Life Course Centre Working Paper Series

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ARC Centre of Excellence for Children and Families over the Life Course

Sources of Variation in the Income Gradient in Child Mental Health: Evidence from Australia

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No. 2017-19
November 2017

The University of Queensland AUSTRALIA
The University of Melbourne
The University of Western Australia
The University of Sydney

Australian Government
Australian Research Council

NON-TECHNICAL SUMMARY

Understanding the factors that enhance or limit children's physical and mental health is a topic of increasing interest to researchers and policymakers alike, as child health is known to have short- and long-term effects on academic attainment, adult health and labour market outcomes. Income is one important precursor of child physical and general health, but studies examining income gradients in child mental health remain scarce. In this paper, we examine the income gradient in child mental health using longitudinal data from a large, national cohort of Australian children (The Longitudinal Study of Australian Children). We contribute to the body of existing literature by (i) better accounting for sources of heterogeneity that might give rise to spurious associations between income and child mental health, (ii) examining the evolution of the income gradient in child mental health by child's age, and (iii) comparing whether child mental health levels and their relationship with income vary when child mental health is assessed by the child's parent, the child's teacher and the child herself/himself.

In a first set of analyses we find that children evaluate their mental health more negatively than their parents, who are in turn harsher in their assessments than the teachers. This suggests that population-level estimates of child mental health will be dependent on who assesses the child's mental health. In addition, we find that assessor discrepancies depend systematically on parental income, being lower in high- than low-income households.

In a second set of analyses we find that, when only a basic set of covariates is present, family income has a significant positive effect on the mental health of Australian children. Yet this effect varies depending on who assesses child's mental health: it is largest when assessed by parents, and smallest when assessed by the child. However, the income gradient in child mental health fades when we add a more comprehensive set of controls to the model (e.g. maternal health), and when we exploit the panel data to better capture time-invariant unobserved effects.

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. Our findings indicate that, depending on the preferred model, the income gradient in child mental health in contemporary Australia is either insubstantial or statistically indistinguishable from zero. Our findings are also indicative that good maternal mental health and positive parenting practices are amongst the factors through which income translates into better childhood mental health. Therefore, these are factors ripe for institutional intervention to redress the (small) gaps in mental health outcomes between children in poorer and richer Australian households. Policy initiatives of this kind can contribute to breaking the cycle of disadvantage experienced by children growing in up in disadvantaged financial circumstances.

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ACKNOWLEDGEMENTS: This research was supported by the Australian Research Council (ARC) Centre of Excellence for Children and Families over the Life Course (project number CE140100027). The Centre is administered by the Institute for Social Science Research at The University of Queensland, with nodes at The University of Western Australia, The University of Melbourne and The University of Sydney. This paper uses unit record data from Growing Up in Australia, the Longitudinal Study of Australian Children. The study is conducted in partnership between the Department of Social Services (DSS), the Australian Institute of Family Studies (AIFS) and the Australian Bureau of Statistics (ABS). The findings and views reported in this paper are those of the author and should not be attributed to the ARC, DSS, AIFS or the ABS.

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Abstract

Understanding the factors that enhance or limit children's physical and mental health is a topic of increasing interest to researchers and policymakers alike, as child health is known to have short- and long-term effects on academic attainment, adult health and labour market outcomes. Income is one important precursor of child physical and general health, but studies examining income gradients in child mental health remain scarce in the economics literature. To our knowledge, only Johnston et al. (2014) have examined these relationships using British data. In this paper, we shed further light on these issues using longitudinal data from a large, national cohort of Australian children. We contribute to the literature by adding further covariates and applying panel approaches to control for unobserved heterogeneity that might be correlated with both income and child mental health, and examining the evolution of the income gradient in child mental health by child's age. We find that, when only a basic set of covariates is present, family income has a significant positive effect on the mental health of Australian children. This effect varies depending on who assesses child's mental health (it is largest when assessed by parents, and smallest when assessed by the child), and it fades in the presence of controls for parental health or unobserved effects.

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

1. Introduction and background

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

A large and growing literature has demonstrated that exposure to economic disadvantage during childhood is an important factor associated with poor mental health and wellbeing among children (Bradley & Corwyn, 2002; Poulton *et al.*, 2002). While sociologists have focused on examining the influence of parental education, occupation and social class, economists have concentrated on the role of income. Income may directly translate into better health outcomes for children by relaxing family budget constraints, so that households are able to buy inputs that directly influence the child's health (e.g. medical care, healthy and nutritious food) as well as inputs that do so indirectly (e.g. high-quality housing in good neighbourhoods). In addition, some of the association between income and child health could be due to factors such as parental education, parental health, parenting practices, and parental relationship quality. Contemporary approaches to examining the income gradient in child general health date back to a seminal paper by Case *et al.* (2002). Since then, a large and growing number of studies have focused on examining how income affects children's general health (as reported by a parent) and the presence of chronic conditions (see e.g., Apouey & Geoffard, 2013; Condliffe & Link, 2008; Currie *et al.*, 2007; Currie & Stabile, 2003; Khanam *et al.*, 2009, 2013; Kruk, 2013; Kuehnle, 2014; Murasko, 2008; Propper *et al.*, 2007; Reinhold & Jurges, 2011). Most of these studies found a significant income gradient in child general health, whereby lower family income leads to poorer child health.

Despite the vast literature on the income gradient in physical/general health, the literature examining whether there is an analogous *income gradient in child mental* health is rather limited. To our

knowledge, in the economics literature only Johnston *et al.* (2014) have delved in detail into this issue. Their findings, using British data from two cross-sectional child mental health surveys (dating to 1999 and 2004), provide evidence of a positive income effect on child's mental health. The authors also examined the extent to which child's mental health levels vary depending on who assesses it (parents, teachers or children), and whether income shows different associations with these different measures. Their results provide evidence of heterogeneity in the average rate of child mean health problems when these are reported by different assessors, and that the income gradient in child mental health varies depending on who rates the child's mental health. Generally, its magnitude was smallest when the child's mental health was assessed by the child, and largest when assessed by the parents (Table 5, Johnston *et al.*, 2014). Their study, however, did not control for some important confounders in the relationship between income and child's mental health (e.g., maternal mean health). In addition, their cross-sectional data limited their ability to examine the evolution of the income/child mental health gradient as children get older, or the role of individual-speific unobserved heterogeneity.

We shed further light on these issues by examining the income gradient in child mental health in Australia, using data from a unique national cohort study: the Longitudinal Study of Australian Children (LSAC). The LSAC data enables us not only to replicate the findings by Johnston *et al.* (2014) in a new country context, but also to expand the literature by testing additional hypotheses. Specifically, we investigate: (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 of child mental health are patterned by parental income; (3) whether there is a child mental health/income gradient in Australia; and (4) if so, whether such gradient can be explained away by the inclusion of additional covariates or by controlling for unobserved individual effects by leveraging the panel data at hand. The latter is an important contribution, as most previous studies in this field either did not have access to panel data (e.g., Case *et al.*, 2002; Currie & Stabile, 2003; Currie *et al.*, 2007, 2008; Propper *et al.*, 2007; Reinhold & Jürges, 2012; Apouey & Geoffard, 2013; Kuehnle, 2014; Johnston *et al.*, 2014) or did have access, but did not exploit their properties by modelling them using panel estimators (e.g., 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 as those deployed by Johnston *et al.* (2014). They also reveal that the gradient varies depending on who assesses the child's mental health: it is generally largest when parents do so, and smallest when the child does. However, the income gradient in child mental health in our Australian sample fades when we control for (i) important covariates omitted in previous analyses (such as maternal health), and (ii) unobserved effects via fixed-effect panel regression models. We did not find any significant differences in the income gradient in child mental

health (or in the differences between assessors) by child's age. These findings suggest that ignoring the endogeneity of income may contribute to overreporting the income gradient in child mental health.

2. Data and descriptive analyses

We use 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.*, 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 focus only on K-cohort children and waves 4 (age 10/11), 5 (age 12/13), and 6 (age 14/15). This is because information on child mental health assessed by parents, children *and* teachers were only collected in those 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 are 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 are comparable to Johnston *et al.* (2014), who used data for British children aged 11-15 years.

