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Author/s:

Mundy, LK;Canterford, L;Tucker, D;Bayer, J;Romaniuk, H;Sawyer, S;Lietz, P;Redmond, G;Proimos, J;Allen, N;Patton, G

Title:

Academic Performance in Primary School Children With Common Emotional and Behavioral Problems

Date:

2017-08-01

Citation:

Mundy, L. K., Canterford, L., Tucker, D., Bayer, J., Romaniuk, H., Sawyer, S., Lietz, P., Redmond, G., Proimos, J., Allen, N. & Patton, G. (2017). Academic Performance in Primary School Children With Common Emotional and Behavioral Problems. *Journal of School Health*, 87 (8), pp.593-601. <https://doi.org/10.1111/josh.12531>.

Persistent Link:

<https://hdl.handle.net/11343/293166>

## **ABSTRACT**

**BACKGROUND:** Many emotional and behavioral problems first emerge in primary school and are the forerunners of mental health problems occurring in adolescence. However, the extent that these problems may be associated with academic failure has been explored less. We aimed to quantify the association between emotional and behavioral problems with academic performance.

**METHODS:** A stratified random sample of 8 to 9 year-olds (N = 1239) were recruited from schools in Australia. Data linkage was performed with a national assessment of academic performance to assess reading and numeracy. Parent report assessed emotional and behavioral problems with students dichotomized into 'borderline/abnormal' and 'normal' categories.

**RESULTS:** One in 5 grade 3 students fell in the 'borderline/abnormal' category. Boys with total difficulties ( $d^2 = -47.8$ , 95% CI: -62.8 to -32.8), conduct problems, and peer problems scored lower on reading. Numeracy scores were lower in boys with total difficulties ( $d^2 = -37.7$ , 95% CI: -53.9 to -21.5) and emotional symptoms. Children with hyperactivity/inattention scored lower in numeracy. Girls with peer problems scored lower in numeracy.

**CONCLUSIONS:** Boys with emotional and behavioral problems in mid-primary school were 12 months behind their peers. Children with emotional and behavioral problems are at high risk for academic failure, and this risk is evident in mid-primary school.

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: [10.1111/josh.12531](https://doi.org/10.1111/josh.12531)

**Keywords:** academic performance; emotional problems; behavior problems; public health

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Education underpins an individual's later life health and well-being.<sup>1</sup> Conversely academic failure and school dropout are some of the clearest antecedents of later adult social, emotional and physical health problems.<sup>2</sup> The close connection between health and academic performance is gaining interest, but for schools the allocation of limited resources means their focus is typically still on learning outcomes.<sup>3,4</sup> However, there has been a growing understanding that the mid-primary school years are a common point of disengagement from school and a time when academic difficulties are often first evident.<sup>5,6</sup> Academic difficulties during these years, often referred to as the 'middle years' within education circles, predict later academic failure and school dropout.<sup>7</sup>

The mid-primary school years are also a time when emotional and behavioral problems commonly emerge.<sup>8</sup> These problems are often the forerunners for mental health problems in adolescence and adulthood.<sup>8</sup> Yet the extent to which these mental health problems may be linked to academic difficulties is uncertain. Behavioral problems have been linked to poor academic performance in boys,<sup>9-11</sup> but no studies have yet quantified the extent of this association with standardized assessments of education. The links between emotional and interpersonal problems have been little studied,<sup>12</sup> even though there is growing recognition that a child's emotional style affects school engagement and academic performance.<sup>13-15</sup>

Earlier studies of the links between behavioral problems and academic performance have generally relied on perceptions, such as brief teacher reports or even student self-report, rather than objective measures.<sup>16,17</sup> Where more objective

measures of academic performance have been used, such as national achievement tests, data loss has been extensive through poor data linkage rates.<sup>18</sup> Previous studies have generally addressed a specific behavioral problem, rather than examining a broader range of emotional, interpersonal and behavioral problems.<sup>16</sup> A recent meta-analysis identified a number of additional research priorities, including a need to examine sex differences, focus on narrower age groups, and where possible address specific academic domains such as reading and mathematics.<sup>19</sup>

This paper addresses these limitations in an analysis designed to quantify the association between common emotional and behavioral problems and to objectively assess academic achievement through data linkage in a large sample of children in mid-primary school. It was hypothesized that both emotional and behavioral problems would be associated with academic performance on a national achievement test and teacher reports.

