The Income Gradient and Child Mental Health in Australia: Does It Vary by Assessors?

Abstract

In this paper, we examine the income gradient in child mental health using longitudinal data from a large, national cohort of Australian children. We contribute to the body of existing literature by: (i) investigating whether and to what extent a child's mental health levels and their relationship to income vary when a child's mental health is assessed by the child's parent, the child's teacher and the child her/himself; (ii) exploring whether the reporting differences in a child's mental health is associated systematically with household income; and (iii) examining the child mental health gradient and the evolution of this gradient by the child's age. We found that a child's mental health and the income gradient vary depending on who assesses the child's mental health (the gradient was the largest when assessed by parents, and the smallest when assessed by the child). Further, the magnitude of the effect of mental health and income gradient faded when we controlled for some important variables, such as maternal health.

Keywords: income; child mental health; children's socio-emotional outcomes; assessors; Australia; panel data

JEL Classification: I12, I14

1. Introduction

Childhood circumstances, including a child's physical and mental health, are gaining increasing attention amongst researchers and policymakers, as there is a growing recognition of their short- and long-term effects on schooling, health, and labour market participation and outcomes (Cornaglia, Crivellaro, & McNally, 2015; Currie & Stabile, 2006; Fletcher & Wolfe, 2008; Fletcher, 2008; Frijters, Johnston, & Shields, 2014; Richards & Abbott, 2009). Childhood health, especially mental health, affects the child's cognitive performance and educational attainment (Currie & Stabile, 2006; Fletcher, 2008; Feltcher & Wolfe, 2008; Richard & Abbott, 2009; Cornaglia *et al.*, 2015; ~~(~~Khanam & Nghiem, 2017); with flow-on consequences on subsequent labor market prospects, and adult socio-economic status (Frijters *et al.*, 2014). Thus, a vicious cycle may be established whereby poor health during childhood progressively leads to lower cognitive performance, poorer educational attainment, low-income jobs, lower consumption of health inputs (e.g. healthy food), and a deterioration in adult health (Halleröd & Gustafsson, 2011). Therefore, gaining a deeper understanding of the socio-economic determinants of poor childhood health not only extends disciplinary knowledge but can also contribute to policies aimed at reducing early-life socio-economic inequalities.

There is extensive literature (see ~~e.g.,~~ Case *et al.* (2002); Apouey & Geoffard, 2013; Condliffe & Link, 2008; Currie *et al.*, 2007; Khanam *et al.*, 2009, 2013; Kruk, 2013; Reiss 2013; Kuehnle, 2014; Nghiem and Khanam, 2016; Propper *et al.*, 2007; Reinhold & Jurges, 2011 ~~among~~ and others) that has explored the relationship between income gradient and the physical and mental health of children. Most of these studies have found a significant income gradient in child health, whereby lower family income leads to poorer child health. In a systematic review by Reiss (2013), 52 of 55 studies revealed inverse relationships between socio-economic status (SES) and mental health problems in children and adolescents. Strohschein (2005) provided a useful review of early studies and empirical evidence on the influence of household income on child mental health for children aged 4 to 14 years using longitudinal data from the 1986-1998 Child Supplement of the National Longitudinal Study of Youth. The author found that low parental income levels when the child was aged four were associated with higher incidences of depression and antisocial behaviour. Fitzsimons *et al.* (2017) examined the effects of temporary and persistent poverty on child mental health using the British Millennium Cohort Study (MCS) and found that both poverty measures were associated with poor mental health, but effects of persistent poverty were greater than temporary poverty.

As the definition of mental health is not as clear as physical health, establishing a relationship between income gradient and mental health is difficult compared to physical health. In general, the existent income gradient literature uses self-reported mental health assessments that are routinely collected in survey data. However, individuals' socio-economic background and income may affect how they

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perceive health, which in turn, may produce biased estimates of the income gradient. Growing literature on adult health (Bago d'Uva, Van Doorslaer, Lindeboom, & O'donnell, 2008; Etilé & Milcent, 2006; Johnston, Propper, & Shields, 2009; Lindeboom & Van Doorslaer, 2004; Mackenbach, Looman, & Meer, 1996) supports this view in self-reports of adult health. Reports of child health in survey data are generally collected from parents (and in a few cases from teachers). However, reports of child health from different observers may provide a different and more insightful perspective on the child's health, especially when it is mental health. The assessment of child mental health may be related to the observer's socio-economic position, the observer's experience about a particular health issue, relationship with a child, and the environment where the child's health is assessed. Further, a child may exhibit different symptoms in different settings. All of these factors are likely to be an issue in the evaluation of a child's health status, particularly their mental health, compared to their physical health (e.g., asthma, diabetes or other chronic diseases), and these factors may account for the difference in assessments from different assessors. Literature from psychology and medicine (Brown et al., 2006; Goodman, Ford, Simmons, Gatward, & Meltzer, 2000; Youngstrom, Findling, & Calabrese, 2003) have already demonstrated the disagreements between assessors about the assessment of a child's psychological wellbeing. The implication of this is that relying on one particular assessor rather than other types of assessors may lead to different estimated rates of prevalence.

In this paper, we have the opportunity to evaluate child mental health from the perspective of children themselves, their teachers, as well as their parents, using data from a unique national cohort study: the Longitudinal Study of Australian Children (LSAC). To the best of our knowledge, only Johnston et al. (2014) used opinions from three assessors (parents, teachers or children) to investigate the prevalence of child mental health using British data. We provide the first Australian econometric evidence on the relationship between income and child mental health using high-quality panel data from the LSAC to investigate: whether and to what extent the prevalence of child mental health varies with assessors, and what implications does this have on the estimates of the income-child mental health gradient.

The assessment of child mental health from multiple assessors provides us with further opportunity to test several useful hypotheses. First, the assessment of child mental health is prone to measurement

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errors, and hence assessment from multiple assessors can act as a robustness check. Thus, we hypothesise that if measurement error is the sole source of variations, the differences between assessors will not be statistically significant. Second, different assessors may also introduce their specific reporting biases based on different experiences, knowledge and skill level and relationship with the child. ~~Because of this~~Thu, we expect to find significant differences between assessors. Third, symptoms of mental health will become clearer and more apparent as the child ages, thus, we hypothesise that differences between assessors (if any) will reduce with the age of the child. Fourth, as the existcant literature (see~~,~~ ~~for example,~~ Case *et al.* ~~(~~2002~~)~~; Khanam *et al.*, 2009, 2013; Reiss 2013; Propper *et al.*, 2007; Reinhold & Jurges, 2011) reported an association between income and child health, therefore, we hypothesise that differences in the assessment of child mental health may also be systematically associated with income.

One of the aims of the present study was also to investigate whether child mental health reporting variations found by Johnston *et al.* (2014) can be confirmed using Australian data. The LSAC data enabled us not only to replicate the findings by Johnston *et al.* (2014) in a new geographical context, but also to expand the literature by testing additional hypotheses. Specifically, we investigated: (1) the extent to which child mental health varies by assessor (a parent, the child, and a teacher) and by the child's age (ages 10/11, 12/13, and 14/15),~~;~~ (2) whether assessor differences in child mental health were patterned by differences in parental income,~~;~~ (3) whether there is a child mental health/income gradient in Australia,~~;~~ and, if so, (4) whether such a gradient is robust with choice of variables and estimators. The latter is an important contribution, as most previous studies in this field either did not have access to panel data (see ~~for example,~~ Case *et al.*, 2002; Currie & Stabile, 2003; Currie *et al.*, 2007, 2008; Propper *et al.*, 2007; Reinhold & Jürges, 2012; Johnston *et al.*, 2014) or did have access, but did not exploit their properties by modelling them using panel estimators (see ~~for example,~~ Apouey & Geoffard, 2013; Kuehnle, 2014).

Our results provide evidence of an income gradient in child mental health in the Australian context when using similar covariates and models to those deployed by Johnston *et al.* (2014). Our results also revealed that the gradient varies depending on who assesses the child's mental health: it is generally the largest when parents do so, and the smallest when the child does. However, the income gradient in child mental health in our Australian sample fades when we controlled for: (i) important covariates omitted in previous analyses (such as maternal health), and, (ii) unobserved individual characteristics. We did not find any significant differences in the income gradient in child mental

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health (or in the differences between assessors) by the child's age. These findings suggest that omitted variable bias may contribute to the over-reporting of the income gradient in child mental health.