2.1 Outcome variable: the Strengths and Difficulties Questionnaire

Our outcome variables capturing child mental health are based on the *Strengths and Difficulties Questionnaire* (SDQ), a composite measure of the child's socio-emotional outcomes which has been widely used in the literature (including Johnston *et al.*, 2014). The SDQ is divided into five separate subscales capturing pro-social behaviour, hyperactivity, emotional symptoms, conduct problems, and peer problems. Following Johnston *et al.* (2014), we restrict 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 study child is able to stay still, constantly fidgeting, easily distracted, stop 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 study 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 study child has a hot temper, is obedient and fights, is argumentative with adults, and is spiteful to others. For all of the questions response options are scored 0 = 'true', 1 = 'somewhat

true', and 2 = 'certainly true'. As a result, when the five items per subscale are added together, all subscales range from 0 to 10, where higher scores denote 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 study child parents' weekly income from all sources, and multiplying the resulting figure by 52 weeks to obtain an annual amount.[1] 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 Control variables

Our base model includes a basic set of control variables that resemble those used in previous studies of the predictors of child health (see e.g., Case *et al*. 2002; Currie, 2003; Khanam *et al.*, 2009; Apouey & Geoffard, 2013; Johnston *et al.*, 2014; Perales *et al.*, 2017). These include the study child's age expressed in months, gender, and ethnicity, as well as the language spoken at home, family structure, number of siblings and mother's education.

In subsequent analyses, we further mitigate potential ommited-variable bias due to the endogeneity of income by controlling for an extended set of covariates. These capture other factors known to be correlated with both income and child mental health, including the study child's general health, maternal general and mental health, three scales capturing warm, angry and consistent parenting practices, and parental relationship happiness (Gregg *et al.*, 2005; Khanam & Nghiem, 2016; Nghiem *et al.*, 2015). Because our sample also includes single-parent families, the new parental relationship happiness variable is interacted with the family type variable (as per Table 1).

2.4 SDQ scores

The top panel in Table 1 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,

[1] The weekly income data is 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, and we are thus unable to use a measure of *household* instead of *parental* income.

and study children.[2] The means for the parent-assessed, child self-assessed and teacher-assessed emotional symptoms subscales from all waves (pooled) are 1.86 (SD=1.92), 2.78 (SD=2.24) and 1.18 (SD=1.70), respectively. The means for the parent-assessed, child self-assessed and teacher-assessed hyperactivity subscales are 2.87 (SD=2.30), 3.66 (SD=2.28), and 2.48 (SD=2.65), respectively; whereas those for the parent-, child- and teacher-assessed conduct problem subscales are 1.01 (SD=1.40), 1.65 (SD=1.61), and 0.66 (SD=1.41), respectively. The full distributions of parent, child and teacher evaluations of children's emotional symptoms, conduct problems and hyperactivity are depicted in Figure 1.

Overall, these descriptive statistics suggest that, in our sample of Australian children, (i) hyperactivity is the most common socio-emotional problem and conduct problems are the least common; and (ii) teachers perceive fewer problem behaviours across these three domains of child mental health than do parents, which in turn perceive fewer problems than the children themselves. These findings are consistent with those reported in Johnston *et al.* (2014) for Britain.

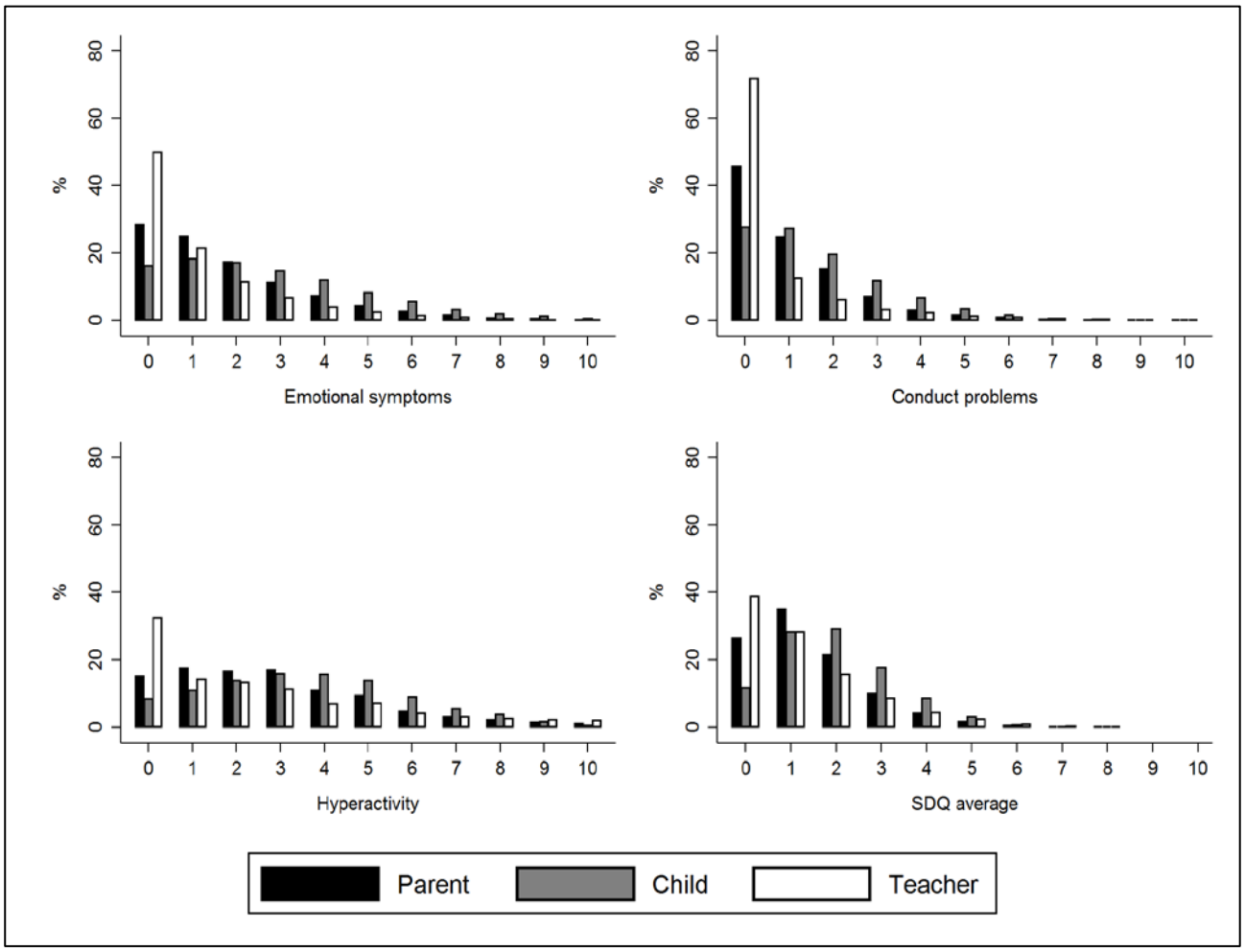
[2] Parental reports come from the child's main carer, or Parent 1 in LSAC (i.e. the parent who knows the child best). In these data, in over 95% of the cases this is the child's biological mother. For simplicity, in the remainder of the paper we refer to the Parent 1 as the mother.

Table 1. 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
Child's general health [c]	4.273	0.777	4.297	0.749	4.281	0.824	4.283	0.781
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 [d]								
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 general health (Likert scale from 1 = 'excellent' to 5 = 'poor'). [b] Maternal mental health (Kessler 6 scale; Kessler *et al.*, 2010); [c] Child's general health (Likert scale from 1 = 'excellent' to 5 = 'poor'); [d] 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.

Figure 1. Distribution of SDQ scores



Notes: LSAC, K Cohort, Waves 4-6.

2.5 Differences in SDQ reporting by assessors

Table 2 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 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.

Parents report significantly more severe behavioural problems (positive differences) than teachers, while both parents and teachers report significantly less severe behavioural problems (negative differences) than the child himself/herself. In addition, the differences seem to decrease (in absolute

value) as children grow older. For example, the difference in parent-teacher evaluations of emotional symptoms moves from 0.77 in Wave 4 (when children are 8/9 years of age) to 0.62 in Wave 6 (when children are 12/13 years of age).