## **METHODS**

### **Participants**

Data for this study (collected in 2012) were drawn from the first wave of the Childhood to Adolescence Transition Study (CATS). This is a cohort study with a broad focus on health, education and social adjustment as children make the transition through puberty to adolescence. The full study design is reported elsewhere.<sup>20</sup> Briefly, children were selected from a stratified random sample of 43 primary schools (Government, Catholic, Independent strata) in metropolitan Melbourne, Australia. All

grade 3 children (8 to 9 years of age; the fourth year of formal schooling) in the selected schools were invited to participate. There were no inclusion or exclusion criteria. Following the provision of active, informed consent from parents (Figure 1), 1239 of the 2289 invited children (54%) were recruited. The main reason for non-recruitment was parents failing to return the consent form.

### **Instruments**

*Academic performance.* Two measures of academic performance were used in the current study: National Assessment Programme – Literacy and Numeracy (NAPLAN) and teacher report. NAPLAN assesses academic performance on 4 domains - reading, writing, numeracy, and language conventions (spelling, grammar and punctuation). NAPLAN is administered to all students in schools across Australia in grades 3, 5, 7, and 9. This paper focuses on the reading and numeracy domains, with results for the other domains presented in the appendix (Supplementary Table 1). A score ranging from 0 to 1000 is provided for each domain completed by each child and this score is scaled across all grades.<sup>21</sup> Grade 3 students with a score lower than 270 are considered to perform below the national minimum standard. As a guide, one year of learning between grades 3 and 4 equates to approximately 40 NAPLAN points.<sup>21</sup> NAPLAN data were provided by the Victorian Curriculum and Assessment Authority for children whose parents had provided additional optional consent at recruitment for data linkage.

Teachers provided an overall rating of children's abilities in English and mathematics on items adapted from the Longitudinal Study of Australian Children. Teachers were asked to provide a rating of the child's ability in these areas compared with other children of the same grade level on a 5-point scale ranging from "far below average" to "far above average". Responses were dichotomized to identify students who were below average (far below average/below average) and average or above (average/above average/far above average) in each subject area.

***Child emotional and behavior problems.*** The Australian version of the Strengths and Difficulties Questionnaire (SDQ) was used to assess child emotional and behavior problems.<sup>22</sup> The SDQ is a well-validated brief mental health-screening questionnaire. The SDQ consists of 25 items divided among 5 scales: emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and pro-social behavior. A total difficulties score is derived from the first 4 subscales and is a marker of overall mental health problems. Parents rate each of the items as "Not True," "Somewhat True," or "Certainly True." "Somewhat True" is always scored as one but the scoring of "Not True" and "Certainly True" varies by item as 1 or 2. Thus, SDQ subscale scores can range from 0 to 10 and the score for total difficulties can range from 0 to 40. Higher scores indicate higher levels of emotional or behavioral problems, with the exception of the pro-social subscale where higher scores indicate better functioning. SDQ scores were dichotomized as 'borderline or abnormal' or 'normal' in the current study.<sup>22</sup> For the pro-social subscale the borderline/abnormal group represents children with problematic pro-social behavior.

**Covariates.** To assess potential confounding the following variables were included in the analyses: child's age in months and family socio-economic status (SES). Family SES was assigned from small area deprivation measures calculated for home postcode using the Index of Relative Socio-economic Advantage and Disadvantage (IRSAD; population mean (M) = 1000, standard deviation (SD) = 100) from the Australian Bureau of Statistics census-based local neighborhood Socio-Economic Index for Areas (SEIFA).<sup>23</sup> Higher scores on this measure indicate higher socio-economic status. Additional individual demographic characteristics on child's indigenous status (Aboriginal Torres Strait Islander, ATSI) and country of birth (Australia or other) were used to describe the sample.

### **Procedure**

Trained research assistants visited each school during 2012 and completed the child assessment for those children with parental consent (results from child assessment not reported here). Teachers completed a short paper questionnaire on each participating child. Parents completed 2 questionnaires (part one was administered as a paper version at the same time as the consent process; part 2 was sent to parents after the child's data collection session, either as a paper version or online). All parent data presented in this paper were obtained from part one of the questionnaire.

