Child Abuse & Neglect 101 (2020) 104326

Contents lists available at ScienceDirect

Child Abuse & Neglect

journal homepage: www.elsevier.com/locate/chiabuneg

Reading and numeracy attainment of children reported to child protection services: A population record linkage study controlling for other adversities

Kristin R. Laurens[a,b,*], Fahkrul Islam[b], Maina Kariuki[b], Felicity Harris[b], Marilyn Chilvers[c], Merran Butler[c], Jill Schofield[d], Claire Essery[d], Sally A. Brinkman[e,f], Vaughan J. Carr[b,g,h], Melissa J. Green[b,h]

[a] School of Psychology and Counselling, and Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane, QLD, Australia
[b] School of Psychiatry, University of New South Wales, Sydney, NSW, Australia
[c] NSW Department of Family and Community Services, NSW, Australia
[d] NSW Department of Education, NSW, Australia
[e] Telethon Kids Institute, University of Western Australia, Perth, WA, Australia
[f] School of Population Health, University of Adelaide, Adelaide, SA, Australia
[g] Department of Psychiatry, Monash University, Melbourne, VIC, Australia
[h] Neuroscience Research Australia, Sydney, NSW, Australia

ARTICLE INFO

Keywords:
Academic achievement
Out-of-home-care
Child maltreatment
Childhood adversity
Educational support

ABSTRACT

Background: Maltreated children are at risk of poor educational outcomes, but also experience greater individual, family, and neighbourhood adversities that may obscure an understanding of relationships between child protection involvement and educational attainment.
Objective: To examine associations between child protection involvement and 3rd- and 5th-grade reading and numeracy attainment, while controlling multiple other adversities.
Participants and Setting: Participants were 56,860 Australian children and their parents from the *New South Wales Child Development Study* with linked multi-agency records.
Methods: Multinomial logistic regressions examined associations between level of child protection involvement (Out-Of-Home Care [OOHC] placement; substantiated Risk Of Significant Harm [ROSH]; unsubstantiated ROSH; non-ROSH; and no child protection report) and standardised tests of 3rd- and 5th-grade reading and numeracy. Fully adjusted models controlled demographic, pregnancy, birth, and parental factors, and early (kindergarten) developmental vulnerabilities on literacy and numeracy, and other developmental domains (social, emotional, physical, communication).
Results: All children with child protection reports were more likely to attain below average, and less likely to attain above average, 3rd- and 5th-grade reading and numeracy, including children with reports below the ROSH threshold. Children with substantiated ROSH reports who were not removed into care demonstrated the worst educational attainment, with some evidence of protective effects for children in OOHC.
Conclusions: A cross-agency response to supporting educational attainment for all children reported to child protection services is required, including targeted services for children in OOHC

* Corresponding author at: School of Psychology and Counselling, O Block, B Wing, Level 5, Queensland University of Technology, Victoria Park Road, Kelvin Grove QLD 4059, Australia.
E-mail addresses: kristin.laurens@qut.edu.au, kristin.laurens@unsw.edu.au (K.R. Laurens).

https://doi.org/10.1016/j.chiabu.2019.104326
Received 11 July 2019; Received in revised form 15 November 2019; Accepted 10 December 2019
Available online 31 January 2020

or with substantiated ROSH reports, and referral of vulnerable families (unsubstantiated and non-ROSH cases) to secondary service organisations (intermediate intervention).