The distributions of these differences are shown in Figure 2. These indicate that there is less assessor variance in evaluations of conduct problems and more variance in evaluations of hyperactivity. In addition, almost all of the *t*-tests reject the null hypothesis of no differences in SDQ scores between assessors (the only exception being the difference in hyperactivity scores between parents and teachers in Wave 6).

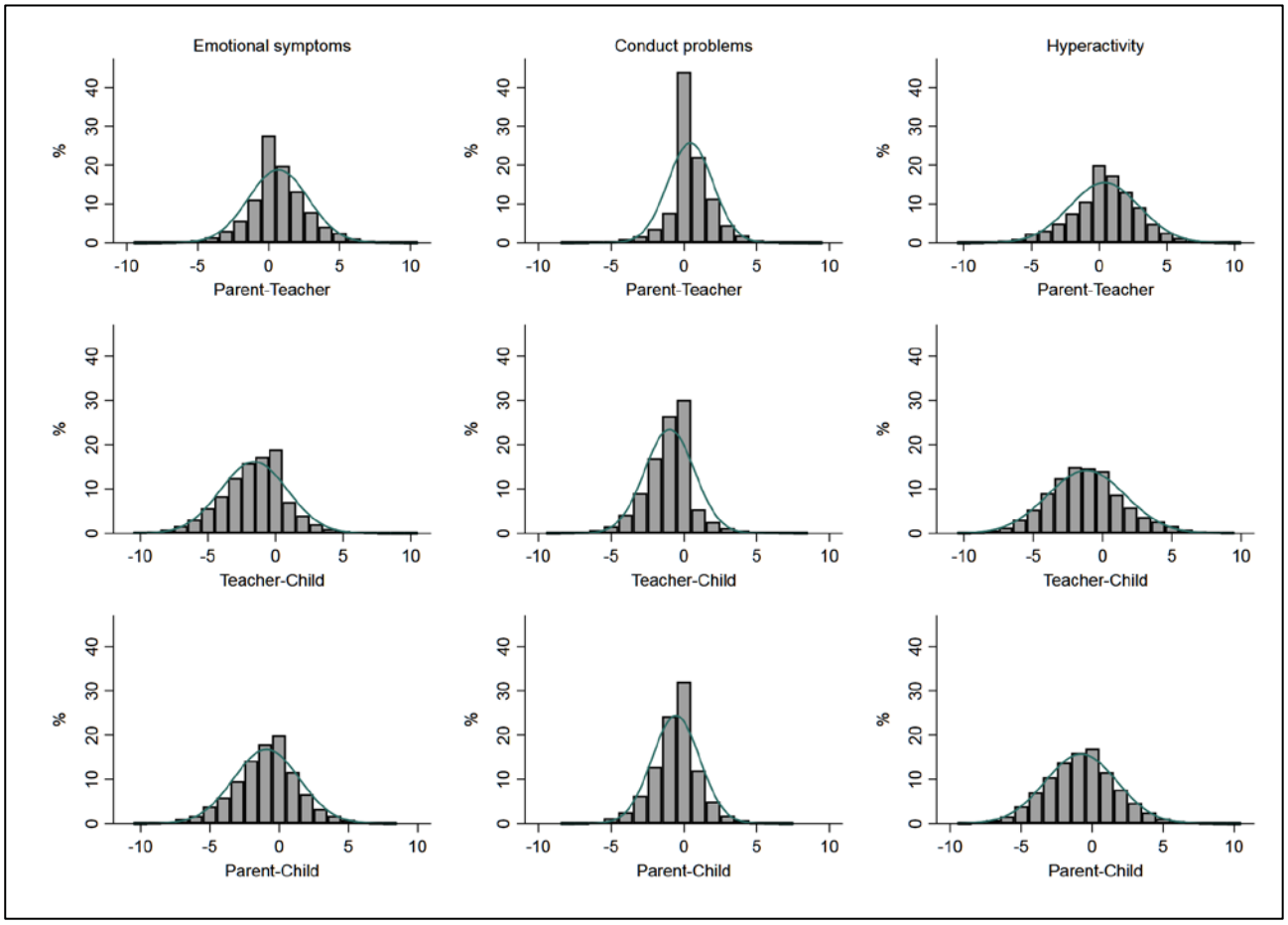
Altogether, these results suggest that the evaluations of the child's mental health differ between parents, teachers, and the children themselves, with children reporting more negative symptoms than parents or teachers. Additionally, parents tend to make more negative evaluations than teachers.

Table 2. 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	0.70	0.57	-1.85	-1.00	-1.24	-1.08	-0.50	-0.66
Standard deviation	2.10	2.48	1.57	2.44	2.69	1.79	2.44	2.52	1.76
Wave 5									
Mean	0.64	0.32	0.38	-1.24	-1.04	-0.85	-0.60	-0.72	-0.47
Standard deviation	2.16	2.64	1.58	2.35	2.86	1.67	2.31	2.54	1.57
Wave 6									
Mean	0.62	0.08	0.31	-1.69	-1.31	-0.84	-1.07	-1.23	-0.53
Standard deviation	2.10	2.58	1.47	2.60	2.92	1.58	2.36	2.51	1.53
All waves									
Mean	0.68	0.39	0.43	-1.59	-1.17	-0.99	-0.91	-0.78	-0.56
Standard deviation	2.12	2.57	1.55	2.47	2.81	1.70	2.38	2.54	1.63

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.

Figure 2. Distribution of assessor differences in SDQ scores



Notes: LSAC, K Cohort, Waves 4-6.