2. Data and descriptive analyses

We used data from the LSAC, an ongoing nationally representative birth cohort study first conducted in 2004 and then repeated every two years (AIFS, 2005; ~~&;~~ Soloff *et al.*, ~~Lawrence, & Johnstone~~, 2005). The survey includes two cohorts: children born between March 2003 and February 2004 (B Cohort), and children born between March 1999 and February 2000 (K Cohort). The data were collected using a two-stage clustered sampling survey, where postcodes were used as the primary sampling unit. More details about the study methodology can be found in AIFS (2015). The LSAC sample contains approximately 5,000 children in each cohort. In this study, we focussed only on the K cohort children and waves 4 (age 10/11), 5 (age 12/13), and 6 (age 14/15) because information on child mental health assessed by parents, children *and* teachers was only collected in those particular study waves. The initial sample sizes for the K cohort in those waves were 4,169 observations in Wave 4, 3,956 observations in Wave 5, and 3,537 observations in Wave 6. Due to missing values in the variables used, the analytic sample sizes were smaller: 4,169 observations in Wave 4, 2,898 observations in Wave 5, and 2,416 observations in Wave 6. The age group (aged 10-15) used in our paper is comparable to Johnston *et al.* (2014), who used data for British children aged 11-15 years.

2.1 Outcome variable: Strengths and Difficulties Questionnaire (SDQ)

Our outcome variables of child mental health are based on the SDQ (Goodman *et al.*, 2000; Goodman ~~and~~ & Goodman, 2009; Goodman, 1997), a composite measure of the child's socio-emotional outcomes, which is a tool that has been widely used in the literature. As SDQ is a popular contemporary measure of child mental health, we have performed a literature survey to find any study other than Johnston *et al.* (2014) that investigated SDQ reporting differences among three assessors: the child, teachers and parents. ~~—~~ Most of the exist~~e~~nt literature examined the difference between ~~either~~ parent and teacher (Papageorgiou *et al.*, ~~Kalyva, Dafoulis, & Vostanis,~~ 2008) and~~;~~ father and mother (Davé *et al.*, ~~Nazareth, Senior, & Sherr,~~ 2008;)(Gupta *et al.*, ~~Lausten, & Pozzoli,~~ 2012). We confirm that the only paper examining differences in SDQ reporting between three assessors is that of Johnston et al. (2014). [1]

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The SDQ is divided into five separate subscales covering pro-social behaviour, hyperactivity, emotional symptoms, conduct problems, and peer problems. Following Johnston *et al.* (2014), we restricted our analyses to the hyperactivity, emotional symptoms, and conduct problem subscales. The hyperactivity subscale is the sum of responses to five questions about the degree to which the child: is able to stay still, is constantly fidgeting, is easily distracted, stops to think before acting, and, has a good attention span. The emotional symptoms subscale is the sum of responses to five questions about the degree to which the child: complains of headaches, seems worried, is unhappy or tearful, is nervous or easily loses confidence, and, has fears. The conduct problems subscale is the sum of responses to five questions about the degree to which the child: has a hot temper, is disobedient, often fights or bullies other children, is argumentative with adults, and is spiteful to others. For all of the questions, response options were scored 0 = 'true', 1 = 'somewhat true', and 2 = 'certainly true'. As a result, when the five items per subscale were added together, all subscales range from 0 to 10, where higher scores denoted worse child mental health outcomes (i.e. the presence of problematic behaviours).

2.2 Key independent variable: parental income

Our key predictor is the natural log of parental income. This was constructed by adding up the weekly income from all sources of the study child's parents' income and multiplying the resulting figure by 52 weeks to obtain an annual amount.[2] This was subsequently adjusted for inflation using the consumer price index, using 2014 LSAC Wave 6 as the base. We then took the natural logarithm of the inflation-adjusted parental income variable to reduce its skewness.

2.3 Other variables

Our base model included a basic set of control variables that resembled those used in previous studies (see e.g. Case *et al.*, 2002; Currie, 2003; Khanam *et al.*, 2013, Khanam *et al.*, 2016; Johnston *et al.*, 2014; Perales *et al.*, 2017). These control variables were: the study child's age expressed in months, gender, ethnicity, mother's education, number of siblings, family structure, as well as the language spoken at home. In subsequent analyses, we included other control variables such as maternal health

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[2] The weekly income data was collected from responses to the following question "Before income tax is taken out, how much does … usually receive from all sources in total?" Unfortunately, LSAC lacks sufficient information on the income of other household members, so we were unable to use *household* income similar to Johnston et al. (2014) and instead we used *parental* income.

(physical and mental), parenting styles (represented in three scales: warm, angry and consistent), and, the quality of the relationship between the parents (Gregg *et al.*, ~~Washbrook, Propper, & Burgess,~~ 2005; Khanam & Nghiem, 2016; Nghiem *et al.*, ~~Nguyen, Khanam, & Connelly,~~ 2015). These additional control variables were included in subsequent analyses because these are considered as important inputs of child health production from previous studies. As our sample also included single-parent families, the parental relationship quality variable interacts with the family type variable (as per Table A1 in the Appendix). These additional variables are expected to control for unobserved heterogeneity to some extent.~~,~~ In addition we use appropriate methodology to mitigate effects ~~take~~ of unobserved heterogeneity.

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2.4 SDQ scores

The top panel in Table A1 presents descriptive statistics of the emotional symptoms, hyperactivity and conduct problems subscales of the SDQ (on a scale from 0 to 10), as assessed by the parents, teachers, and study children~~.~~[3]. For the emotional symptoms subscales from all waves (pooled), the means for the parent-assessed, child self-assessed and teacher-assessed responses were 1.86 (SD=1.92), 2.78 (SD=2.24) and 1.18 (SD=1.70), respectively. For the hyperactivity subscales, the means for the parent-assessed, child self-assessed and teacher-assessed responses were 2.87 (SD=2.30), 3.66 (SD=2.28), and 2.48 (SD=2.65), respectively. For the conduct problems subscales, the means for the parent-, child- and teacher-assessed responses were 1.01 (SD=1.40), 1.65 (SD=1.61), and 0.66 (SD=1.41), respectively.

Overall, these descriptive statistics reveal two issues. First, hyperactivity was rated the most severe socio-emotional problem while conduct problems were rated the least severe, on average. Second, teachers perceived fewer problematic behaviours across these three domains of child mental health than parents, who in turn perceived fewer problems than the children themselves. These findings are consistent with those reported in Johnston *et al.* (2014) for Britain.

2.5 Differences in SDQ reporting by assessors

Table 1 presents descriptive statistics on the differences between assessors on their reports of the child's emotional symptoms, hyperactivity and conduct problems (on a scale from -10 to 10). This

[3] Parental reports come from the child's main carer, or Parent 1 in LSAC (i.e. the parent who knows the child best). In these data, in over 95% of the cases this is the child's biological mother. For simplicity, in the remainder of the paper we refer to Parent 1 as the mother.

table also reports the results of *t*-tests in which the null hypothesis is that the mean differences in the SDQ components are equal to zero.

We found that parents reported significantly more severe behavioural problems (positive differences) than teachers, while both parents and teachers reported significantly less severe behavioural problems (negative differences) than the child him/herself. These findings are consistent with Johnston et al. (2014). In addition, the differences seemed to decrease (in absolute value) as children grew older. For example, the difference in parent-teacher evaluations of emotional symptoms moved from 0.77 in Wave 4 (when children were 8/9 years of age) to 0.62 in Wave 6 (when children were 12/13 years of age).

Altogether, the descriptive statistics in Table 1 show that evaluations of the child's mental health differed between parents, teachers, and the children themselves, with children reporting more negative symptoms than parents or teachers. Additionally, parents tended to make more negative evaluations than teachers.

Table 1. Descriptive statistics on assessor differences in SDQ scores

	Parent-Teacher			Teacher-Child			Parent-Child		
	Emotional symptoms	Hyperactivity	Conduct problems	Emotional symptoms	Hyperactivity	Conduct problems	Emotional symptoms	Hyperactivity	Conduct problems
Wave 4									
Mean	0.77	0.77	0.77	0.77	0.77	0.77	0.77	-0.5	-0.66
Standard errors	0.04	0.04	0.03	0.04	0.05	0.03	0.04	0.05	0.03
Wave 5									
Mean	0.64	0.32	0.38	-1.24	-1.04	-0.85	-0.6	-0.72	-0.47
Standard errors	0.04	0.05	0.03	0.04	0.05	0.03	0.04	0.05	0.03
Wave 6									
Mean	0.62	0.08	0.31	-1.69	-1.31	-0.84	-1.07	-1.23	-0.53
Standard errors	0.04	0.05	0.03	0.05	0.06	0.03	0.05	0.05	0.03
All waves									
Mean	0.68	0.39	0.43	-1.59	-1.17	-0.99	-0.91	-0.78	-0.56
Standard errors	0.02	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.02

Notes: LSAC, K Cohort, Waves 4-6. Results from *t*-tests show that the mean differences in SDQ scores are all significantly differ from 0 at $p < 0.01$, except for the difference in parent and teacher rating of hyperactivity in Wave 6.