1. Introduction

Over the past decade, there has been increasing recognition of the need for effective cross-agency approaches to the provision of educational support for maltreated children and young people who are placed in out-of-home care (NSW Ombudsman, 2014). In New South Wales (NSW), Australia, State Government education policy requires that *Individual Education Plans* be developed and maintained for those placed in out-of-home care (OOHC) and educated within the public (government) school system (NSW Education, 2010), as in various jurisdictions nationally and internationally (Maclean, Taylor, & O'Donnell, 2016; Piescher, Colburn, LaLiberte, & Hong, 2014). The *Individual Education Plans* provide personalised learning and support planning to sustain these children's access to the full range of school activities and programs, and to overcome well-established gaps in their educational outcomes. Children with maltreatment histories experience poorer literacy, numeracy, and scholastic achievement levels, and increased rates of grade retention, absence, and school drop-out (Fry et al., 2018; Maguire et al., 2015; Romano, Babchishin, Marquis, & Frechette, 2015), with consequent long-term occupational, social, and wellbeing impacts. Those characterised by the most severe maltreatment and placed in OOHC are recognised as experiencing particularly adverse educational outcomes (Romano et al., 2015), but they are also at pronounced risk for a broader constellation of child, family, and neighbourhood adversities. As such, the poor educational outcomes of children in OOHC might be attributable to their maltreatment and placement experiences, and/or to co-occurring risk factors. In this context, the contribution of potentially confounding child, family, and neighbourhood factors also need to be considered in evaluating the effect of OOHC placement on their educational experience.

Capacity to simultaneously consider a broad range of such factors has been afforded by recent data linkage studies of large population cohorts drawn from different jurisdictions in the United States of America (Berger, Cancian, Han, Noyes, & Rios-Salas, 2015; Fantuzzo, Perlman, & Dobbins, 2011; Piescher et al., 2014) and Australia (Maclean et al., 2016; Maclean, Taylor, & O'Donnell, 2018; Rossen et al., 2019). In these large cohorts, administrative records from child protection agencies have been linked with educational records of standardised assessments spanning kindergarten to the 12th-grade, and sometimes also with children's health records. Such studies have included indicators of the child's sex and race/ethnicity, socioeconomic disadvantage, English language proficiency, prenatal and birth factors, and parental factors. They demonstrated that the educational achievement gap for children in OOHC relative to children not reported to child protection services was reduced (Rossen et al., 2019), or eliminated (2018, Berger et al., 2015; Maclean et al., 2016; Piescher et al., 2014), in fully adjusted models that considered multiple other adversities. In these studies, maltreated children investigated by child protection services but not removed from their homes experienced worse educational outcomes than the children placed in OOHC. This implies that targeted interventions such as *Individual Education Plans* might benefit not just children placed in OOHC, but maltreated children in general who are identified by child protection services.

Several linkage studies have additionally examined educational outcomes for children with reports to child protection services that met the threshold for further investigation but were not substantiated (i.e., where the risk of significant harm could not be sufficiently determined or the reports were not prioritised for investigation owing to resource constraints) (Bell, Bayliss, Glauert, & Ohan, 2018; Fantuzzo et al., 2011; Maclean et al., 2016; Rossen et al., 2019). These studies indicated that children with non-substantiated reports also experienced poorer teacher-rated literacy and numeracy in kindergarten (Bell et al., 2018; Rossen et al., 2019), and poorer achievement on standardised tests of reading, mathematics, language, and science in the 2nd-grade (Fantuzzo et al., 2011), and on 3rd-grade standardised reading assessments (Maclean et al., 2016), relative to children with no history of child protection contact. These effects remained following consideration of multiple other child, family, and neighbourhood adversities, although they were typically of smaller magnitude than the educational under-achievement observed for the children with substantiated reports. These data imply that there is an unmet need for services to improve educational attainment for any child who is the subject of a report to child protection services. Indeed, a recent study that further demarcated children with reports that did not present sufficient risk of harm to meet the threshold for further investigation (Rossen et al., 2019) demonstrated that these children were significantly more likely to be reported by their classroom teachers as achieving in the bottom 10 % of children on literacy and numeracy in their first year of compulsory schooling (kindergarten) relative to children not reported to child protection services. These effects remained of medium magnitude (odds ratio = 2.00) after controlling for sex, proficiency of English, socioeconomic disadvantage, young maternal age at the child's birth, preterm birth, exposure to maternal smoking in utero, and parental mental illness. Across the multiple levels of child protection services involvement considered in that study, in the fully adjusted analyses the magnitude of effects for children with child protection services involvement relative to children without reports increased in the pattern: sub-threshold reports (medium effects), non-substantiated reports (medium effects), children removed to OOHC (large effects), and substantiated reports not removed into care (large effects). Thus, all children reported to child protection services, even those who did not meet the threshold for further investigation, arrived at school already vulnerable to poor educational achievement according to teacher ratings of early literacy and numeracy skills. This raises the important question of whether these children also experience poorer attainment on subsequent standardised tests of literacy and numeracy, and whether their educational attainment is further affected by a range of other child, family, and neighbourhood factors.