3. Associations between income and assessor differences in SDQ reports

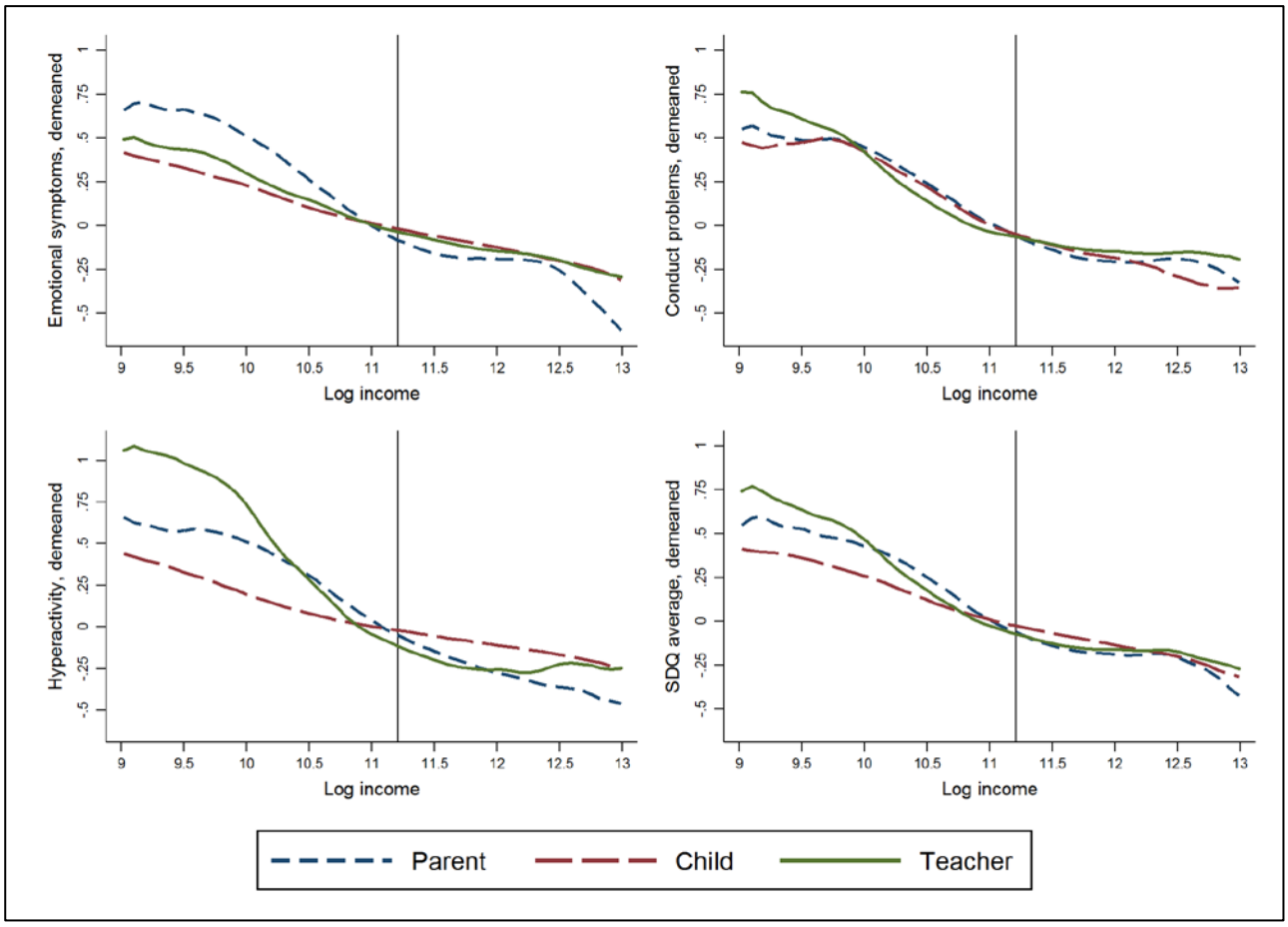
3.1 Bivariate associations

Figure 3 depicts the bivariate relationships between income and SDQ scores using kernel-weighted local polynomial regressions. 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).

All four panels show a similar pattern: assessor differences in assessments of child mental health decrease with income. Therefore, there is higher variation in such differences for children living in low-income households. Three panels (emotional symptoms, hyperactivity, and SDQ average) show that children from low-income families rate their mental health better than their parents do. In addition, parents from low-income families evaluate their children better than their teachers –except for emotional symptoms. However, teachers' evaluations of the mental health of children in high-income households are similar to those of parents and children. Figure 3 also shows that there are

lower divergences in the reporting of conduct problems between parents, teachers and children, and higher divergences in the reporting of hyperactivity.

Figure 3. Associations between income and demeaned SDQ scores



Notes: LSAC, K Cohort, Waves 4-6. Kernel-weighted local polynomial regressions. The vertical line represents mean parental income in the sample.

3.2 Multivariate associations

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

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

where ΔMD_i is the difference in assessor is 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 decrease with income (i.e., that there is higher 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 decreases with income.

Results from the LHMs estimated on our Australian sample (Table 3, Panel b) are generally 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 reduces assessor differences of child mental health (β parameter) and the variance of such differences (α parameter). This finding suggests that there is higher consensus on children's mental health in higher income households. However, the magnitude of our estimates seems 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 is only 0.7 units. Likewise, the income estimate for parents-child differences in hyperactivity in Britain and Australia are -0.31 and -0.11, respectively. Our results also show 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 is in our study (-0.11) is half of that reported in Johnston *et al.* (2014) – of -0.22.

To examine whether the results presented in Table 3 are sensitive to the omission of some important factors in the child-health production function, we include additional variables capturing maternal general and mental health, parenting practices, parental relationship quality, and child's general health. The results (Table 3, Panel c) indicate that differences in the SDQ scores reported by children, parents and teachers no longer differ significantly by income (except for teacher-child differences in hyperactivity ratings, which are significant at the 10% level). This finding suggests that the inclusion of the extended set of variables in the model accounts for the systematic variation in SDQ reports across assessors. However, income remains a significant predictor of the variance of assessor differences in child mental health. That is, income remains significantly correlated with the heteroscedasticity of assessor differences in SDQ scores. Hence, income is correlated with unobservable factors captured 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	-0.08	-0.001	-0.06	-0.05	-0.001
Standard error	0.03	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	-0.02	-0.001	-0.19	-0.05	-0.07	-0.08	-0.08	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. 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

As discussed earlier, there is an established literature on the income gradient in child physical/general health. However, fewer studies focus on the income gradient in child *mental* health. In this section we investigate such gradient using Australian data and covariates that are comparable to those used in the literature on the income/child general health gradient (e.g., Case *et al.*, 2002; Currie & Stabile, 2003; Khanam *et al.*, 2009).

A general specification to estimate the income gradient in child mental health in the presence of panel data is:

$$H_{it} = X_{it}\beta_1 + Z_i\beta_2 + v_{it} \quad (2)$$

where H_{it} represents the mental health of child i in wave t; X_{it} is a set of time-varying covariates, including income; Z_i is a set of time-invariant covariates; β_1 and β_2 are vectors of parameters to be estimated; and v_{it} is a composite error term. This is a simple pooled OLS model, which is never the most consistent or efficient approach in the presence of panel data. Here, we only show estimates from pooled OLS models to make our results as comparable as possible to those presented in Johnston *et al.* (2014). A second approach to estimate the associations between income and child mental health with panel data is the random-effect estimator. This approach splits the error term in Equation 2, v_{it}, as follows:

$$v_{it} = \mu_i + \varepsilon_{it} \quad (3)$$

where the time-invariant portion of the error, μ_i, represents time-invariant unobserved individual characteristics (e.g., genetic inheritance, personality traits, culture and traditions), while the time-varying portion, ε_{it}, is the usual random error in regression estimation. Therefore Equation 3 becomes:

$$H_{it} = X_{it}\beta_1 + Z_i\beta_2 + \mu_i + \varepsilon_{it} \quad (4)$$

However, consistent estimation of the random-effect model is contingent on the assumption that μ_i is uncorrelated with other covariates ($E(u_i|X_{it}, Z_i) = 0$). A way to relax this assumption is to apply the within transformation, fitting a fixed-effect model:

$$H_{it} - \bar{H}_i = (X_{it} - \bar{X}_i)\beta + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (5)$$

This fixed-effect model allows for arbitrary correlations between the time-invariant unobserved heterogeneity and the observed covariates (including income), by averaging out the time-invariant error, μ_i –although the estimates of the time-invariant covariates, Z_i, cannot be directly retrieved. However, the fixed-effect estimator is inefficient, as it requires considerable within-individual over-time variation in the panel data.

As is customary in the panel data literature, we use a Hausman test to determine whether the potentially biased but consistent estimator (the random-effect model) is preferable over the unbiased but inefficient estimator (the fixed-effect model). The results suggest that the fixed-effect estimates are in virtually all cases preferable (exceptions include the models with basic covariates for emotional symptoms assessed by the teacher or child, and conduct problems assessed by the child). For the sake of parsimony and comparability with other studies, we present income coefficients from all three estimators in Table 4.

When controlling for only for a basic set of covariates (Panel b), the pooled OLS results indicate that higher parental income is significantly associated with fewer child problem behaviours. The only exception is the model for child-reported hyperactivity, in which the income coefficient is not statistically significant. These results are consistent with those in Johnston *et al.* (2014, Panel a). However, the magnitude of the income coefficients in our Australian sample appears to be sensibly smaller than that of the estimates for their British sample. For example, the log income coefficients in our analyses have a magnitude of around 0.1, indicating that a 10% increase in income is associated with 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, both our and their results 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 (not shown in the tables, but available upon request) 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 thuis somewhat reassuring, as they suggests that, in most cases, the observed income gradient in child mental health will be similar irrespective of the evaluator of child mental health.

Results from random-effect models are similar to those from pooled OLS models –probably due to the inability of random-effect models to fully control for unobserved heterogeneity. In contrast, results from fixed-effect models (which are better equipped to control for unobserved effects) show no evidence that income is a significant predictor of child mental health. Results from F tests for these panel regression models also reveal no significant differences in the income gradient in child mental health, as evaluated by different assessors.

When controlling for an extended set of covariates (Panel c), results from pooled OLS models still indicate that income is a significant predictor of conduct problems for all assessors. However, the magnitudes of the estimated income parameters are modest: a 10% increase in parental income is

associated with a reduction in conduct problems of just 0.7 to 0.8 units. The income coefficient also has the expected negative sign in the models for emotional symptoms and hyperactivity, but the estimate is only statistically significant in the models in which child mental health is evaluated by teachers. Income has a significant effect on parent-reported emotional symptoms, but no significant effect on child-reported emotional symptoms and hyperactivity. The F test results (not shown, but available upon request) reveal that when using extended covariates there are 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 produce very similar results to the pooled OLS models. And again, in fixed-effect models with extended covariates income is no longer a significant predictor of child mental health, regardless of its assessor. As could be expected, neither are the differences in the income coefficient across fixed-effect models.