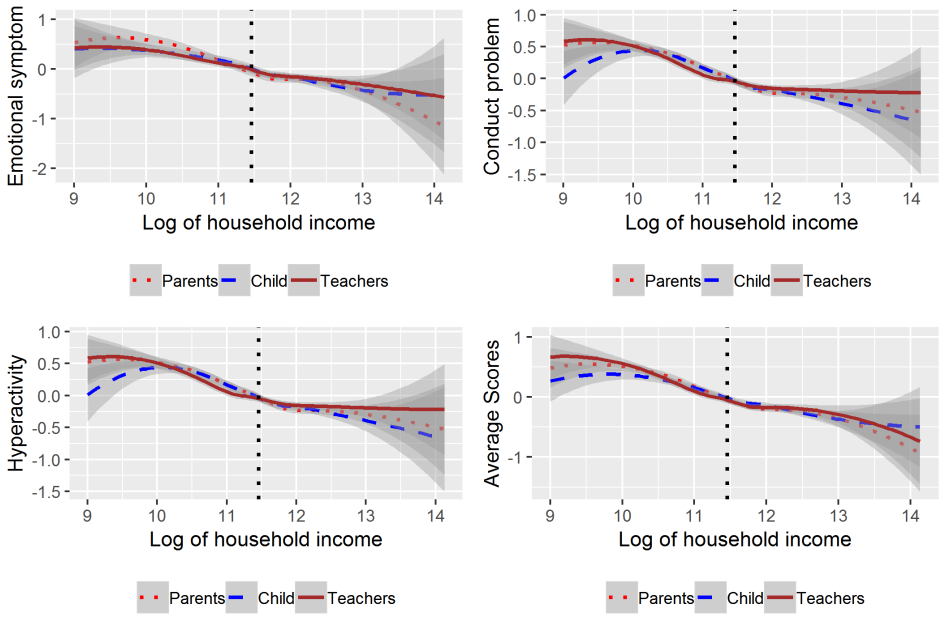
3. Associations between income and assessor differences in SDQ reports

3.1 Bivariate associations

Figure 1 depicts the bivariate relationships between income and SDQ scores using locally estimated scatterplot smoothing (LOESS). The vertical line represents mean parental income in the sample and hence splits the graph into lower-than-average and higher-than-average income households (as denoted by parental income). We demean SDQ scores in Figure 1 for the ease of comparing variations of scores across raters and domains. Outliers in income (log of income less than 9 or greater than 14) were also dropped to reveal a clearer trend and patterns in the relationship between income and SDQ scores by raters. The distributions of original SDQ scores and log income are presented in the Appendix.

All four panels show a similar pattern: assessor differences in assessments of child mental health decreased with income. Therefore, there was a greater variation in such differences for children living in low-income households. Three panels (emotional symptoms, hyperactivity, and the SDQ average) show that children from low-income families rated their mental health better than their parents did. In addition, parents from low-income families evaluated their children better than their teachers – except for emotional symptoms. However, teachers' evaluations of the mental health of children in high-income households were similar to those of parents and children. Figure 1 also shows that there were lower divergences in the reporting of conduct problems between parents, teachers and children, and higher divergences in the reporting of hyperactivity.

Figure 1. Associations between income and demeaned SDQ scores



Notes: LSAC, K Cohort, Waves 4-6. Locally estimated scatterplot smoothing (LOESS) plots. The vertical dotted line represents mean parental income in the sample. Shaded areas represent 95% confidence intervals.

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3.2 Multivariate associations

To investigate the factors associated with variations in SDQ scores across different assessors we applied a linear heteroscedastic model – LHM (Harvey, 1976). This estimator allowed us to estimate predictors of both the level and variation of SDQ differences among assessors. A general specification of an LHM estimator takes the following form:

$$\Delta MD_i = Z_i\beta + \varepsilon_i \qquad \varepsilon_i|Z_i \sim N\{0, exp(Z_i\alpha)\} \qquad (1)$$

where ΔMD_i is the difference in assessors' reports of the mental health of child i, Z_i represents income and other covariates, β and α are parameters to be estimated, and ε_i is a random error that follows a normal distribution with a non-constant variance. A negative value in β indicates that assessor differences in SDQ scores decreased with income (i.e. that there was a greater consensus about the child's mental health in high-income households). A negative value in α suggests that the

variance in assessor differences in SDQ scores also decreased with income. Results from the LHMs estimated on our Australian sample (Table 3, Panel b) were consistent with those reported for Britain by Johnston *et al.* (2014, Table 3, Panel a). For most assessors and domains of the SDQ, income significantly reduced assessor differences in reporting of child mental health (β parameter) and the variance of such differences (α parameter). This finding suggests that there was greater consensus on children's mental health amongst different assessors in higher income areas. However, the magnitude of our estimates seemed smaller than that reported previously. For example, Johnston *et al.* (2014) found that a 10% increase in income was associated with a 1.3 unit difference in parent-teacher conduct scores, while the analogous figure in our study was only 0.7 units. Likewise, the income estimate for parent-child differences in hyperactivity in Britain and Australia were -0.31 and -0.11, respectively. Our results also showed a substantially smaller income gradient in the variance of assessor differences in children's SDQ scores in Australia compared to Britain. For example, the association between income and the variance in parent-teacher scores of emotional symptoms in our study (-0.11) was ~~a~~ half of that reported in Johnston *et al.* (2014) (-0.22).

To examine whether the results presented in Table 3 were sensitive to the omission of some important factors in the child health production function, we included additional variables, namely, maternal health, parenting styles, and parental relationship quality. The results (Table 3, Panel c) indicated that differences in the SDQ scores reported by children, parents and teachers no longer differed significantly by income (except for teacher-child differences in hyperactivity ratings, which were significant at the 10% level). This finding suggests that the inclusion of the extended set of variables in the model accounted for the systematic variation in SDQ reports across assessors. However, income remained a significant predictor of the variance of assessor differences in child mental health. That is, income remained significantly correlated with the heteroscedasticity of assessor differences in SDQ scores. Hence, income was correlated with unobservable factors, which were accounted for in the error term of Equation 1, even in the presence of an extended set of covariates.

Table 3. Associations between income and assessor differences in SDQ scores, linear heteroscedastic models

	Parent-Teacher			Teacher-Child			Parent-Child		
	Emotional symptoms	Hyperactivity	Conduct problems	Emotional symptoms	Hyperactivity	Conduct problems	Emotional symptoms	Hyperactivity	Conduct problems
Panel a: Johnston *et al*. (2014)									
Mean (β in Eq.1)									
Coefficient	0.11	-0.02	-0.13	-0.16	-0.29	-0.06	-0.05	-0.31	-0.20
Standard error	0.07	0.08	0.05	0.08	0.09	0.06	0.07	0.08	0.05

Significance level	n.s.	n.s.	**	**	***	n.s.	n.s.	***	***
Variance (α in Eq.1)									
Coefficient	-0.22	-0.07	-0.26	-0.27	-0.15	-0.23	-0.07	-0.09	-0.13
Standard error	0.04	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05
Significance level	***	n.s.	***	***	***	***	n.s.	**	***
Panel b: This paper, basic covariates									
Mean (β in Eq.1)									
Coefficient	-0.13	-0.05	-0.07	0.01	-0.06	0.02	-0.13	-0.11	-0.05
Standard error	0.04	0.05	0.03	0.04	0.05	0.03	0.04	0.05	0.03
Significance level	***	n.s.	***	n.s.	n.s.	n.s.	***	**	n.s.
Variance (α in Eq.1)									
Coefficient	-0.11	-0.02	-0.21	-0.09	-0.08	-0.08	-0.12	-0.01	-0.10
Standard error	0.04	0.03	0.04	0.03	0.03	0.04	0.03	0.03	0.03
Significance level	***	n.s.	***	***	***	**	***		***
Panel c: This paper, extended covariates									
Mean (β in Eq.1)									
Coefficient	-0.04	0.03	-0.01	-0.02	-0.09	-0.001	-0.06	-0.05	-0.001
Standard error	0.04	0.04	0.02	0.04	0.05	0.03	0.04	0.04	0.03
Significance level	n.s.	n.s.	n.s.	n.s.	*	n.s.	n.s.	n.s.	n.s.
Variance (α in Eq.1)									
Coefficient	-0.03	-0.001	-0.19	-0.05	-0.07	-0.08	-0.09	0.02	-0.07
Standard error	0.03	0.03	0.05	0.03	0.03	0.04	0.03	0.03	0.03
Significance level	n.s.	n.s.	***	n.s.	**	**	***	n.s.	**

Notes: LSAC, K Cohort, Waves 4-6. Linear heteroscedastic models. Only income coefficients are reported. Each coefficient is obtained from a separate regression model. Basic and extended covariates as in Table 1. Panel C reports results from regressions that include additional variables capturing maternal health, parenting practices, and parental relationship quality. Significance levels: n.s. $p > 0.1$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4. The Australian income gradient in child mental health

In this section we investigate the income gradient in child mental health using Australian data and covariates that are comparable to those used in previous literature (e.g., Case *et al.*, 2002; Currie & Stabile, 2003; Khanam *et al.*, 2009, 2013). Three estimators were used. First, we used a pooled OLS estimator, which ignored the panel structure of the data used but made our results as comparable as possible to those presented in Johnston *et al.* (2014). Second, we applied a random-effects estimator, which assumed that individuals unobserved characteristics were uncorrelated with other covariates. Third, a fixed-effect estimator was applied to eliminate individual unobserved effects. The fixed-effect estimator requires considerable within-individual over-time variation in the panel data. However we only had three observations per individual in the data set (i.e. three waves of data on SDQ and child mental health). Therefore, we did not report the results of the fixed-effect estimator in the paper.[4]