## Data Analysis

Child characteristics, family SES, school type, SDQ scores, and academic performance were summarized and compared by sex. Means and standard deviations were calculated for all continuous measures and compared using t-tests. Percentages were calculated for categorical variables and compared using chi-squared tests. Generalized estimating equations (GEE) with robust standard errors were used to investigate the associations between each binary SDQ measure on each measure of academic achievement, and to account for the clustering of children in schools.<sup>24</sup> Linear regression models were used for the continuous NAPLAN scores and logistic models were used for the binary measures of teachers' report of ability with average or above selected as the reference category. All effects were estimated separately for boys and girls, after adjusting for child's age (in months; centered about the mean) and home SEIFA score. All model effects were tested for statistical significance using the Wald test (2-tailed). All data analysis was undertaken using Stata 13 (Stata Corp, College Station, TX).

## RESULTS

The sample of students who had parental consent contained a slightly smaller proportion of boys than girls (46% boys; 54% girls) compared with census data for 8 to 9 year-old children enrolled in grade 3 across the state of Victoria, Australia (51% boys; 49% girls).<sup>25</sup> This Victorian sample scored slightly higher on SES (SEIFA) compared with the entire Australian population ( $M = 1012$ ,  $SD = 67$  vs.  $M = 1000$ ,

SD = 100). A higher percentage of the sample was indigenous compared with all grade 3 children in Victoria (5% vs. 1%).

Of the parents who provided consent, 1221 (99%) took part in wave one (98% completing part one questionnaire) and 1147 (93%) provided additional consent to link with their child's NAPLAN results in 2012. Of those who provided consent for data linkage, NAPLAN results were not available for 103 (9%) students (Figure 1). Teachers reported on the academic ability of 1145 (92%) of recruited children. Students were excluded from the analysis sample if they did not have at least one academic performance and at least one SDQ scale score (N = 49) and if they were <8 and >10 years of age at the time of the assessment (N = 17). This resulted in an analysis sample of 1173 (46% boys) students, who had complete data for sex, age and family SES score (Figure 1). Child characteristics and family SES were similar for boys and girls (Table 1). Almost one in 5 children were in the 'borderline/abnormal' category for total difficulties. There was statistical evidence that a higher proportion of boys compared with girls were reported as having borderline/abnormal scores on the SDQ total difficulties scale, the hyperactivity/inattention and the pro-social behavior subscales.

NAPLAN results in the analysis sample aligned well with results for the Victoria metropolitan area presented in the 2012 national report (scaled score means: reading 436.2; mathematics 412.8).<sup>21</sup> There was statistical evidence that boys scored significantly higher on the NAPLAN numeracy domain than girls, whereas there was no statistical evidence of a difference in NAPLAN reading scores between boys and

girls (Table 1). In terms of teacher ratings, a significantly higher proportion of boys than girls were rated by their teacher as having below-average English skills. In contrast, there was only weak statistical evidence of a difference in the proportion of boys and girls rated by their teacher as having below average mathematical skills.

Table 2 presents the cross-sectional association of NAPLAN reading score and NAPLAN numeracy score with each of the 6 SDQ mental health measures. Boys with borderline/abnormal total difficulties ( $\beta = -47.8$ , 95% CI: -62.8 to -32.8), conduct problems ( $\beta = -39.3$ , 95% CI: -57.9 to -20.7), hyperactivity/inattention ( $\beta = -26.7$ , 95% CI: -45.4 to -7.9), emotional symptoms ( $\beta = -34.0$ , 95% CI: -48.3 to -19.7), and peer problems ( $\beta = -32.6$ , 95% CI: -50.3 to -15.0) were found to have lower reading scores on average than boys who were classified as normal. For girls, no statistical evidence was found of an association between mental health problems and NAPLAN reading scores.

For both boys and girls, hyperactivity/inattention was associated with lower numeracy scores within the NAPLAN numeracy domain (boys:  $\beta = -24.9$ , 95% CI: -40.9 to -8.9; girls:  $\beta = -21.9$ , 95% CI: -37.8 to -6.0). Among boys, total difficulties ( $\beta = -37.7$ , 95% CI: -53.9 to -21.5) and emotional symptoms ( $\beta = -33.7$ , 95% CI: -47.4 to -20.0) were also associated with lower numeracy scores. Problematic pro-social behavior was associated with higher numeracy scores among boys ( $\beta = 26.2$ , 95% CI: 6.8 to 45.5). There was weaker statistical evidence of an association between conduct problems and numeracy for boys. Among girls, peer problems were associated with lower numeracy scores ( $\beta = -16.6$ , 95% CI: -29.8 to -3.4) and there

was evidence of a weaker association between total difficulties and numeracy. Results were similar across writing and the language convention domains of NAPLAN (Supplementary Table 2).