Full sets of estimates for representative models are shown in the Appendix. Significant predictors of child mental health include the gender and general health 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 are less likely to experience emotional symptoms but more likely to experience conduct problems and hyperactivity. Generally, children with good general health have fewer socio-emotional problems, particularly emotional symptoms. Somewhat surprisingly, children from families that speak English at home have significantly higher scores (i.e. worse mental health) in all three SDQ domains, regardless of who assesses them. Given known disadvantages for the non-English-speaking group in other life domains, it could be speculated that this may be due to cultural differences in the reporting of problem behaviours. Indigenous children, on the other hand, display worse mental health outcomes than non-Indigenous children –especially in relation to conduct problems and hyperactivity. In addition, when the primary carer reports having an unhappy relationship with her partner or exerts angry parenting, children have significantly higher problem scores on emotional symptoms, conduct problems and hyperactivity, irrespective of the assessor. In contrast, children whose primary carers exert a consistent parenting style and have good mental or general health have significantly lower scores on emotional symptoms, conduct problems and hyperactivity.

Table 4. Associations between income and SDQ scores: Pooled OLS, random-effect and fixed-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)
FE estimates			
Emotional symptoms	0.03 (0.04)	0.05 (0.05)	-0.07 (0.06)
Conduct problems	-0.03 (0.03)	0.01 (0.04)	-0.02 (0.04)
Hyperactivity	-0.03 (0.04)	-0.09 (0.06)	0.001 (0.06)
Panel c: This paper, extended covariates			
OLS estimates			
Emotional symptoms	-0.11*** (0.03)	-0.07** (0.03)	-0.04 (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)	-0.11** (0.04)	-0.01 (0.04)
FE estimates			
Emotional symptoms	0.03 (0.04)	-0.07 (0.06)	0.05 (0.05)
Conduct problems	-0.03 (0.03)	0.01 (0.04)	-0.02 (0.04)
Hyperactivity	-0.02 (0.04)	-0.08 (0.06)	0.01 (0.06)

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

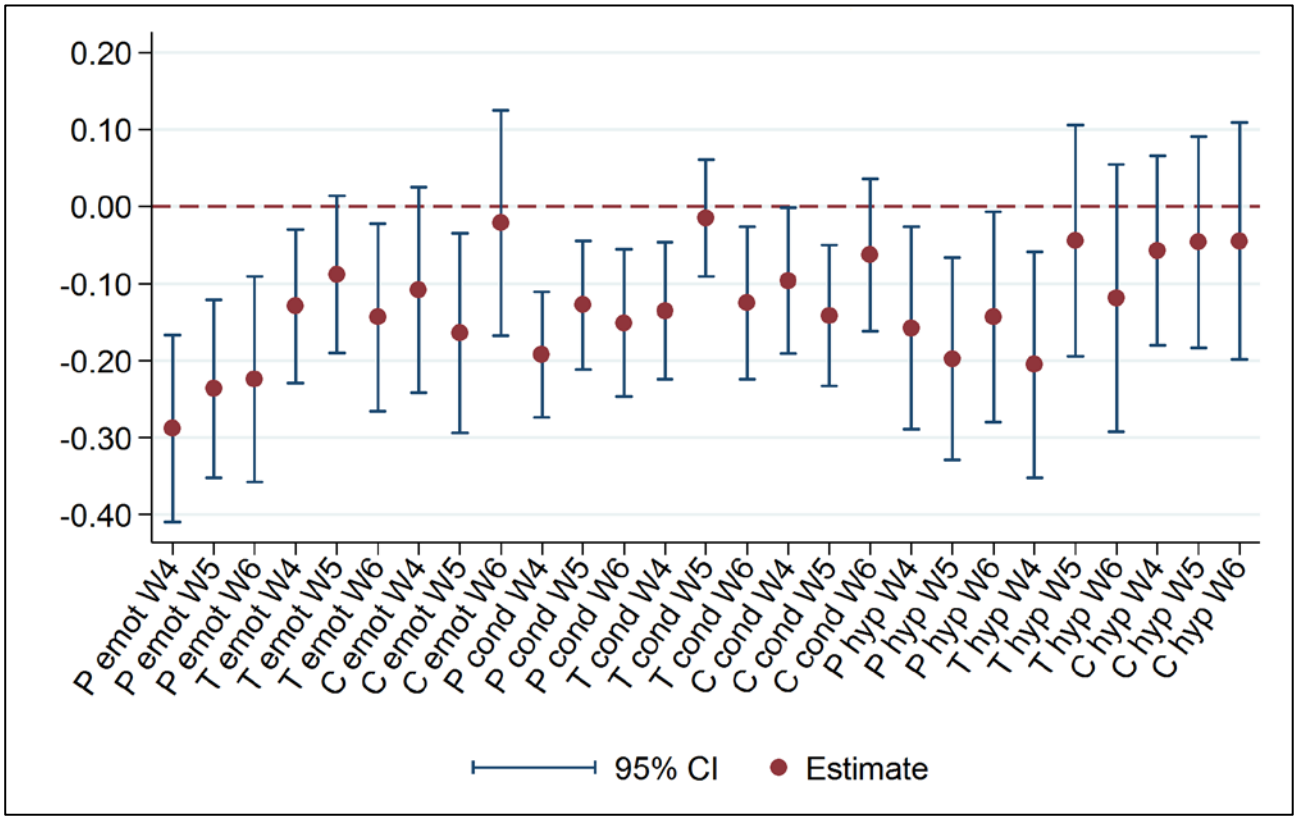
4.1 The income gradient in child mental health & differences between assessors' reports, by child's age

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 increase with age. We do so by comparing children in the LSAC sample at ages 8/9, 10/11 and 12/13.

Figure 4 shows the point estimates and 95% confidence intervals for the income gradient in child mental health across assessors, domains of the SDQ, and child ages. These results are from OLS models using the basic set of covariates. The figure shows that income is negatively associated with SDQ scores, but reveals few apparent trends by child's age. As an exception, for parent-reported emotional symptoms, the income estimate becomes less negative as the child ages. The income gradient is only statistically significant across all three waves for parent-reported scores, and only insignificant across all three waves for child-rated hyperactivity.

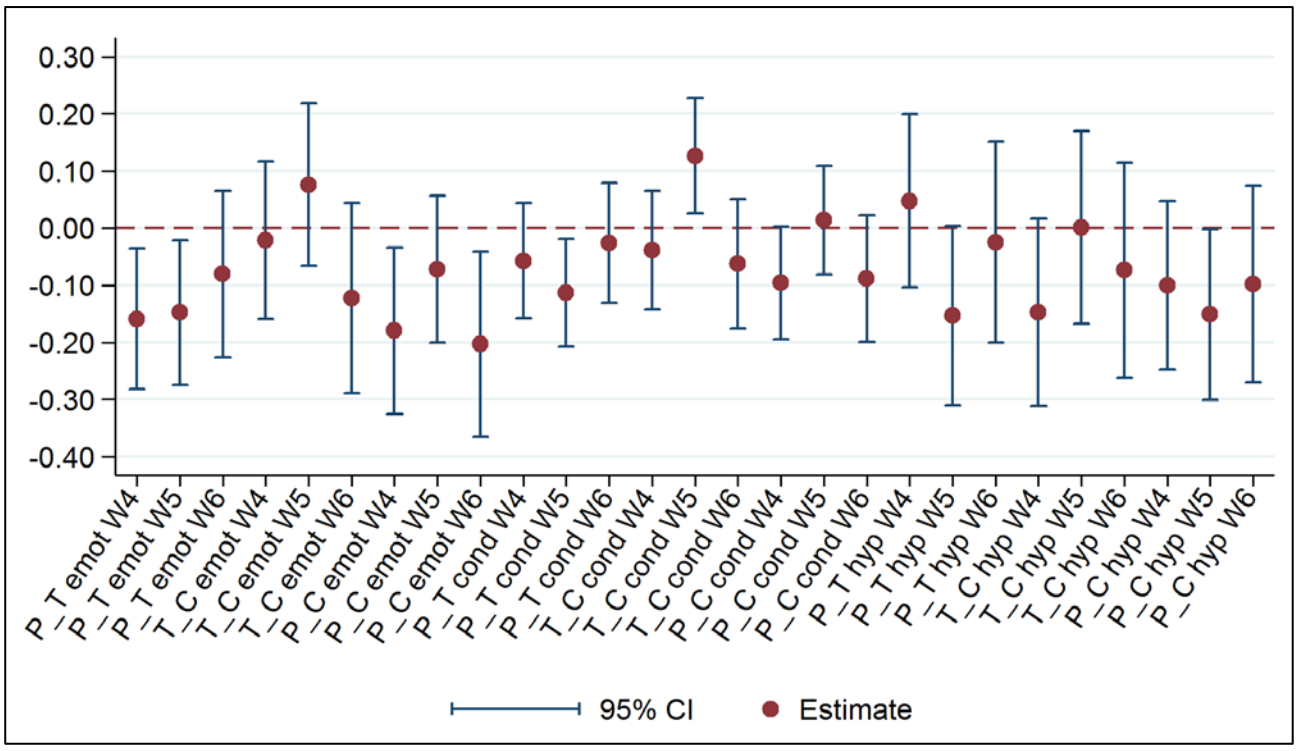
Figure 5 shows the point estimates and 95% confidence intervals for assessor differences in child mental health, by SDQ domain and child's age –again, from OLS models using a basic set of covariates. Consistent with the descriptive findings presented in Table 2, differences in child mental health ratings across assessors diminish as the child grows older. Where there are significant differences across assessors at ages 8/9 and 10/11, these differences become insignificant at ages 12/13.