Table 4. Associations between income and SDQ scores: Pooled OLS and random-effect estimates

	Income coefficients		
SDQ scores reported by	Parent	Teacher	Child
Panel a: Johnston *et al.* (2014)			
OLS estimates			
Emotional symptoms	-0.28*** (0.06)	-0.43*** (0.06)	-0.23*** (0.06)
Conduct problems	-0.29*** (0.05)	-0.19*** (0.05)	-0.10** (0.05)
Hyperactivity	-0.34*** (0.08)	-0.34*** (0.08)	-0.03 (0.07)
Panel b: This paper, basic covariates			
OLS estimates			
Emotional symptoms	-0.25*** (0.04)	-0.12*** (0.03)	-0.11*** (0.04)
Conduct problems	-0.16*** (0.03)	-0.09*** (0.03)	-0.11*** (0.03)
Hyperactivity	-0.17*** (0.04)	-0.13*** (0.05)	-0.06 (0.04)
RE estimates			
Emotional symptoms	-0.15*** (0.04)	*-0.09*** (0.03)*	-0.11*** (0.04)
Conduct problems	-0.11*** (0.02)	-0.07** (0.03)	-0.09*** (0.03)
Hyperactivity	-0.12*** (0.04)	-0.14*** (0.05)	-0.05 (0.04)
Panel c: This paper, extended covariates			
OLS estimates			
Emotional symptoms	-0.10*** (0.03)	-0.06** (0.03)	-0.03 (0.04)
Conduct problems	-0.08*** (0.02)	-0.07*** (0.03)	-0.07** (0.03)
Hyperactivity	-0.05 (0.04)	-0.09** (0.05)	-0.001 (0.04)
RE estimates			
Emotional symptoms	-0.08** (0.03)	-0.05 (0.03)	-0.06 (0.04)
Conduct problems	-0.08*** (0.02)	-0.06** (0.03)	-0.07** (0.03)
Hyperactivity	-0.06* (0.03)	-0.09** (0.05)	-0.01 (0.04)

Notes: LSAC, K Cohort, Waves 4-6. Each coefficient is obtained from a separate regression model. Standard errors in

[4] However, we provide the results of fixed effects estimator in the Appendix for interested readers.

parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. For panel-data estimators, results from Hausman tests indicate that the fixed-effect estimates are preferable, except for those in italics.

When controlling for only a basic set of covariates (Table 4, Panel b), the pooled OLS results indicated that higher parental income was significantly associated with fewer problematic behaviours of the child. The only exception was the model for child-reported hyperactivity, in which the income coefficient was not statistically significant. These results were consistent with those in Johnston *et al.* (2014, Panel a). However, the magnitude of the income coefficients in our Australian sample appeared to be notably smaller than that of the estimates for their British sample. For example, the log income coefficients in our analyses had a magnitude of around 0.1, indicating that a 10% increase in income was associated with a one-unit reduction in SDQ scores. This is less than half of the magnitude of the income parameters reported by Johnston *et al.* (2014). However, the results of both the present study and that of Johnston et al.'s (2014) indicate that income is not a significant predictor of child-assessed hyperactivity.

We conducted F tests to determine whether the income coefficients across models in which the same domain of child mental health was rated by different observers were significantly different. The test results for these pooled OLS models (see Appendix for details) indicate that only three pairs of differences were statistically significant: parent-teacher differences in emotional symptoms, parent-child differences in emotional symptoms, and parent-child differences in hyperactivity. The results are thus somewhat reassuring, as they suggest that in most cases, the observed income gradient in child mental health will be similar, irrespective of the evaluator of child mental health.

When controlling for an extended set of covariates (Panel c), results from the pooled OLS models still indicated that income was a significant predictor of conduct problems for all assessors. However, the magnitudes of the estimated income parameters were modest: a 10% increase in parental income was associated with a reduction in conduct problems by only 0.7 to 0.8 units. The income coefficient also had the expected negative sign in the models for emotional symptoms and hyperactivity, but the estimate was only statistically significant in the models in which child mental health was evaluated by teachers. Income had a significant effect on parent-reported emotional symptoms, but no significant effect on child-reported emotional symptoms and hyperactivity. The F test results (see Appendix for details) revealed that when using extended covariates, there were no significant differences in the income coefficients across models with different assessors except for the teacher and child models of hyperactivity (at $p<0.1$). Random-effect models with extended covariates again produced similar results to the pooled OLS models. If we compare the results of Panel c with Panel b of Table 4 we see that the magnitude and significance of the income coefficients have reduced substantially because of the inclusion of extended covariates (variables capturing maternal general

and mental health, parenting styles, and parental relationship quality). In a series of regression analyses, we explored which variable was responsible for reducing the significance and magnitude of the income coefficients by progressively including variables capturing parental relationship quality, parenting styles, and maternal general and mental health with the basic model. We found that maternal health, especially maternal mental health, was responsible for reducing the magnitude of income coefficient.

Full sets of estimates for representative models are shown in the Appendix. Significant predictors of child mental health include: the gender of the child, whether English is spoken at home, Indigenous status, family structure, parenting style, and maternal general and mental health. Compared to girls, boys were less likely to experience emotional symptoms but more likely to experience conduct problems and hyperactivity. Somewhat surprisingly, children from families speaking English at home had significantly higher scores (i.e. worse mental health) in all three SDQ domains, regardless of who assessed them. Given the known disadvantages for the non-English-speaking group in other life domains, it could be speculated that this may have been due to cultural differences in the reporting of problem behaviours. Indigenous children, on the other hand, displayed worse mental health outcomes than non-Indigenous children – especially in relation to conduct problems and hyperactivity. In addition, when the primary carer reported having an unhappy relationship with her partner or if she exhibited angry parenting, children had significantly worse scores on emotional symptoms, conduct problems and hyperactivity, irrespective of the assessor. In contrast, children whose primary carers exhibited a consistent parenting style and had good mental or general health had significantly lower scores on emotional symptoms, conduct problems and hyperactivity.

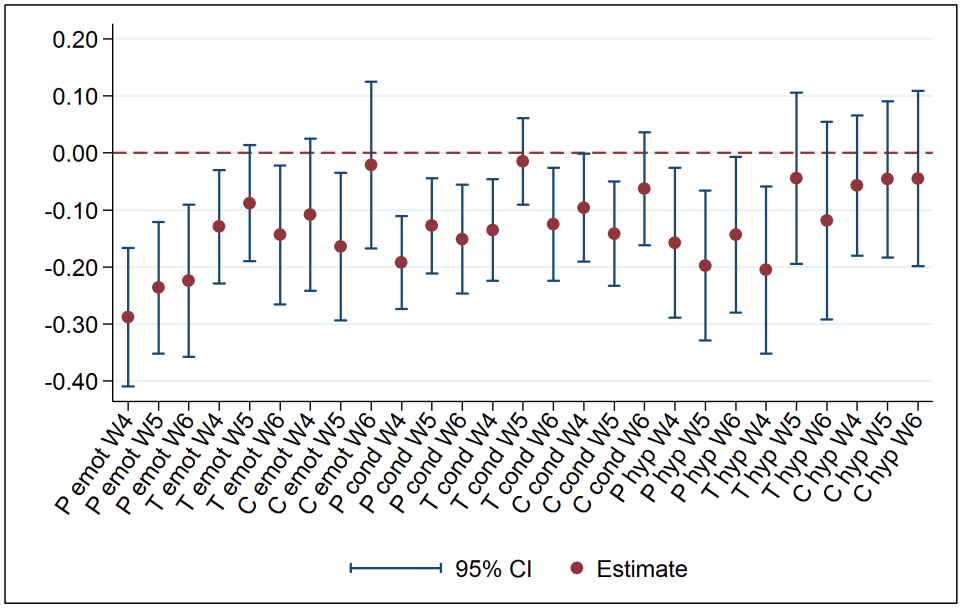
4.1 The income gradient in child mental health and differences between assessors' reports, by child's age

Previous literature shows that the income gradient in child *general* health becomes more pronounced as children age (e.g. Case *et al.*, 2002; Currie & Stabile, 2003). In this section, we examine whether the income gradient in child *mental* health and any assessor differences ~~in it~~ also increases with age. We do so by comparing children in the LSAC sample at ages 8/9, 10/11 and 12/13.

Figure 2 shows the point estimates and 95% confidence intervals for the income gradient in child mental health across assessors, domains of the SDQ~~,~~ and age of the child. These results are from OLS models using the basic set of covariates. The figure shows that income was negatively associated with SDQ scores, but reveals some apparent trends with~~by~~ the child's age. As an exception, for parent-reported emotional symptoms, the income estimate becomes less negative as the child ages. The income gradient was only statistically significant across all three waves for parent-reported scores, and only insignificant across all three waves for child-rated hyperactivity.