The present study was conducted in partnership with representatives from the NSW Government departments charged with delivering child protection and public education services in the State, with the aim of providing an evidence-base to inform policies

for effective and integrated cross-agency responses to support the educational attainment of children reported to child protection services. Using linked intergenerational data from a population cohort followed longitudinally within the NSW Child Development Study [NSW-CDS; (Carr et al., 2016; Green et al., 2018)], in whom kindergarten literacy and numeracy attainment was reported previously (Rossen et al., 2019), the present research sought to determine the associations between level of child protection involvement and attainment on standardised assessments of reading and numeracy administered to children in the 3rd- and 5th-grades. As in Rossen et al., the study distinguished five levels of child protection service involvement: at least one OOHC placement, substantiated risk of significant harm (ROSH) reports *not resulting* in OOHC placement, non-substantiated ROSH reports, and non-ROSH reports, versus no report to child protection services. A broad range of potential confounding factors were considered in focal models, including demographic, pregnancy, birth, and parental risk factors, as well as early childhood (kindergarten) developmental vulnerabilities in literacy, numeracy, and other developmental domains (i.e., social, emotional, physical, and communication skills). In contrast to previous linkage investigations of educational attainment, this study determined the association of levels of child protection service involvement in the context of other risk factors, not only with educational under-achievement, but also with *above* average reading and numeracy attainment, each examined relative to average (or expected) levels of attainment specified for each school grade according to the Australian Curriculum (ACARA, 2019).

2. Method

2.1. Study context and record linkage

Data for this study were drawn from the second wave of record linkage of multi-agency records, conducted in 2016, for the NSW-CDS population cohort of 91,635 children (Green et al., 2018). The NSW Population and Health Services Research Ethics Committee (PHSREC AU/1/1AFE112) provided ethical approval for the linkage under the waiver of consent conditions specified in the Australian National Health and Medical Research Council's *National Statement of Ethical Conduct in Human Research*, and data custodian approvals were granted by the relevant Government Departments. The Centre for Health and Record Linkage conducted the record linkage using probabilistic linkage methods across a set of minimal identifiers (detailed in Green et al., 2018), and preserved the privacy and confidentiality of all persons in the linkage by maintaining separation of personal identifiers from record content. Data were supplied to the research team in de-identified form.

Linked data from the following administrative records were used in the present study: NSW Family and Community Services *Child Protection Case Management System – Key Information Directory System* (CMS-KiDS, years 2001–2016); NSW Education Standards Authority *National Assessment Program – Literacy and Numeracy* (NAPLAN, 3rd-grade: 2012, and 5th-grade: 2014); Australian Government Department of Education and Training *Australian Early Development Census* (AEDC, 2009); NSW *Registry of Births, Deaths and Marriages - Birth Registrations* (2000–2006); NSW Ministry of Health *Perinatal Data Collection* (2003–2005), *Admitted Patient Data Collection* (2001–2016), *Emergency Department Data Collection* (2005–2016), and *Mental Health Ambulatory* (2001–2015) collections; and NSW *Bureau of Crime Statistics and Research Reoffending* data (1994–2015).

Two exposure time periods (not mutually exclusive) were defined relative to the NAPLAN 3rd- and 5th-grade assessments that provided the outcome measures for the present study: *Time 1 (T1)* incorporated child protection reports recorded in CMS-KiDS from the child's birth up until 31 December 2011 (5 months prior to the NAPLAN 3rd-grade assessment conducted in May 2012); *Time 2 (T2)* incorporated child protection reports from the child's birth up until 31 December 2013 (5 months prior to the NAPLAN 5th-grade assessment conducted in May 2014).