Figure 4. 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 5. 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. Transmission mechanisms

Finally, we examine different factors that may act as potential transmission mechanisms in the relationship between income and child mental health in Australia. In the economics literature, the relationship between family income and child development has been chiefly theorised using investment and family stress theories. Investment theory (Becker & Tomes, 1986; Becker, 1981) poses that, as parents care about the long-term wellbeing of their children, they make investments (such as time, effort and material inputs) to maximise this. Since many productive inputs (such as good housing, health care, or extracurricular activities) can be purchased with income, high-income parents are in a better position to invest in these and enhance their children's wellbeing. Family stress theory (Smith & Brooks-Gunn, 1997; Yeung *et al.*, 2002), on the other hand, postulates that economic hardship adversely affects the physical and psychological wellbeing of parents, with flow-on negative consequences on inter-parental conflict and parenting practices.

Following from these broad theoretical frameworks, previous studies on the income/child *general* health gradient have identified transmission mechanisms such as physical activity and nutrition intake (Currie *et al.*, 2007), maternal health (Proper *et al.*, 2007; Khanam *et al.*, 2009), or access to health care services, good-quality housing, nutrition and clothing (Apouey and Geoffard, 2013; Kuehnle, 2014). Here, in addition to the basic covariates, we consider the child's general health status, parenting practices, parental relationship quality, and maternal general and mental health as potential mechanisms driving the income gradient in child *mental* health. In the models presented in Table 6 we accomplish this by progressively including variables capturing these factors and examining how the income coefficients change. Unlike previous studies based on cross-sectional samples (Case *et al.* 2002; Proper *et al.*, 2007), we undertake this exercise using panel data and random-effect panel regression models.

Including variables capturing child's general health, parenting practices, and parental relationship quality (Models 2 to 4) to a model with basic covariates similar to those in Johnston *et al*. (2014, Model 1) does not change the level of statistical significance of the income coefficients, and bears little to no change to their magnitudes. This finding suggests that these factors cannot be considered important transmission mechanisms in the income/child mental health gradient in our Australian data. However, the inclusion of maternal general and/or mental health (Models 6 and 7) substantially reduces the magnitude and significance of the income coefficients, though these remain significantly different from zero (except for teacher-reported emotional symptoms). For example, the income coefficients in Model 7 (adding both maternal general health and maternal mental health) for parent-reported emotional symptoms, hyperactivity and conduct problems are -0.07, -0.06 and -0.07, respectively, compared to -0.15, -0.12 and -0.11 in the model with basic control variables. Although

the inclusion of these new variables to the model does not make the income coefficient statistically insignificant, all added covariates are statistically significant predictors of child's mental health (see full tables of estimates in the Appendix).

Table 6. Mechanisms underlying the income/child mental health gradient in Australia

	Parents			Teachers			Child		
	Emotional symptoms	Hyperactivity	Conduct problems	Emotional symptoms	Hyperactivity	Conduct problems	Emotional symptoms	Hyperactivity	Conduct problems
Panel a: Basic covariates									
Model 1	-0.15***	-0.12***	-0.11***	-0.09***	-0.14***	-0.07**	-0.11***	-0.05	-.09***
Panel b: Model 1 + additional covariates									
Model 2	-0.14***	-0.11***	-0.11***	-0.08**	-0.14***	-0.07***	-0.09**	-0.04	-0.09***
Model 3	-0.13***	-0.10***	-0.10***	-0.08***	-0.12***	-0.07***	-0.09**	-0.03	-0.08***
Model 4	-0.14***	-0.11***	-0.11***	-0.09***	-0.14***	-0.07***	-0.11***	-0.04	-0.09***
Model 5	-0.11***	-0.09***	-0.10***	-0.06**	-0.13***	-0.06**	-0.07*	-0.02	-0.08***
Model 6	-0.09***	-0.08**	-0.08***	-0.06*	-0.12***	-0.06**	-0.08*	-0.02	-0.07**
Model 7	-0.07**	-0.06*	-0.07***	-0.05	-0.12**	-0.05**	-0.06	-0.01	-0.07**
Model 8	-0.08**	-0.06*	-0.08***	-0.05	-0.11**	-0.06**	-0.06	-0.01	-0.07**

Notes: LSAC, K Cohort, Waves 4-6. Random-effect models. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. We choose to report the results of random-effect models because they are preferable over pooled OLS models, and because all income coefficients are statistically insignificant in fixed-effect models. Results from the latter are available from the authors upon request. Additional covariates, defined as per the Table 1 notes. Model 2 adds child's general health. Model 3 adds parenting practices. Model 4 adds parental relationship happiness interacted with family structure. Model 5 adds the general health of mother. Model 6 adds maternal mental health. Model 7 adds maternal general & mental health, together. Model 8 adds all additional covariates together.

8. Discussion and conclusions

Identifing 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. However, few studies have provided detailed examinations of the role of income as a predictor of *child mental health*. In this paper, we have used unique longitudinal data from a large Australian cohort study to shed 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 measures changes the associations between child mental health and income. To the best of our knowledge, only Johnston *et al.* (2014) have done this using British data. Our first contribution was thus to provide the first replication of their study using data from another country, Australia. Our results indicate that children generally evaluate their mental health more negatively than their parents, who are in turn harsher in their assessments than the 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 their study. 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 for older children.

In addition, we find that assessor discrepancies depend systematically on parental income, being lower in high- than low-income households. Interestingly, children from low-income households rate their mental health more positively than their teachers or parents, with evidence that teachers are 'harsher' in their assessments of these children. However, the magnitude of our Australian estimates is substantially lower than that reported by Johnston and colleagues for Britain. This result is consistent with the findings in Khanam *el al.* (2009) using also LSAC the data. Khanam and her collegues 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 *el al.* 2002), Canada (Currie & Stabile, 2003) and the UK (Proper *et al.* 2007). While it is difficult to pinpoint what factors are responsible for this attenuation, it can be speculated that Australia's high living standards, high rates of income mobility, and – most importantly – its well-established universal and compulsory health care system (Medicare) may collectively provide a safety net for Australian children.

Second, we examined whether and how parental income relates to children's mental health, using different measures from different assessors. That is, we contributed to existing knowledge by (for the first time) revealing whether there is an income gradient in child *mental* health in contemporary Australia, and whether such 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 relationships may differ when considering the judgements made by other assessors. An initial set of analyses aimed to replicate as closely as possible those deployed by Johnston *et al.* (2014) using cross-sectional data and regression models, and a parsimonious set of covariates. In these circumstances, our findings resemble 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 random- and fixed-effect panel regression models. 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. However, when controlling for further sources of time-invariant unobserved heterogeneity using a fixed-effect estimator, the income gradient in child mental health faded completely. Parental income was no longer a significant predictor in any of the models, irrespective of the assessor.