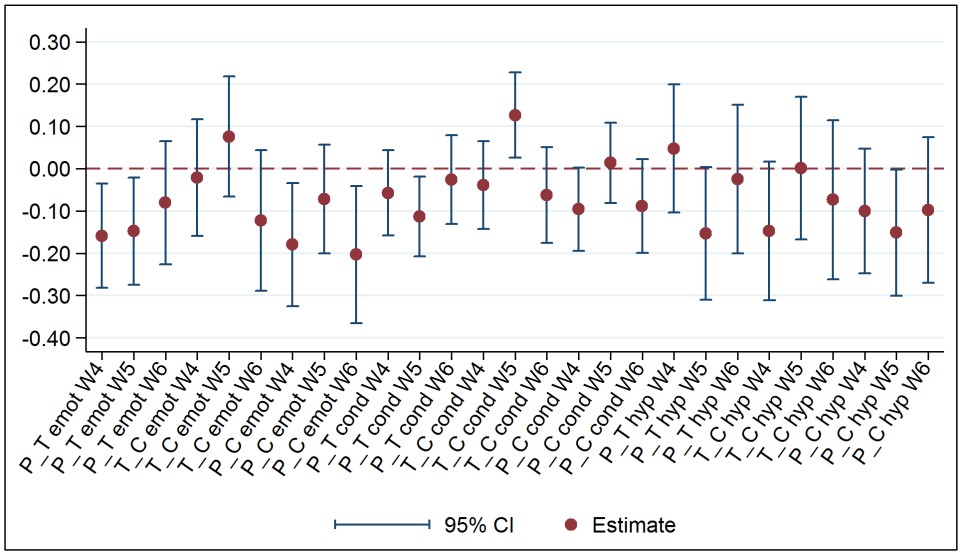
Figure 3 shows the point estimates and 95% confidence intervals for assessor differences in child mental health, by SDQ domain and child's age – again, from OLS models using a basic set of covariates. Consistent with the descriptive findings presented in Table 2, differences in child mental health ratings across assessors diminished as the child grew older. Where there were significant differences across assessors at ages 8/9 and 10/11, these differences became insignificant at ages 12/13. However, we caution the readers about this result as we were only able to look at five years of development (from 8 ~~years~~ to 13 years), which is only a snapshot of the ~~from the~~ entire course of child development.

Figure 2. The income/child mental health gradient, by child's age



Notes: LSAC, K Cohort, Waves 4-6. Results from OLS models including the basic set of covariates. 95% confidence intervals around point estimates.

Figure 3. Assessor differences in SDQ reports, by child's age



Notes: LSAC, K Cohort, Waves 4-6. Results from OLS models including the basic set of covariates. 95% confidence intervals around point estimates.

5. Discussion and conclusions

Identifying the socio-economic antecedents of child physical and mental health is increasingly recognised as an important objective of research and policy, as mounting evidence points to long-term effects of ill health during childhood on outcomes such as academic achievement, adolescent and adult health, and labour market outcomes later in life. In this paper, we have used longitudinal data from a large Australian cohort study to shed further light on these issues.

We first considered important questions on the measurement of child mental health by various assessors: parents, teachers and the child. The LSAC data provided us with a unique opportunity to evaluate differences in parent-, child- and teacher-reported mental health reports, and whether using different assessor reports changed the associations between child mental health and income. Our first contribution was thus to provide the first replication of Johnston *et al.* (2014) using data from another country, Australia. Our results indicated that children generally evaluate their mental health more negatively than their parents, who are in turn ~~harsher (being negative)~~more negative in their

assessments than teachers. This ordering across assessors is the same as that reported by Johnston *et al.* (2014), which suggests that there may be genuine mechanisms producing it, rather than it being specific to the data, methods or country used in each study. Several studies also support this discrepancy in reporting. Brown et al. (2006) found that parents were oblivious to the needs of children who were considered to be seriously impaired by their teachers (emotionally, behaviourally and functionally). Goodman et al. (2000) reported that parents were found to be slightly better at noticing emotional issues than teachers but teachers were better at detecting conduct and hyperactivity disorders. ~~(~~ This finding suggests that population-level estimates of child mental health will be dependent on who assesses the child's mental health. Our results suggest that such measurement discrepancies may be larger for younger children, as assessor differences in child mental health reports were ~~smaller~~ larger for younger~~older~~ children than old~~young~~er children.

There may be many reasons for assessor differences. One of the reasons may be due to the type of mental illness. Certain disorders may only come to the fore in certain environments. For example, conduct and hyperactivity disorders may be exaggerated in the school environment when children are required to strictly follow authority and rules and focus and concentrate for long periods. Also, certain mental illnesses are more externalised than others (e.g. conduct disorder and hyperactivity) and so disorders that are mostly internalised (e.g. emotional disorders) may be under-reported by parents and teachers. Another reason may be due to the quality of the relationship between the child and the assessor and also the assessor's personality type, expectations and knowledge about the symptoms of certain mental illnesses. Different perceptions of a child's mental health may lead to varying responses to the child's needs and whether assessors take the child's concerns seriously or not.

Policy-makers should implement educational interventions (e.g. in schools to teachers, via general practitioners or child health nurses in the community to parents) to increase mental health knowledge and to make sure assessors have appropriate expectations. In addition, there should be policies implemented to ensure regular assessments of a child's mental health, particularly to screen for~~detect~~ internalised disorders (e.g. emotional disorders like depression and anxiety), as they are more likely to be under-reported. Further, a~~A~~ny systematic differences in the rating of assessors would be the issues of interest of various stakeholders. For example, researchers would be interested in designing SDQ questionnaires that generate consistent ratings across assessors. Determinants of systematic differences between assessors may provide useful policy insights. Income is a possible determinant because it can affect the provision of inputs, especially purchased inputs, to produce emotional and mental health.

In addition, we found~~ind~~ that assessor discrepancies depend systematically on parental income: fewer discrepancies in high-income households compared to low-income households. This is expected as

we have already discussed how ~~one rates~~assessment of child health depends on SES, so assessment differences (among assessors) will also depend on income. Interestingly, children from low-income households rated their mental health more positively than their teachers or parents, with evidence that teachers are 'harsher (rating negatively)' in their assessments of these children. This finding ~~leaves us to~~raises the question of ~~think~~ whether teachers are biased against low SES children. Several studies have found that teachers consistently underestimate the potential of minority students and those from low SES areas (Gibbons ~~and~~ & Chevalier, ~~(~~2008~~);~~ Jussim ~~and~~ & Harber, ~~(~~2005~~;), and,~~ Burgess ~~and~~ & Greaves, ~~(~~2009~~)~~). Despite this, Johnson *et al.* (2014) found that teachers were better predictors of child absenteeism than parents ~~of children~~. However, absenteeism may not be the best assessment of a child's mental health status as some children may prefer to attend school, as their home environment may exacerbate their illness. Thus, teachers' opinions may be an unreliable assessment of child mental health, particularly in low socio-economic areas. In terms of policy change, this discrepancy of teacher reports in low SES areas shows that state-based education departments should employ teachers from low SES backgrounds to teach in low SES settings, or, every university/TAFE student studying to be a teacher should have mandatory placements in low SES settings. This will ensure teachers understand the backgrounds of the low SES students and make appropriate assessments. Educational interventions may also clarify some of the misconceptions of mental illness and make assessors aware of their internalised prejudice. Policy-makers should implement educational interventions that provide information of symptoms and signs of mental illnesses and also the differences in display of these symptoms and signs based on setting, backgrounds of the children and the person they are interacting with. These strategies may alleviate some of the bias against children in these low SES areas. Alleviating this bias will potentially result in better mental health outcomes for the children in these areas as the children's needs and concerns will be addressed without prejudice.

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This result of assessor discrepancies based on parental income is consistent with the findings of Khanam *et al.* (2009), using the LSAC data as well. Khanam and her colleagues found that the associations between income and *child general health* in Australia were substantially lower than those reported in similar studies conducted in the US (Case *et al.*, 2002), Canada (Currie & Stabile, 2003) and the UK (Proper *et al.*, 2007).

~~Second, W~~We also examined whether and how parental income relates to children's mental health, using different measures from different assessors. We contributed to the existing body of knowledge by revealing whether there is an income gradient in child *mental* health in contemporary Australia, and whether such a gradient is sensitive to the different ways in which child mental health is measured. The latter is important: the literature typically relies on parental assessments, but the

gradient may differ when considering the judgements made by other assessors. An initial set of analyses was aimed at replicating as closely as possible those deployed by Johnston *et al.* (2014), using cross-sectional data and regression models, and a basic set of covariates. In these circumstances, our findings resembled theirs: income is positively and statistically significantly associated with improved child mental health, thus hinting at the existence of an income gradient in child mental health in Australia. In a subsequent set of analyses, the LSAC data enabled us to move beyond the analyses in Johnston *et al.* (2014) by controlling for further sources of unobserved heterogeneity through additional control variables and panel-data regressions. When adding other important variables as controls, such as maternal mental health, the magnitude of the income coefficients reduced substantially, but in almost all cases remained statistically significant.