Table 3 shows the cross-sectional association of teacher-rated English and mathematical skills with each of the 6 SDQ exposures. Among boys, conduct problems and emotional symptoms were again associated with a greater likelihood of having below average English and mathematical skills compared with boys who did not have conduct problems or emotional symptoms. Among both boys and girls, total difficulties, hyperactivity/inattention, and peer problems were associated with a greater likelihood of having below average English and mathematical skills. To highlight, boys with an abnormal/borderline total difficulties score were 3 times more likely to be rated by their teacher as having below average English skills and mathematics skills compared with boys without these problems.

## **DISCUSSION**

Around one in 5 boys and one in 7 girls in mid-primary school had an emotional or behavioral problem at least at a borderline level. Boys with emotional and behavioral problems were 12 months behind their peers in both reading and numeracy on nationally standardized tests. When using an alternative teacher rating of academic performance, boys with emotional or behavioral problems were approximately 3 times as likely to be rated as having poor English or mathematical skills. In girls, the associations between emotional and behavioral problems with

academic performance were more modest and most clear for girls with attentional and peer problems. The strengths of the study include the standardized assessments of educational outcomes, complemented by teacher ratings and the assessment of mental health and behavior from parental report with a widely used measure in a large sample.

Boys with emotional and behavioral problems were 12 months behind in their academic performance, a major delay at only the fourth year of formal schooling.

Underlying factors, such as socio-economic disadvantage, child temperament and a family background of mental health problems, might explain the association between poor academic performance and mental health problems.<sup>26</sup> Adjustment for one index of socio-economic disadvantage did little to diminish the association between mental health and the measures of academic performance, but the possibility of confounding cannot be excluded. While it is theoretically possible that educational problems may heighten the risk for emotional and behavioral problems through increasing academic pressure, such mechanisms are more likely to play a stronger role in secondary school contexts.<sup>27,28</sup> A more likely explanation is that mental health and behavioral problems are directly contributing to poor academic performance, possibly through reduced attention to school work or school absence.<sup>29</sup> Although it is not possible to establish directionality with cross-sectional data, it does seem there is a need for a clearer connection between education policy and mental health promotion in primary school children.

Longitudinal analyses will ultimately be needed to understand the effects of early emotional and behavioral problems on academic achievement, school engagement and outcomes such as academic failure and school dropout.<sup>12</sup> However, the size of this association between mental health and academic problems at an early point in education suggests that emerging mental health problems are an essential aspect of child development to be addressed in the primary school system. A conjoint approach, using frameworks such as Whole School, Whole Community, and Whole Child (WSCC),<sup>4,30</sup> and building on intervention programs such as KidsMatter, Positive Action and FRIENDS,<sup>31-33</sup> to integrate mental health promotion into education seems likely to be an attractive option.<sup>34,35</sup>

### **Limitations**

Some limitations should be noted. Because we were engaging participants in a long-term cohort study, we used active written consent from parents in recruitment. Fifty-four percent agreed to their child's participation raising a possibility of selection bias. Yet our sample was very close to the Australian population mean on SES, albeit with a higher proportion of ATSI children. The sample's rate of mental health problems was similar to those found in representative samples for similarly aged children in Australia, as were the NAPLAN scores compared with children in the sampling area.<sup>21,36</sup> It is therefore possible that the specification of the association may have differed slightly with a higher response rate, but the similarity in outcomes and

exposures to population norms suggests it is unlikely that response bias will have substantially changed the study's findings.

## **Conclusions**

In mid-primary school, emotional and behavioral problems affected one in 5 boys and were consistently associated with poor academic performance across all domains. These boys were 12 months behind their peers after only 3 full years of formal schooling. They are an important group at high risk for academic failure and school disengagement. It is possible that interventions integrating educational outcomes and mental health promotion may be effective in improving both the educational and health profiles of this group of children.