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. Our findings indicate that, depending on the preferred model, the income gradient in child mental health in contemporary Australia is either insubstantial or statistically indistinguishable from zero. Our findings are also indicative that good maternal mental health and positive parenting practices are amongst the factors through which income translates into better childhood mental health. Therefore, these are factors ripe for institutional intervention to redress the (small) gaps in mental health outcomes between children in poorer and richer Australian households. Policy initiatives of this kind can contribute to breaking the cycle of disadvantage experienced by children growing in up in disadvantaged financial circumstances. Future research that replicates our Australian analyses in other country context is required to extend the external validity of our findings. Analyses which further identify the factors that link income to better child mental health outcomes (e.g., those ruled out by our fixed-effect models) would be particularly informative for the development of evidence-based interventions.

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Appendix. Full estimates from models of child mental health with extended covariates

OLS models

	Emotional symptoms			Conduct problems			Hyperactivity		
	Parent	Child	Teacher	Parent	Child	Teacher	Parent	Child	Teacher
Log of parental income	-.11***	-0.04	-0.07**	-.08***	-0.07**	-.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	0.02	-0.01	0.04***	-.07***	-.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	-.36***	-.73***	-0.05	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	0.25***	0.15*	0.26***	0.24***	0.35***	0.20***	0.46***	0.65***	0.51***
	(0.07)	(0.08)	(0.06)	(0.05)	(0.06)	(0.05)	(0.08)	(0.08)	(0.10)
Indigenous child	-0.05	0.00	0.41***	0.43***	0.61***	0.76***	0.45***	0.31**	1.00***
	(0.12)	(0.15)	(0.15)	(0.09)	(0.13)	(0.15)	(0.14)	(0.16)	(0.19)
Maternal education (ref. postgraduate)									
Graduate	-0.12**	-0.19**	-0.06	-0.07**	-0.03	-.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	-0.01	0.13**	0.06	0.12***	0.22***	0.13***	0.42***	0.20***	0.28***
	(0.05)	(0.07)	(0.05)	(0.03)	(0.04)	(0.04)	(0.06)	(0.07)	(0.07)
Unknown	1.11	0.61	-0.84*	0.70	0.71	-0.07	-0.13	0.98	-0.74
	(0.75)	(0.83)	(0.48)	(0.64)	(1.09)	(0.71)	(0.97)	(0.90)	(1.44)
# siblings	-.09***	-0.01	-0.05**	0.07***	0.09***	0.02	-0.13***	0.00	0.04
	(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	-0.12*	-0.01	-0.02	-0.07	0.02	-0.07	-0.13*	-0.05
	(0.06)	(0.07)	(0.05)	(0.03)	(0.05)	(0.04)	(0.06)	(0.07)	(0.08)
Original family, no info	-0.02	0.19	1.22*	-0.38	0.17	0.58	0.74	0.09	0.98
	(0.66)	(0.63)	(0.73)	(0.33)	(0.53)	(0.63)	(0.87)	(0.72)	(0.76)
Blended family, unhappy	0.51***	0.77***	0.44**	0.27**	0.45***	0.52***	0.47**	0.36	0.87***
	(0.19)	(0.21)	(0.19)	(0.13)	(0.14)	(0.17)	(0.21)	(0.22)	(0.25)
Blended family, happy	0.14	0.29**	0.19**	0.22***	0.18**	0.32***	0.29***	0.14	0.52***
	(0.09)	(0.12)	(0.09)	(0.06)	(0.08)	(0.08)	(0.10)	(0.12)	(0.13)
Blended family, no info	0.18	-1.07	-0.98	2.34**	2.09*	1.26	1.19	0.06	-0.79
	(0.53)	(0.72)	(0.65)	(0.91)	(1.24)	(1.22)	(1.38)	(0.90)	(1.45)
Single-parent family	0.00	0.11	0.21***	0.09*	0.16**	0.32***	0.13	0.27***	0.65***
	(0.08)	(0.10)	(0.08)	(0.05)	(0.07)	(0.06)	(0.09)	(0.10)	(0.11)
Other family, unhappy	0.89***	1.04	0.92	2.82***	0.84	1.65*	2.28**	0.66	1.83
	(0.33)	(0.96)	(0.94)	(0.85)	(0.83)	(0.94)	(1.01)	(0.46)	(1.18)
Other family, happy	0.47	-0.08	0.58	0.01	0.37	0.56*	0.73**	1.06***	0.30
	(0.29)	(0.33)	(0.37)	(0.22)	(0.29)	(0.33)	(0.37)	(0.30)	(0.42)
Other family, no info	0.39	-0.55	1.12*	0.43	0.87	0.80	0.31	0.26	1.61*
	(0.88)	(0.72)	(0.68)	(0.51)	(0.58)	(0.59)	(0.78)	(0.71)	(0.86)
Child general health	-.59***	-.39***	-0.30***	-.15***	-.10***	-.07***	-0.17***	-.11***	-.13***
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)
Warm parenting	0.17***	0.12***	0.09***	-0.01	0.06**	0.05*	0.01	0.04	0.15***
	(0.03)	(0.04)	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Angry parenting	0.63***	0.24***	0.21***	0.96***	0.58***	0.45***	1.25***	0.61***	0.87***
	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Consistent parenting	-0.07**	-.11***	-0.02	-.24***	-.14***	-0.05*	-0.25***	-.12***	-.19***
	(0.03)	(0.04)	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Mother's general health	-0.04	-.10***	-0.05**	-0.01	-0.03	0.02	-0.09***	-0.07**	0.03
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Mother's mental health	-.62***	-.13***	-0.13***	-.22***	-0.02	-0.08**	-0.34***	-0.08*	0.00
	(0.04)	(0.05)	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)
Constant	6.62***	5.64***	2.55***	3.02***	2.62***	0.64*	4.45***	2.12***	-0.01
	(0.49)	(0.57)	(0.46)	(0.31)	(0.40)	(0.37)	(0.52)	(0.58)	(0.66)
N (observations)	8,433	8,433	8,433	8,433	8,433	8,433	8,433	8,433	8,433
R^2	0.213	0.078	0.057	0.371	0.155	0.128	0.296	0.076	0.199