From a policy perspective, it is important to gain a holistic understanding of the health handicaps experienced by children in low-income households, as these children are known to be vulnerable to disadvantage in other life domains, such as neighbourhood and schooling, which may also affect their physical and mental health~~.~~. Policy initiatives to improve affordability and accessibility of services in poorer communities can contribute to breaking the cycle of hardship experienced by children growing up in disadvantaged financial circumstances. It may also be that accessibility and affordability is not the single issue in these areas, but rather, a lack of acknowledgement of mental illness (due to stigma) ~~that is the~~is also an issue. In these circumstances, educational interventions to increase awareness and acceptability to seek support may help children in these areas. Future research that replicates our Australian analyses in another country's context is required to extend the external validity of our findings. Analyses, which further identify the factors that link higher income to better child mental health outcomes would be particularly informative for the development of evidence-based interventions.

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Appendix

Table A1. Descriptive statistics

	Wave 4		Wave 5		Wave 6		All waves	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SDQ								
Emotional symptoms								
Parent-reported	1.867	1.925	1.882	1.928	1.850	1.922	1.867	1.925
Child-reported	2.946	2.246	2.484	2.103	2.920	2.378	2.780	2.247
Teacher-reported	1.100	1.721	1.244	1.707	1.226	1.689	1.185	1.708
Hyperactivity								
Parent-reported	3.105	2.332	2.896	2.320	2.546	2.205	2.873	2.303
Child-reported	3.604	2.195	3.618	2.314	3.774	2.369	3.658	2.288
Teacher-reported	2.410	2.596	2.575	2.730	2.468	2.651	2.483	2.659
Conduct problems								
Parent-reported	1.307	1.454	1.030	1.396	0.898	1.324	1.095	1.408
Child-reported	1.971	1.751	1.497	1.526	1.432	1.459	1.654	1.613
Teacher-reported	0.733	1.468	0.648	1.409	0.589	1.329	0.663	1.410
Basic covariates								
Natural log of annual parental income, 2014 prices	11.421	0.728	11.474	0.743	11.505	0.724	11.463	0.733
Child's age in months	10.313	0.464	12.409	0.492	14.394	0.489	12.203	1.716
Child is female	0.508		0.502		0.492		0.502	
Child speaks English at home	0.912		0.930		0.912		0.918	
Child is Indigenous	0.029		0.025		0.023		0.026	
Maternal education								
Postgraduate degree	0.166		0.181		0.184		0.176	
Degree	0.173		0.170		0.178		0.173	
Below degree	0.661		0.649		0.636		0.650	
Unknown	0.000		0.001		0.001		0.001	
Family structure								
Original family	0.773		0.754		0.750		0.760	
Step/blended family	0.072		0.082		0.084		0.079	
Single-parent family	0.147		0.157		0.161		0.155	
Other family type	0.008		0.007		0.005		0.007	
No. siblings in household	1.605	1.021	1.570	1.031	1.483	0.995	1.558	1.018
Extended covariates								
Maternal mental health (K6)[a]	4.456	0.604	4.489	0.608	4.481	0.617	4.474	0.609
Maternal general health [b]	3.702	0.893	3.645	0.916	3.648	0.916	3.667	0.908
Warm parenting scale	4.266	0.586	4.157	0.636	4.038	0.683	4.163	0.639
Angry parenting scale	2.151	0.641	2.144	0.660	2.044	0.660	2.118	0.655
Consistent parenting scale	4.199	0.640	4.142	0.655	4.145	0.663	4.164	0.652
Parental relationship happiness [c]								
Original family & Unhappy	0.140		0.145		0.132		0.140	
Original family & Happy	0.632		0.608		0.616		0.619	
Original family & No info	0.001		0.001		0.001		0.001	
Step/blended fam. & Unhappy	0.016		0.014		0.013		0.015	
Step/blended fam. & Happy	0.055		0.067		0.071		0.064	
Step/blended fam. & No info	0.001		0.001		0.000		0.000	
Single-parent family	0.147		0.157		0.161		0.155	
Other family & Unhappy	0.001		0.001		0.000		0.001	
Other family & Happy	0.005		0.004		0.004		0.004	
Other family & No info	0.002		0.002		0.001		0.001	
Observations	3,119		2,898		2,416		8,433	

Notes: LSAC, K Cohort, Waves 4-6. [a] Maternal mental health (Kessler 6 scale; Kessler *et al.*, 2010); [b]Maternal general health (Likert scale from 1 = 'excellent' to 5 = 'poor'); [c] Parental relationship happiness (Likert scale from 1 = 'extremely unhappy' to 7 'perfectly happy'; Happy = scores 5-7; Unhappy = scores 1-3). The parental relationship happiness variable is interacted with the family structure variable so that single parents are not excluded from the model.

Full estimates from models of child mental health with extended covariates

Table A2. OLS

	Emotional symptoms			Conduct problems			Hyperactivity		
	Parent	Child	Teacher	Parent	Child	Teacher	Parent	Child	Teacher
Log of parental income	-0.10***	-0.03	-0.06**	-0.08***	-0.07**	-0.07***	-0.05	-0.00	-0.09**
	(0.03)	(0.04)	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Child's age	0.01	-0.02	0.03***	-0.07***	-0.11***	-0.01*	-0.09***	0.06***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Child is male	-0.36***	-0.73***	-0.04	0.12***	0.43***	0.43***	0.92***	0.35***	1.62***
	(0.04)	(0.05)	(0.04)	(0.02)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)
English-speaking household	0.16**	0.08	0.21***	0.21***	0.34***	0.18***	0.44***	0.63***	0.49***
	(0.07)	(0.08)	(0.06)	(0.04)	(0.06)	(0.05)	(0.08)	(0.08)	(0.10)
Indigenous child	-0.01	0.03	0.43***	0.44***	0.61***	0.76***	0.46***	0.32**	1.01***
	(0.12)	(0.15)	(0.14)	(0.09)	(0.13)	(0.15)	(0.14)	(0.16)	(0.19)
Maternal education (ref. postgraduate)									
Graduate	-0.12*	-0.19**	-0.05	-0.07*	-0.03	-0.11***	-0.12*	-0.12	-0.13
	(0.06)	(0.08)	(0.06)	(0.04)	(0.05)	(0.04)	(0.07)	(0.08)	(0.08)
Below graduate	0.05	0.16**	0.09*	0.13***	0.23***	0.14***	0.44***	0.21***	0.29***
	(0.05)	(0.07)	(0.05)	(0.03)	(0.04)	(0.04)	(0.06)	(0.07)	(0.07)
Unknown	1.09	0.60	-0.85*	0.70	0.71	-0.08	-0.13	0.98	-0.74
	(0.72)	(0.89)	(0.50)	(0.66)	(1.09)	(0.71)	(0.98)	(0.90)	(1.45)
# siblings	-0.11***	-0.02	-0.05***	0.07***	0.09***	0.02	-0.13***	0.00	0.03
	(0.02)	(0.03)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Family structure * parental relationship happiness (reference original family, unhappy)									
Original family, happy	-0.01	-0.01	-0.07	0.02	-0.06	-0.13*	-0.05	-0.01	-0.01
	(0.05)	(0.03)	(0.05)	(0.04)	(0.06)	(0.07)	(0.08)	(0.05)	(0.03)
Original family, no info	1.24*	-0.37	0.18	0.59	0.75	0.10	0.99	1.24*	-0.37
	(0.75)	(0.32)	(0.53)	(0.63)	(0.87)	(0.72)	(0.77)	(0.75)	(0.32)
Blended family, unhappy	0.42**	0.26*	0.45***	0.51***	0.45**	0.35	0.85***	0.42**	0.26*
	(0.19)	(0.13)	(0.14)	(0.17)	(0.22)	(0.22)	(0.25)	(0.19)	(0.13)
Blended family, happy	0.19**	0.22***	0.19**	0.32***	0.29***	0.14	0.52***	0.19**	0.22***
	(0.09)	(0.06)	(0.08)	(0.08)	(0.10)	(0.12)	(0.13)	(0.09)	(0.06)
Blended family, no info	-0.84	2.42***	2.15*	1.29	1.27	0.12	-0.72	-0.84	2.42***
	(0.54)	(0.93)	(1.30)	(1.22)	(1.47)	(0.94)	(1.53)	(0.54)	(0.93)
Single-parent family	0.24***	0.11**	0.17***	0.32***	0.14*	0.28***	0.66***	0.24***	0.11**
	(0.08)	(0.05)	(0.07)	(0.06)	(0.09)	(0.10)	(0.11)	(0.08)	(0.05)
Other family, unhappy	0.85	2.78***	0.81	1.64*	2.24**	0.63	1.80	0.85	2.78***
	(0.96)	(0.87)	(0.83)	(0.94)	(1.02)	(0.46)	(1.18)	(0.96)	(0.87)
Other family, happy	0.66*	0.06	0.40	0.58*	0.77**	1.09***	0.33	0.66*	0.06
	(0.37)	(0.23)	(0.29)	(0.34)	(0.37)	(0.30)	(0.42)	(0.37)	(0.23)
Other family, no info	1.08	0.41	0.86	0.79	0.29	0.25	1.60*	1.08	0.41
	(0.69)	(0.51)	(0.59)	(0.60)	(0.80)	(0.73)	(0.87)	(0.69)	(0.51)
Warm parenting	0.07**	-0.02	0.05*	0.05*	0.00	0.04	0.14***	0.07**	-0.02
	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.03)	(0.02)
Angry parenting	0.23***	0.97***	0.59***	0.45***	1.26***	0.62***	0.88***	0.23***	0.97***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.03)	(0.03)
Consistent parenting	-0.05	-0.26***	-0.15***	-0.06**	-0.27***	-0.13***	-0.21***	-0.05	-0.26***
	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.03)	(0.02)
Mother's general health	-0.12***	-0.04***	-0.06***	0.00	-0.13***	-0.10***	0.00	-0.12***	-0.04***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Mother's mental health	-0.14***	-0.22***	-0.02	-0.09***	-0.35***	-0.08*	-0.01	-0.14***	-0.22***
	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.04)	(0.03)
Constant	1.78***	2.62***	2.35***	0.47	4.01***	1.84***	-0.36	1.78***	2.62***
	(0.45)	(0.31)	(0.40)	(0.37)	(0.52)	(0.58)	(0.66)	(0.45)	(0.31)
N (observations)	8,433	8,433	8,433	8,433	8,433	8,433	8,433	8,433	8,433
R^2	0.042	0.365	0.153	0.127	0.293	0.075	0.198	0.042	0.365