## **IMPLICATIONS FOR SCHOOL HEALTH**

Previous reports have brought a growing recognition of middle childhood as a common time of onset for many mental health problems of later life. They have also documented how risks in the school context, such as peer bullying, play an important role in the onset of these problems in children.<sup>37</sup> Our findings that emotional and behavioral problems are associated with poorer academic performance after only 3 full years of school carry further significant implications for school policies. Social and emotional skills are increasingly seen as important for educational achievement.<sup>13-15</sup> Taking steps to prevent the onset of emotional and behavioral problems in children and responding effectively to those with visible problems are

likely to bring multiple further benefits, including educational, for children in primary school. To date, the major focus of many mental health initiatives in school has been with adolescents in secondary school.<sup>38</sup> The current study suggests that we will need to begin these efforts earlier to optimize education achievement, reduce rates of later mental disorder and ultimately improve the quality of life of many children.

### **Human Subjects Approval Statement**

Ethics approval was granted by the Royal Children's Hospital Human Research Ethics Committee (#31089). Permission was granted from the Victorian Department of Education and Training and the Catholic Education Office Melbourne to recruit through their schools.

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## ACKNOWLEDGEMENTS

This research was supported by a NHMRC project grant (#1010018). MCRI research is supported by the Victorian Government's Operational Infrastructure Program. LM receives funding from the Invergowrie Foundation. GP is supported by a Senior Principal Research Fellowship from NHMRC. LC and HR are the statistical experts for this research and take responsibility for accuracy of the data analysis. LM and GP have full access to all the data in the study and take responsibility for the integrity of the data. We thank all of the families and schools who have participated in this study. We thank all staff involved in data collection and processing at MCRI. The authors report no financial interests or potential conflicts of interest.

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Table 1. Summary of Demographic Characteristics, Emotional and Behavioral Problems, and Academic Performance Among 8-to-9- Year-Old Grade 3 Children (N = 1173).

Measure	Boys			Girls		
	N	n	Value	N	n	Value
<b>Children's characteristic</b>						
Age (years) (mean (SD))	535	535	9.0 (0.4)	638	638	9.0 (0.4)
Australian born (%)	527	462	87.7	634	563	88.8
ATSI (%)	529	29	5.5	630	27	4.3
<b>Family SES</b>						
SEIFA score (mean (SD))	535	535	1016 (63)	638	638	1013 (67)
<b>School type</b>						
Education sector (%)*	535			638		
Government		365	68.2		469	73.5
Catholic		149	27.9		135	21.2
Independent		21	3.9		34	5.3

**SDQ (borderline/abnormal)**

Total difficulties (%)**	535	111	20.8	637	95	14.9
Conduct problems (%)	535	116	21.7	637	113	17.7
Hyperactivity/inattention (%)***	534	134	25.1	637	81	12.7
Emotional symptoms (%)	534	118	22.1	637	157	24.7
Peer problems (%)	535	112	20.9	637	148	23.2
Problem pro-social behavior (%)***	535	55	10.3	638	27	4.2

**Academic performance**

## NAPLAN score (mean (SD))

Reading	455	455	439.2 (90.3)	545	545	447.7 (82.2)
Numeracy***	448	448	430.5 (74.7)	541	541	412.7 (69.4)
Teacher report (%)						
Below average English***	506	150	29.6	594	109	18.4
Below average Mathematics	506	92	18.2	594	133	22.4

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Note.

ATSI = *Aboriginal and Torres Strait Islander*. NAPLAN = National Assessment Program – Literacy and Numeracy. SDQ = Strengths and Difficulties Questionnaire.

SEIFA = Socioeconomic Index for Areas, Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD).

Chi-squared tests were applied to the categorical variables and independent-samples t-tests to the continuous variables; tests were applied to determine if there were any sex difference for the variables. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

Table 2. Associations Between Continuous NAPLAN Reading and Numeracy Scores with Emotional and Behavioral Problems in 8-to-9-Year-Old Grade 3 Children (N = 1173)

SDQ (borderline/abnormal)	NAPLAN reading score			
	Boys <sup>a</sup>		Girls <sup>b</sup>	
	<sup>2</sup> c	95% CI	<sup>2</sup> c	95% CI
Total difficulties	-47.8***	-62.8 to -32.8	-14.3	-33.8 to 5.3
Conduct problems	-39.3***	-57.9 to -20.7	-7.5	-22.7 to 7.6
Hyperactivity/inattention	-26.7**	-45.4 to -7.9	-15.5	-35.3 to 4.3
Emotional symptoms	-34.0***	-48.3 to -19.7	5.0	-12.3 to 22.2
Peer problems	-32.6***	-50.3 to -15.0	-11.0	-25.6 to 3.5
Problem pro-social behavior	3.9	-17.4 to 25.2	6.1	-41.4 to 53.6
SDQ (borderline/abnormal)	NAPLAN numeracy score			
	Boys <sup>a</sup>		Girls <sup>b</sup>	
	<sup>2</sup> c	95% CI	<sup>2</sup> c	95% CI
Total difficulties	-37.7***	-53.9 to -21.5	-15.9	-32.5 to 0.7