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

Random-effect models

	Emotional symptoms			Conduct problems			Hyperactivity		
	Parent	Child	Teacher	Parent	Child	Teacher	Parent	Child	Teacher
Log of parental income	-0.08**	-0.06	-0.05	-.08***	-0.07**	-0.06**	-0.06*	-0.01	-0.11**
	(0.03)	(0.04)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)
Child's age	0.02**	-0.01	0.04***	-.07***	-.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	-.34***	-.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	0.23***	0.15*	0.25***	0.17***	0.32***	0.14**	0.41***	0.60***	0.44***
	(0.08)	(0.09)	(0.07)	(0.05)	(0.07)	(0.06)	(0.09)	(0.10)	(0.12)
Indigenous child	0.02	0.03	0.39**	0.45***	0.61***	0.76***	0.50***	0.30	0.99***
	(0.14)	(0.18)	(0.16)	(0.12)	(0.16)	(0.18)	(0.17)	(0.19)	(0.20)
Maternal education (ref. postgraduate)									
Graduate	-0.11	-0.20**	-0.06	-0.07	-0.02	-0.11**	-0.10	-0.10	-0.13
	(0.07)	(0.09)	(0.07)	(0.05)	(0.06)	(0.05)	(0.09)	(0.10)	(0.10)
Below graduate	-0.01	0.09	0.07	0.13***	0.25***	0.14***	0.38***	0.19**	0.23***
	(0.06)	(0.08)	(0.06)	(0.04)	(0.05)	(0.05)	(0.07)	(0.08)	(0.09)
Unknown	1.03	0.24	-0.92**	0.50	0.70	-0.05	0.40	0.85	-0.81
	(0.85)	(1.04)	(0.41)	(0.72)	(1.45)	(0.45)	(0.99)	(1.06)	(1.51)
# siblings	-.10***	-0.02	-0.05**	0.06***	0.08***	0.02	-0.13***	0.00	0.05
	(0.02)	(0.03)	(0.02)	(0.02)	(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)	(0.04)	(0.04)	(0.05)	(0.07)	(0.07)
Original family, no info	0.13	-0.26	0.91	-0.37	-0.13	0.53	0.77	-0.16	0.84
	(0.55)	(0.39)	(0.63)	(0.26)	(0.46)	(0.61)	(0.76)	(0.64)	(0.75)
Blended family, unhappy	0.38**	0.83***	0.41**	0.15	0.48***	0.47***	0.45**	0.31	0.68***
	(0.18)	(0.20)	(0.19)	(0.12)	(0.14)	(0.17)	(0.19)	(0.22)	(0.23)
Blended family, happy	0.20**	0.26**	0.20**	0.31***	0.25***	0.39***	0.27**	0.14	0.60***
	(0.10)	(0.13)	(0.10)	(0.07)	(0.09)	(0.09)	(0.11)	(0.13)	(0.14)
Blended family, no info	0.17	-0.89*	-1.06*	1.52	1.94	0.84	-0.06	0.33	-0.12
	(0.31)	(0.54)	(0.61)	(1.07)	(1.39)	(0.59)	(1.52)	(1.22)	(1.43)
Single-parent family	0.11	0.17*	0.25***	0.15***	0.18***	0.32***	0.16*	0.28***	0.65***
	(0.08)	(0.10)	(0.08)	(0.05)	(0.07)	(0.07)	(0.09)	(0.10)	(0.11)
Other family, unhappy	0.74*	0.81	0.75	2.23***	0.50	1.23	1.20*	0.72*	1.85*
	(0.42)	(0.80)	(0.92)	(0.74)	(0.72)	(0.79)	(0.63)	(0.40)	(1.12)
Other family, happy	0.71**	0.21	0.67*	0.15	0.57*	0.62*	0.36	1.10***	0.55
	(0.34)	(0.33)	(0.41)	(0.27)	(0.33)	(0.33)	(0.37)	(0.34)	(0.48)
Other family, no info	0.28	-0.32	1.28	0.41	1.07*	0.68	0.35	0.30	1.89**
	(0.80)	(0.68)	(0.84)	(0.49)	(0.55)	(0.57)	(0.61)	(0.65)	(0.81)
Child general health	-.50***	-.36***	-0.27***	-.12***	-.10***	-0.05**	-0.11***	-.12***	-.10***
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)
Warm parenting	0.15***	0.10**	0.08**	-0.06**	0.01	0.03	-0.11***	-0.02	0.02
	(0.04)	(0.05)	(0.04)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Angry parenting	0.57***	0.21***	0.19***	0.84***	0.50***	0.38***	0.92***	0.50***	0.68***
	(0.04)	(0.05)	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Consistent parenting	-.11***	-.12***	-0.02	-.23***	-.10***	-0.03	-0.26***	-0.10**	-.17***
	(0.04)	(0.04)	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Mother's general health	-0.06**	-.09***	-0.05**	-0.01	-0.02	0.00	-0.08***	-0.07**	0.02
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Mother's mental health	-.49***	-0.12**	-0.14***	-.20***	-0.03	-0.07**	-0.26***	-0.09*	-0.03
	(0.04)	(0.05)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.05)	(0.05)
Constant	5.80***	5.80***	2.38***	3.27***	2.81***	0.64	5.46***	2.80***	1.21*
	(0.51)	(0.58)	(0.48)	(0.32)	(0.42)	(0.41)	(0.51)	(0.62)	(0.69)
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)	0.212	0.078	0.057	0.369	0.154	0.127	0.291	0.076	0.197
Rho	0.514	0.415	0.292	0.499	0.430	0.433	0.638	0.449	0.455

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

Fixed-effect models

	Emotional symptoms			Conduct problems			Hyperactivity		
	Parent	Child	Teacher	Parent	Child	Teacher	Parent	Child	Teacher
Log of parental income	0.03	-0.07	0.05	-0.03	-0.02	0.01	-0.02	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*	-0.00	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	0.23	-0.08	0.37	-0.25*	0.12	-0.01	0.28	0.37	0.28
	(0.22)	(0.31)	(0.26)	(0.15)	(0.21)	(0.19)	(0.22)	(0.31)	(0.33)
Graduate									
Below graduate	-0.08	-0.19	-0.17	0.00	0.14	-0.04	0.00	0.13	0.14
	(0.17)	(0.24)	(0.20)	(0.12)	(0.16)	(0.15)	(0.17)	(0.24)	(0.26)
Unknown	-0.28	-0.12	-0.06	0.00	0.39**	-0.03	-0.05	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	-0.17***	-0.01	-0.03	-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	0.02	0.07	0.01	0.02	-0.02	-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	0.55	-0.64	0.65	-0.16	-0.25	0.57	0.97**	-0.27	0.88
	(0.49)	(0.67)	(0.57)	(0.33)	(0.46)	(0.41)	(0.47)	(0.66)	(0.72)
Blended family, unhappy	0.07	0.53	0.24	-0.20	0.13	-0.07	-0.08	-0.11	0.09
	(0.24)	(0.34)	(0.29)	(0.16)	(0.23)	(0.21)	(0.24)	(0.33)	(0.36)
Blended family, happy	0.17	-0.24	0.03	0.21	-0.04	0.05	-0.28	-0.38	0.33
	(0.20)	(0.27)	(0.23)	(0.13)	(0.19)	(0.17)	(0.19)	(0.27)	(0.29)
Blended family, no info	-0.08	-0.64	-1.42	-0.37	1.30	-0.62	-1.90	0.72	1.08
	(1.21)	(1.68)	(1.43)	(0.81)	(1.15)	(1.03)	(1.18)	(1.65)	(1.79)
Single parent family	0.19	0.12	0.36**	0.11	-0.03	0.04	-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	0.10	0.14	0.20	0.61	-0.77	-0.59	-0.69	-0.08	1.39
	(0.82)	(1.13)	(0.96)	(0.55)	(0.78)	(0.70)	(0.80)	(1.11)	(1.21)
Other family, happy	0.68	0.49	1.10*	-0.25	0.46	-0.07	-0.78	0.62	0.59
	(0.53)	(0.74)	(0.63)	(0.36)	(0.51)	(0.45)	(0.52)	(0.73)	(0.79)
Other family, no info	-0.95	-0.01	2.66**	-0.70	0.06	-0.49	-1.15	-0.89	2.12
	(0.89)	(1.24)	(1.05)	(0.60)	(0.85)	(0.76)	(0.87)	(1.22)	(1.32)
Child general health	-0.39***	-0.28***	-0.15***	-0.08***	-0.09***	-0.03	-0.06**	-0.13***	-0.02
	(0.03)	(0.04)	(0.04)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)
Warm parenting	0.14***	0.06	-0.01	-0.09***	-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	0.45***	0.16**	0.10*	0.55***	0.28***	0.16***	0.50***	0.23***	0.23***
	(0.05)	(0.07)	(0.06)	(0.03)	(0.05)	(0.04)	(0.05)	(0.07)	(0.07)
Consistent parenting	-0.16***	-0.15**	0.01	-0.18***	0.00	0.02	-0.22***	-0.04	-0.13*
	(0.05)	(0.07)	(0.06)	(0.03)	(0.05)	(0.04)	(0.05)	(0.07)	(0.07)
Mother's general health	-0.03	-0.02	-0.02	0.01	0.04	-0.01	-0.04	-0.03	0.02
	(0.03)	(0.04)	(0.04)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)
Mother's mental health	-.18***	-0.07	-0.18***	-.10***	0.01	-0.01	-0.13***	-0.11*	-0.03
	(0.05)	(0.07)	(0.06)	(0.03)	(0.05)	(0.04)	(0.05)	(0.07)	(0.07)
Constant	3.28***	5.44***	1.25	3.38***	2.77***	0.55	6.16***	4.08***	3.74***
	(0.71)	(0.98)	(0.84)	(0.48)	(0.67)	(0.60)	(0.69)	(0.97)	(1.05)
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)	0.073	0.017	0.015	0.132	0.053	0.006	0.083	0.018	0.015
Rho	0.643	0.571	0.499	0.656	0.594	0.606	0.745	0.590	0.638

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.