2.2. Participants

Fig. 1 summarises the sample selection procedure for the present study. Among the 91,635 children in the NSW-CDS cohort, records were excluded for children who met the following criteria: (i) no linked parental data; (ii) no AEDC assessment completed; (iii) a designation of "special needs" status recorded by the teacher on the AEDC assessment (indicating a diagnosed medical, physical, or intellectually disabling condition such as cerebral palsy, Down syndrome, or Autism); (iv) missing data on any of the five AEDC domains assessing early childhood developmental vulnerabilities in kindergarten (~5 years of age); (v) no NSW birth record (i.e., child born out of State); (vi) a first child protection record occurring after 31 December 2011 (for 3rd-grade outcomes) and 31 December 2013 (for 5th-grade outcomes); and (vii) missing data for either reading or numeracy at the 3rd- and 5th-grades. This process yielded a final sample of 56,860 children (62.1 % of the NSW-CDS cohort) who provided data for analysis of 3rd-grade NAPLAN outcomes, and 56,189 children (61.3 %) who provided data for analysis of 5th-grade outcomes.

2.3. Measures

2.3.1. Exposure variables

2.3.1.1. Highest level of child protection services involvement. Reports to child protection services were allocated to a 5-level hierarchy variable representing the highest level of involvement with child protection services (coded in decreasing order): (1) children with at least one placement in OOHC; (2) children with a substantiated ROSH report representing instances of actual harm or risk of harm verified by child protection case-workers that did not result in removal of the child from their family (as indicated by the presence of a Secondary Assessment Outcome); (3) children with an unsubstantiated ROSH report that met the threshold for further investigation, but where risk of harm or actual maltreatment could not be sufficiently determined, or was not prioritized for investigation owing to

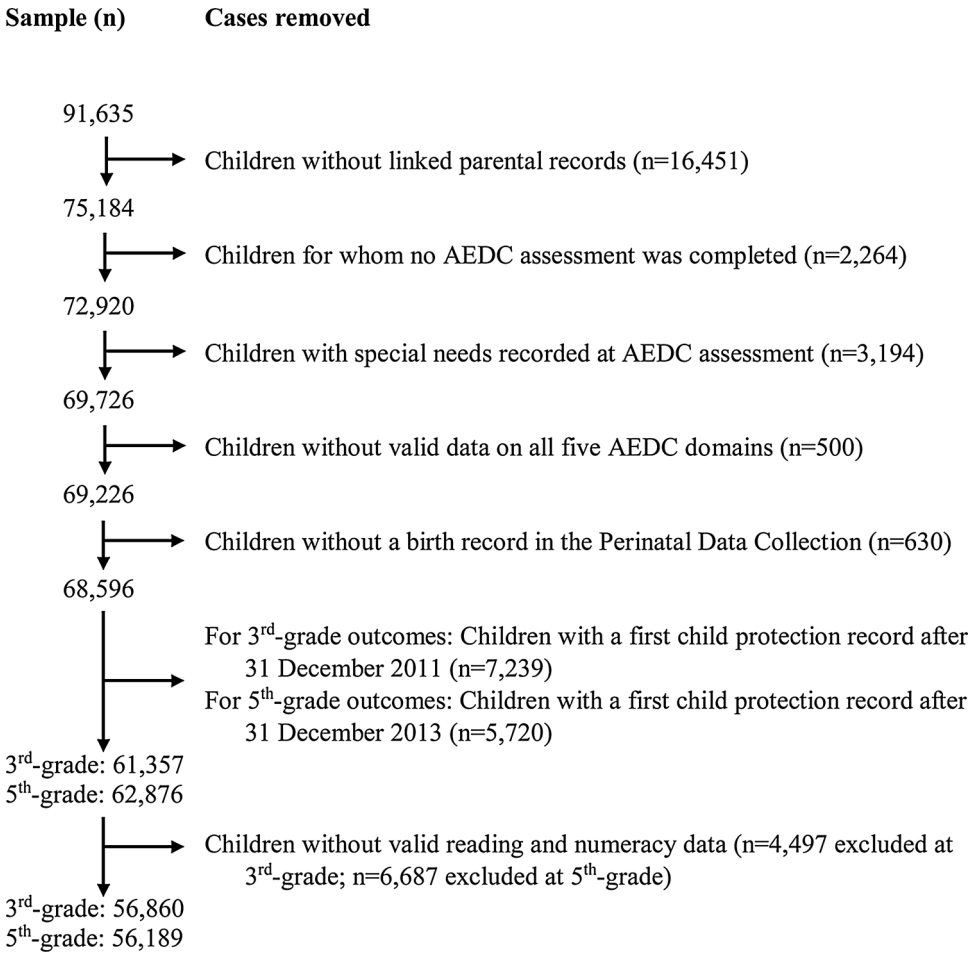

Fig. 1. Sample selection procedure.

