise	0.17	0.37
Number of older siblings	Number of older siblings	0.80	0.88
Number of younger siblings	Number of younger siblings	0.74	0.81
Number of same age siblings	Number of same age siblings	0.03	0.19

Notes: Figures are calculated using a regression sample of overall non-cognitive skill scale reported by parents on parental K6 measure. [(a)] denotes reports from parents while [(b)] represents reports from teachers.

Appendix Table A2: Correlation structure

	Maternal K6 (rev.)	Paternal K6 (rev.)	Mother depressed	Father depressed	Maternal general health	Paternal general health	PPVT	MR	Reading	Writing	Spelling	Grammar	Numeracy	Overall non-cognitive scale [a]	Prosociality [a]	Hyperactivity (rev.) [a]	Emotional (rev.) [a]	Conduct (rev.) [a]	Peer (rev.) [a]	Overall non-cognitive scale [b]	Prosociality [b]	Hyperactivity (rev.) [b]	Emotional (rev.) [b]	Conduct (rev.) [b]	Peer (rev.) [b]
Maternal K6 (rev.)	1.00																								
Paternal K6 (rev.)	0.21	1.00																							
Mother depressed	0.46	0.10	1.00																						
Father depressed	0.14	0.49	0.12	1.00																					
Maternal general health	0.36	0.11	0.26	0.08	1.00																				
Paternal general health	0.11	0.30	0.07	0.23	0.18	1.00																			
PPVT	-0.08				-0.05	-0.07	1.00																		
MR						-0.02	0.31	1.00																	
Reading		-0.03		-0.06	-0.03	-0.03	0.54	0.36	1.00																
Writing				-0.06	-0.04	-0.03	0.41	0.30	0.70	1.00															
Spelling				-0.07	-0.03	-0.03	0.40	0.31	0.75	0.73	1.00														
Grammar		-0.03		-0.06	-0.04		0.47	0.36	0.79	0.70	0.78	1.00													
Numeracy		-0.03		-0.07			0.47	0.40	0.76	0.65	0.75	0.75	1.00												
Overall non-cognitive scale [a]	-0.32	-0.15	-0.19	-0.11	-0.21	-0.14	0.18	0.13	0.18	0.21	0.17	0.18	0.14	1.00											
Prosociality [a]	-0.15	-0.09	-0.05	-0.05	-0.09	-0.09	0.11	0.03	0.08	0.10	0.06	0.08	0.03	0.63	1.00										
Hyperactivity (rev.) [a]	-0.21	-0.10	-0.13	-0.09	-0.13	-0.11	0.13	0.16	0.22	0.24	0.22	0.23	0.18	0.75	0.32	1.00									
Emotional (rev.) [a]	-0.27	-0.09	-0.17	-0.07	-0.18	-0.09	0.07	0.06	0.04	0.06	0.05	0.04	0.05	0.61	0.14	0.26	1.00								
Conduct (rev.) [a]	-0.25	-0.13	-0.15	-0.09	-0.14	-0.10	0.22	0.10	0.15	0.16	0.15	0.17	0.12	0.71	0.41	0.47	0.30	1.00							
Peer (rev.) [a]	-0.21	-0.10	-0.14	-0.07	-0.16	-0.09	0.07	0.05	0.05	0.09	0.06	0.06	0.05	0.64	0.26	0.29	0.40	0.29	1.00						
Overall non-cognitive scale [b]	-0.09	-0.08	-0.07	-0.08	-0.07	-0.08	0.13	0.14	0.21	0.27	0.23	0.23	0.19	0.47	0.29	0.43	0.16	0.33	0.34	1.00					
Prosociality [b]	-0.06	-0.05	-0.04	-0.04	-0.04	-0.06	0.13	0.07	0.11	0.16	0.09	0.12	0.06	0.34	0.30	0.29	0.06	0.25	0.22	0.78	1.00				
Hyperactivity (rev.) [b]	-0.07	-0.06	-0.05	-0.07	-0.04	-0.06	0.10	0.17	0.27	0.32	0.29	0.30	0.23	0.39	0.22	0.47	0.06	0.28	0.19	0.81	0.54	1.00			
Emotional (rev.) [b]	-0.07	-0.05	-0.06	-0.05	-0.07	-0.04	0.07	0.11	0.15	0.15	0.17	0.15	0.17	0.25	0.10	0.15	0.28	0.10	0.22	0.52	0.16	0.22	1.00		
Conduct (rev.) [b]	-0.06	-0.07	-0.04	-0.06	-0.02	-0.06	0.09	0.08	0.14	0.17	0.15	0.14	0.12	0.35	0.22	0.31	0.06	0.34	0.22	0.74	0.56	0.57	0.20	1.00	
Peer (rev.) [b]	-0.08	-0.06	-0.07	-0.05	-0.08	-0.06	0.05	0.06	0.04	0.09	0.07	0.05	0.05	0.34	0.16	0.23	0.16	0.19	0.40	0.67	0.39	0.32	0.40	0.39	1.00

Notes: Figures are calculated using a regression sample of overall non-cognitive skill scale reported by parents on parental K6 measure. [a] denotes reports from parents while [b] represents reports from teachers. Only correlation with statistical significance level of 5 % or higher is listed.

The Bankwest Curtin Economics Centre is an independent economic and social research organisation located within the Curtin Business School at Curtin University. The Centre was established in 2012 through the generous support from Bankwest (a division of the Commonwealth Bank of Australia), with a core mission to undertake high quality, objective research on the key economic and social issues of relevance to Western Australia.

The Centre's research and engagement activities are designed to influence economic and social policy debates in state and Federal Parliament, regional and national media, and the wider Australian community. Through high quality, evidence-based research and analysis, our research outcomes inform policy makers and commentators of the economic challenges to achieving sustainable and equitable growth and prosperity both in Western Australia and nationally.

The Centre capitalises on Curtin University's reputation for excellence in economic modelling, forecasting, public policy research, trade and industrial economics and spatial sciences. Centre researchers have specific expertise in economic forecasting, quantitative modelling, microdata analysis and economic and social policy evaluation.

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