Conduct problems	-15.2	-31.4 to 1.1	2.3	-10.4 to 14.9
Hyperactivity/inattention	-24.9**	-40.9 to -8.9	-21.9**	-37.8 to -6.0
Emotional symptoms	-33.7***	-47.4 to -20.0	4.9	-4.4 to 14.3
Peer problems	-12.7	-32.2 to 6.8	-16.6*	-29.8 to -3.4
Problem pro-social behavior	26.2**	6.8 to 45.5	1.3	-34.6 to 37.1

Note.

NAPLAN = National Assessment Program – Literacy and Numeracy. SDQ = Strengths and Difficulties Questionnaire.

<sup>a</sup>For boys, the sample size ranged from 447 to 455. <sup>b</sup>For girls, the sample size ranged from 540 to 545. <sup>c</sup>Mean difference estimated from multivariable linear regression models adjusted for age (in months) and SEIFA (Socioeconomic Index for Areas, Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD)).

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

Table 3. Association Between Teacher Rated English and Mathematics Skills Score with Emotional and Behavioral Problems in 8-to-9-Year-Old Grade 3 Children (N = 1173)

SDQ (borderline/abnormal)	English skills <sup>a</sup>			
	Boys <sup>b</sup>		Girls <sup>c</sup>	
	OR <sup>d</sup>	95% CI	OR <sup>d</sup>	95% CI
Total difficulties	2.91***	1.78 to 4.75	2.14	1.27 to 3.60**
Conduct problems	2.24***	1.42 to 3.52	1.01	0.62 to 1.65
Hyperactivity/inattention	2.12**	1.34 to 3.37	2.94	1.84 to 4.69***
Emotional symptoms	2.91***	1.86 to 4.56	0.92	0.54 to 1.56
Peer problems	2.08***	1.44 to 3.01	2.17	1.36 to 3.45**
Problem pro-social behavior	1.21	0.66 to 2.24	2.68	0.95 to 7.52
SDQ (borderline/abnormal)	Mathematical skills <sup>a</sup>			
	Boys <sup>b</sup>		Girls <sup>c</sup>	
	OR <sup>d</sup>	95% CI	OR <sup>d</sup>	95% CI
Total difficulties	2.96***	1.93 to 4.52	1.94*	1.15 to 3.28
Conduct problems	2.42***	1.47 to 3.99	1.15	0.76 to 1.75
Hyperactivity/inattention	2.26***	1.51 to 3.38	2.30***	1.46 to 3.62
Emotional symptoms	3.04***	1.91 to 4.85	1.06	0.66 to 1.70

Peer problems	1.79**	1.16 to 2.75	1.76*	1.13 to 2.74
Problem pro-social behavior	1.05	0.52 to 2.12	2.07	0.84 to 5.13

Note.