Notes: LSAC, K Cohort, Waves 4-6. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A3. Random-effects

	Emotional symptoms			Conduct problems			Hyperactivity		
	Parent	Child	Teacher	Parent	Child	Teacher	Parent	Child	Teacher
Log of parental income	-0.07**	-0.05	-0.05	-0.07***	-0.07**	-0.06**	-0.06*	-0.00	-0.11**
	(0.03)	(0.04)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Child's age	0.02*	-0.01	0.04***	-0.07***	-0.11***	-0.01**	-0.10***	0.06***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Child is male	-0.33***	-0.72***	-0.04	0.14***	0.46***	0.45***	0.97***	0.36***	1.64***
	(0.05)	(0.06)	(0.04)	(0.03)	(0.04)	(0.04)	(0.06)	(0.06)	(0.07)
English-speaking household	0.14*	0.09	0.20***	0.15***	0.31***	0.13**	0.39***	0.58***	0.43***
	(0.08)	(0.10)	(0.08)	(0.05)	(0.07)	(0.06)	(0.09)	(0.10)	(0.11)
Indigenous child	0.07	0.06	0.41***	0.46***	0.62***	0.76***	0.51***	0.31*	1.00***
	(0.15)	(0.18)	(0.14)	(0.10)	(0.13)	(0.11)	(0.18)	(0.19)	(0.20)
Maternal education (ref. postgraduate)									
Graduate	-0.10	-0.20**	-0.06	-0.06	-0.02	-0.11*	-0.09	-0.10	-0.13
	(0.08)	(0.10)	(0.07)	(0.05)	(0.07)	(0.06)	(0.09)	(0.10)	(0.11)
Below graduate	0.04	0.13	0.10	0.15***	0.26***	0.14***	0.39***	0.21**	0.24***
	(0.07)	(0.08)	(0.06)	(0.04)	(0.06)	(0.05)	(0.07)	(0.08)	(0.09)
Unknown	1.01	0.22	-0.94	0.49	0.69	-0.05	0.40	0.84	-0.82
	(0.93)	(1.11)	(0.83)	(0.60)	(0.77)	(0.69)	(1.07)	(1.13)	(1.24)
# siblings	-0.10***	-0.02	-0.05**	0.06***	0.08***	0.02	-0.13***	0.00	0.05
	(0.02)	(0.03)	(0.02)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Family structure * parental relationship happiness (reference original family, unhappy									
Original family, happy	0.02	-0.08	0.00	0.02	-0.04	0.02	-0.05	-0.14**	-0.02
	(0.05)	(0.07)	(0.05)	(0.03)	(0.05)	(0.04)	(0.05)	(0.07)	(0.07)
Original family, no info	0.17	-0.24	0.92*	-0.36	-0.12	0.53	0.78*	-0.15	0.85
	(0.46)	(0.61)	(0.50)	(0.30)	(0.42)	(0.37)	(0.45)	(0.60)	(0.66)
Blended family, unhappy	0.33**	0.80***	0.39**	0.14	0.47***	0.46***	0.44***	0.29	0.67***
	(0.16)	(0.20)	(0.16)	(0.10)	(0.14)	(0.12)	(0.16)	(0.20)	(0.22)
Blended family, happy	0.19**	0.25**	0.20**	0.31***	0.25***	0.39***	0.26**	0.14	0.60***
	(0.10)	(0.12)	(0.09)	(0.06)	(0.08)	(0.08)	(0.11)	(0.12)	(0.13)
Blended family, no info	0.58	-0.62	-0.89	1.61***	2.02***	0.88	0.05	0.42	-0.04
	(0.88)	(1.12)	(0.88)	(0.58)	(0.77)	(0.69)	(0.92)	(1.12)	(1.22)
Single-parent family	0.16**	0.21**	0.28***	0.17***	0.19***	0.32***	0.17**	0.29***	0.66***
	(0.08)	(0.10)	(0.08)	(0.05)	(0.07)	(0.06)	(0.08)	(0.10)	(0.11)
Other family, unhappy	0.63	0.73	0.68	2.20***	0.47	1.22***	1.18*	0.70	1.83**
	(0.59)	(0.77)	(0.62)	(0.39)	(0.53)	(0.47)	(0.61)	(0.77)	(0.83)
Other family, happy	0.83***	0.30	0.74**	0.18	0.59**	0.63***	0.38	1.12***	0.57
	(0.31)	(0.39)	(0.30)	(0.20)	(0.27)	(0.24)	(0.33)	(0.39)	(0.43)
Other family, no info	0.27	-0.33	1.27**	0.41	1.07**	0.68*	0.35	0.30	1.89***
	(0.51)	(0.65)	(0.51)	(0.33)	(0.45)	(0.40)	(0.55)	(0.65)	(0.71)
Warm parenting	0.12***	0.08*	0.06*	-0.07***	0.00	0.03	-0.12***	-0.03	0.02
	(0.04)	(0.04)	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Angry parenting	0.62***	0.24***	0.21***	0.85***	0.51***	0.39***	0.93***	0.51***	0.69***
	(0.04)	(0.04)	(0.04)	(0.02)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)
Consistent parenting	-0.17***	-0.16***	-0.04	-0.25***	-0.11***	-0.04	-0.27***	-0.11***	-0.18***
	(0.03)	(0.04)	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Mother's general health	-0.15***	-0.16***	-0.11***	-0.03**	-0.04*	-0.01	-0.10***	-0.09***	-0.00
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Mother's mental health	-0.51***	-0.14***	-0.16***	-0.21***	-0.03	-0.07***	-0.27***	-0.10**	-0.03
	(0.04)	(0.04)	(0.04)	(0.02)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)
Constant	4.31***	4.78***	1.64***	2.93***	2.51***	0.48	5.12***	2.46***	0.93
	(0.47)	(0.60)	(0.47)	(0.31)	(0.41)	(0.37)	(0.49)	(0.60)	(0.65)
N (observations)	8,433	8,433	8,433	8,433	8,433	8,433	8,433	8,433	8,433
N (children)	3,909	3,909	3,909	3,909	3,909	3,909	3,909	3,909	3,909
R^2 (overall)	0.163	0.062	0.042	0.363	0.152	0.126	0.288	0.074	0.196

Notes: LSAC, K Cohort, Waves 4-6. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A4. Fixed-effects