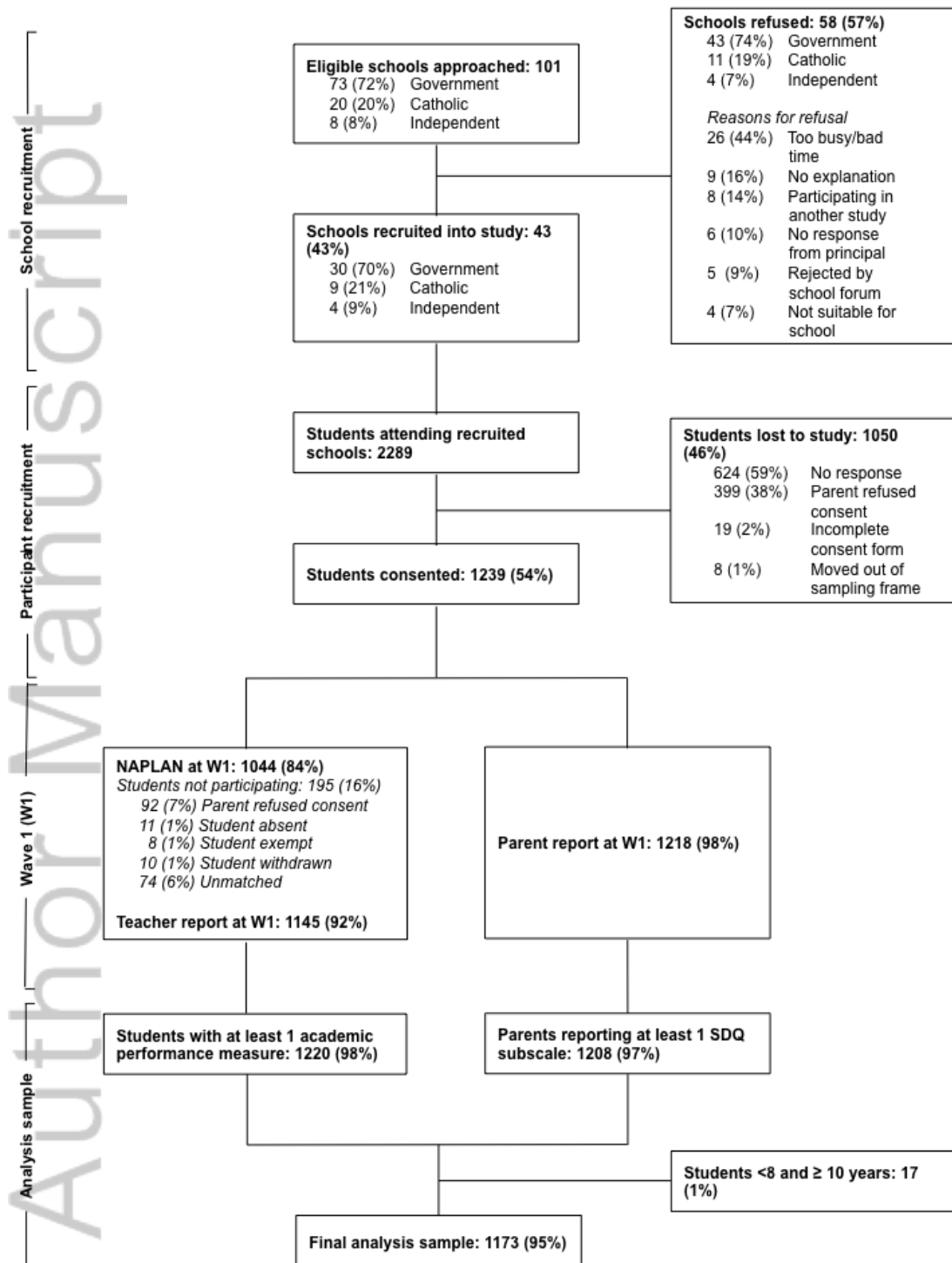
SDQ = Strengths and Difficulties Questionnaire

<sup>a</sup> Reference category: average or above. <sup>b</sup> For boys, the sample size ranged from 505 to 506. <sup>c</sup> For girls, the sample size ranged from 593 to 594.

<sup>d</sup> Odds ratios estimated from multivariable logistic regression models adjusted for age (in months) and SEIFA (Socioeconomic Index for Areas, Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD)). \*p < .05; \*\*p < .01; \*\*\*p < .001.

Figure 1. Flowchart Showing Participant Recruitment through to Final Analysis

Sample



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Supplementary Table 1. **Summary of Academic Performance (Further NAPLAN Domain Scores) among 8-to-9-Year-Old Grade 3 Children (N = 1173), Stratified by Sex**

	Boys (N=535)		Girls (N=638)	
<b>NAPLAN domain (n mean (SD))</b>				
Writing***	451	424.7 (55.8)	544	449.5 (50.0)
Spelling***	452	423.2 (79.0)	544	440.5 (75.2)
Grammar and punctuation***	452	435.3 (90.7)	544	458.4 (85.4)

Note.

NAPLAN = National Assessment Program – Literacy and Numeracy.

<sup>a</sup> Independent-samples t-tests were applied to determine if there were any sex difference for the academic performance outcome variables.

\*p < .05; \*\*p < .01; \*\*\*p < .001.