	Emotional symptoms			Conduct problems			Hyperactivity		
	Parent	Child	Teacher	Parent	Child	Teacher	Parent	Child	Teacher
Log of parental income	0.04	-0.06	0.06	-0.03	-0.02	0.01	-0.01	0.01	-0.08
	(0.04)	(0.06)	(0.05)	(0.03)	(0.04)	(0.04)	(0.04)	(0.06)	(0.06)
Child's age	0.02	-0.01	0.03**	-0.08***	-0.11***	-0.01*	-0.11***	0.05***	0.04***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
English-speaking household	0.19	-0.11	0.36	-0.26*	0.11	-0.01	0.28	0.35	0.28
	(0.23)	(0.31)	(0.26)	(0.15)	(0.21)	(0.19)	(0.22)	(0.31)	(0.33)
Graduate									
Below graduate	-0.03	-0.16	-0.15	0.01	0.15	-0.03	0.01	0.15	0.14
	(0.18)	(0.24)	(0.20)	(0.12)	(0.16)	(0.15)	(0.17)	(0.24)	(0.26)
Unknown	-0.26	-0.11	-0.06	0.01	0.40**	-0.03	-0.04	0.07	-0.32
	(0.18)	(0.25)	(0.21)	(0.12)	(0.17)	(0.15)	(0.17)	(0.24)	(0.26)
Family structure * parental relationship happiness (reference original family, unhappy									
Number of siblings	-0.18***	-0.01	-0.04	-0.05	-0.02	-0.02	-0.18***	0.09	0.09
	(0.06)	(0.08)	(0.07)	(0.04)	(0.05)	(0.05)	(0.06)	(0.08)	(0.09)
Original family, Happy	0.01	-0.04	0.01	0.07	0.01	0.02	-0.03	-0.12	0.01
	(0.06)	(0.09)	(0.07)	(0.04)	(0.06)	(0.05)	(0.06)	(0.08)	(0.09)
Original family, no info	0.58	-0.62	0.66	-0.15	-0.24	0.57	0.98**	-0.26	0.88
	(0.49)	(0.68)	(0.58)	(0.33)	(0.46)	(0.41)	(0.48)	(0.66)	(0.72)
Blended family, unhappy	-0.00	0.48	0.21	-0.21	0.12	-0.08	-0.09	-0.14	0.08
	(0.25)	(0.34)	(0.29)	(0.16)	(0.23)	(0.21)	(0.24)	(0.33)	(0.36)
Blended family, happy	0.12	-0.27	0.01	0.20	-0.05	0.04	-0.28	-0.40	0.33
	(0.20)	(0.27)	(0.23)	(0.13)	(0.19)	(0.17)	(0.19)	(0.27)	(0.29)
Blended family, no info	0.46	-0.26	-1.21	-0.26	1.43	-0.57	-1.81	0.89	1.10
	(1.23)	(1.68)	(1.43)	(0.81)	(1.15)	(1.03)	(1.18)	(1.65)	(1.79)
Single parent family	0.21	0.13	0.37**	0.11	-0.02	0.05	-0.14	0.09	0.35*
	(0.14)	(0.20)	(0.17)	(0.10)	(0.13)	(0.12)	(0.14)	(0.19)	(0.21)
Other family, unhappy	-0.02	0.05	0.15	0.59	-0.80	-0.60	-0.71	-0.12	1.38
	(0.83)	(1.14)	(0.97)	(0.55)	(0.78)	(0.70)	(0.80)	(1.12)	(1.21)
Other family, happy	0.66	0.47	1.09*	-0.26	0.46	-0.07	-0.78	0.61	0.59
	(0.54)	(0.74)	(0.63)	(0.36)	(0.51)	(0.45)	(0.52)	(0.73)	(0.79)
Other family, no info	-0.86	0.05	2.69**	-0.68	0.08	-0.48	-1.14	-0.87	2.13
	(0.91)	(1.24)	(1.06)	(0.60)	(0.85)	(0.76)	(0.87)	(1.22)	(1.32)
Warm parenting	0.12**	0.05	-0.02	-0.10***	-0.08*	0.00	-0.19***	-0.18***	-0.24***
	(0.05)	(0.07)	(0.06)	(0.03)	(0.05)	(0.04)	(0.05)	(0.07)	(0.08)
Angry parenting	0.49***	0.19***	0.12**	0.56***	0.29***	0.17***	0.50***	0.25***	0.23***
	(0.05)	(0.07)	(0.06)	(0.03)	(0.05)	(0.04)	(0.05)	(0.07)	(0.07)
Consistent parenting	-0.20***	-0.17**	-0.01	-0.19***	-0.00	0.01	-0.22***	-0.05	-0.13*
	(0.05)	(0.07)	(0.06)	(0.03)	(0.05)	(0.04)	(0.05)	(0.07)	(0.07)
Mother's general health	-0.07**	-0.04	-0.03	0.00	0.03	-0.01	-0.05	-0.05	0.02
	(0.03)	(0.04)	(0.04)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)
Mother's mental health	-0.19***	-0.08	-0.19***	-0.11***	0.01	-0.01	-0.13***	-0.12*	-0.03
	(0.05)	(0.07)	(0.06)	(0.03)	(0.05)	(0.04)	(0.05)	(0.07)	(0.07)
Constant	1.85***	4.41***	0.71	3.09***	2.43***	0.43	5.92***	3.63***	3.65***
	(0.70)	(0.96)	(0.82)	(0.46)	(0.66)	(0.59)	(0.68)	(0.94)	(1.02)
N (observations)	8,433	8,433	8,433	8,433	8,433	8,433	8,433	8,433	8,433
N (children)	3,909	3,909	3,909	3,909	3,909	3,909	3,909	3,909	3,909
R^2 (within)	0.105	0.022	0.026	0.307	0.093	0.046	0.182	0.042	0.038

Notes: LSAC, K Cohort, Waves 4-6. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Covariates for which there are not estimates in this tables are time-invariant or rarely changing and were automatically dropped in fixed-effect estimation.

Figure A1. Distribution of SDQ scores and Log of income

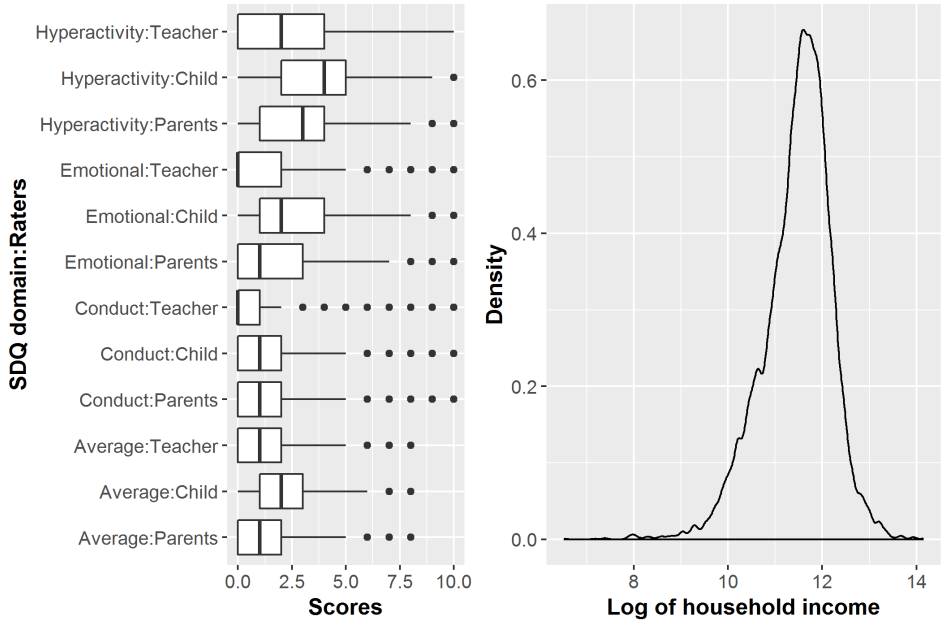

Table A5. F-tests (p-value) for differences in SDQ scores by raters

SDQ domain	Rater pairs	OLS	Random-effects	Fixed-effects
Emotional symptoms	P vs. C	0.1879	0.7431	0.1672
Emotional symptoms	P vs. T	0.3956	0.5838	0.7635
Emotional symptoms	T vs. C	0.5484	0.8803	0.1188
Hyperactivity	P vs. C	0.3692	0.3142	0.7427
Hyperactivity	P vs. T	0.4425	0.3222	0.3857
Hyperactivity	T vs. C	0.1287	0.0736	0.2994
Conduct problem	P vs. C	0.6975	0.8017	0.9356
Conduct problem	P vs. T	0.7306	0.6049	0.4557
Conduct problem	T vs. C	0.9545	0.8292	0.5754

Note: P=parents, T=Teachers, C=Child

Table A6. SDQ:

The SDQ scores are produced from responses to the following questions about child's behaviour over the past 6 months.

SDQ Indicators	Questions
Emotional Problems Scale	(1) Often complains of headaches, stomach aches or sickness; (2) Many worries, often seems worried (3) Often unhappy, down-hearted or tearful (4) Nervous or clingy in new situations, easily loses confidence (5) Many fears, easily scared.
Conduct Problems Scale	(1) Often has temper tantrums or hot tempers; (2) Generally obedient, usually does what adults request; (3) Often fights with other children or bullies them; (4) Often argumentative with adults; (5) Can be spiteful to others.
Hyperactivity Scale	(1) Restless, overactive, cannot stay still for long; (2) Constantly fidgeting or squirming; (3) Easily distracted, concentration wanders; (4) Thinks things out before acting; (5) Sees tasks through to the end, good attention span.