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Supplementary Table 2. **Associations among Continuous NAPLAN Writing, Spelling, and Grammar and Punctuation Scores with Emotional and Behavioral Problems in 8-to-9-Year-Old Grade 3 Children (N = 1173)**

	<b>NAPLAN writing score</b>			
	<b>Boys<sup>a</sup></b>		<b>Girls<sup>b</sup></b>	
	<sup>2</sup> c	<b>95% CI</b>	<sup>2</sup> c	<b>95% CI</b>
Total difficulties	-30.4***	-45.7 to -15.0	-16.1*	-28.6 to -3.6
Conduct problems	-26.0***	-40.6 to -11.4	-5.8	-17.6 to 5.9
Hyperactivity/inattention	-27.3***	-42.1 to -12.5	-25.0***	-37.6 to -12.5
Emotional symptoms	-17.5**	-28.9 to -6.1	0.4	-7.8 to 8.6
Peer problems	-16.9*	-30.7 to -3.1	-10.7*	-19.8 to -1.5
Problem pro-social behaviour	1.1	-10.6 to 12.9	4.1	-15.2 to 23.3
	<b>NAPLAN spelling score</b>			
	<b>Boys<sup>a</sup></b>		<b>Girls<sup>b</sup></b>	
	<sup>2</sup> c	<b>95% CI</b>	<sup>2</sup> c	<b>95% CI</b>
Total difficulties	-45.8***	-65.0 to -26.7	-17.1	-35.0 to 0.7
Conduct problems	-34.8***	-53.4 to -16.2	3.1	-13.0 to 19.3
Hyperactivity/inattention	-29.8**	-49.2 to -10.4	-35.9**	-57.4 to -14.5
Emotional symptoms	-32.1***	-49.3 to -14.8	-3.4	-17.2 to 10.4
Peer problems	-37.2***	-52.6 to -21.8	1.0	-14.8 to 16.7
Problem pro-social behavior	2.9	-25.4 to 31.3	3.1	-38.7 to 45.0
	<b>NAPLAN grammar and punctuation score</b>			

	<b>Boys<sup>a</sup></b>		<b>Girls<sup>b</sup></b>	
	<b>z<sup>c</sup></b>	<b>95% CI</b>	<b>z<sup>c</sup></b>	<b>95% CI</b>
Total difficulties	-49.1***	-66.9 to -31.3	-14.6	-34.5 to 5.2
Conduct problems	-35.8***	-56.6 to -15.0	-8.1	-23.2 to 6.9
Hyperactivity/inattention	-33.0***	-51.3 to -14.8	-22.5	-46.0 to 0.9
Emotional symptoms	-41.0***	-61.1 to -20.9	-10.3	-24.0 to 3.5
Peer problems	-30.0**	-48.0 to -11.9	-9.0	-24.2 to 6.1
Problem pro-social behavior	11.8	-12.9 to 36.4	3.4	-33.1 to 39.8

Note.

NAPLAN = National Assessment Program – Literacy and Numeracy. SEIFA = Socioeconomic Index for Areas, Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD).

<sup>a</sup> For boys, the sample size ranged from 450 to 452. <sup>b</sup> For girls, the sample size ranged from 543 to 544.

<sup>c</sup> Mean difference estimated from multivariable linear regression models adjusted for age (in months) and SEIFA.

\*p < .05; \*\*p < .01; \*\*\*p < .001.

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Research & Ethics

50 Flemington Road, Parkville  
Victoria 3052, Australia  
T. +61 3 9345 5044  
F. +61 3 9345 5198  
E. [rch.ethics@rch.org.au](mailto:rch.ethics@rch.org.au)  
[www.rch.org.au/ethics](http://www.rch.org.au/ethics)

15 June 2011

Dr Lisa Mundy  
CAH  
RCH

Dear Dr Mundy,

**RE: HREC 31089 A**

**Pubertal transitions in mental health and behaviour: the PHASE-A study of social role and lifestyle transitions**

Please find attached the RCH HREC Approval Certificate for the above project.

**Also, please note the conditions of ethics approval which have been listed on the certificate.**

The Committee wishes you well with your research study.

Yours sincerely

Ethics and Research Department, on behalf of the  
RCH Human Research Ethics Committee

Cc: Prof George Patton

The Royal Children's Hospital Human Research Ethics Committee (RCH HREC) is constituted according to the National Health and Medical Research Council's 'National Statement on Ethical Conduct in Humans Research (2007)'. The committee operates in accordance with these guidelines and is registered with the NHMRC