resource constraints (not assigned a Secondary Assessment Outcome); and (4) children with reports that did not reach the threshold to indicate any risk of significant harm (non-ROSH; i.e., those that did not meet the threshold for further investigation). All remaining children without a report to child protection services served as the reference group for all analyses. Exposures were derived according to the highest level of service involvement recorded during T1 (birth to 31 December 2011: age ~8 years) and during T2 (birth to 31 December 2013: age ~10 years).

2.3.2. Outcome variables

2.3.2.1. Reading and Numeracy attainment at the 3rd- and 5th-grades. Attainment of reading and numeracy skills achieved by approximately 8 and 10 years of age was assessed via the national standardised program of assessment (ACARA, 2016) which is delivered annually to all Australian students undertaking 3rd- and 5th-grade studies at government and non-government schools (the fourth and sixth years of compulsory schooling, respectively). At each assessment, scaled NAPLAN scores are categorised into six bands representing increasing complexity of skills and understanding achieved. For the present study, the middle two scoring bands at each grade were grouped to index "average attainment" (constituting the reference group for all analyses; coded 0), and the two bands above and two bands below this average performance were grouped to index "above average" (coded 1) and "below average" (coded 2) attainment, respectively.

2.3.3. Covariates

2.3.3.1. Sociodemographic indicators. Binary indicators coded the child's *age-group* at the 3rd- and 5th-grade NAPLAN assessments (by median split: younger half of year, coded 1; older half of year, coded 0), *sex* (male: coded 1; female: 0), *socioeconomic disadvantage* at the 3rd- and 5th-grade NAPLAN assessments (disadvantaged: coded 1; non-disadvantaged: 0), *English spoken as a second language* by child (yes: coded 1; no: 0), and *Indigenous* (i.e., Aboriginal or Torres Strait Islander) status (yes: coded 1; no: 0). Socioeconomic disadvantage was computed from the Socio-Economic Index for Area (SEIFA) data associated with the child's residential postcode at the 3rd- and 5th-grade NAPLAN assessments. SEIFA indexes the average income and employment status for each residential postcode in Australia in national quintile scores (Pink, 2013); these quintiles were recoded into binary indicators representing disadvantaged

(quintile 1: coded 1) and non-disadvantaged children (quintiles 2–5; coded 0). *English as a Second Language* was indexed from the AEDC assessment completed by kindergarten teachers, with children whose first language was not English but whose English was proficient categorised as non-English as a Second Language. Indigenous status was determined across multiple data collections, with any record of Indigenous status for the child, their mother, or father, in any of the linked data collections, deemed to indicate the child's Indigenous status.

2.3.3.2. Pregnancy and birth factors. Factors relating to pregnancy and birth were obtained from the Perinatal Data Collection. Maternal age at the child's birth was recoded into a categorical variable comprising three levels (25 years and younger [coded 1]; 36 years and older [coded 2]; and 26–35 years [reference group, coded 0]). Dichotomous variables were used to distinguish children exposed to maternal smoking *in utero* (yes: coded 1; no: 0), children whose mothers received no or late (>16 weeks) antenatal care (yes: coded 1; no: 0), and children experiencing pre-term birth (prior to 37 weeks; yes: coded 1; no: 0).

2.3.3.3. Parental factors. Two dichotomous variables indicated children who had a parent with a history of any mental illness (yes: coded 1; no 0) and a history of any criminal offending (yes: coded 1; no 0). Parental history of mental illness was determined based on a hospital admission (admitted patient or emergency department records) and/or an ambulatory service record for either parent for any type of psychiatric disorder, according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) F-codes (NCCH, 1998). Parental criminal offending reflected any appearance in court by either parent for any type of criminal offence, defined according to the Australian and New Zealand Standard Offence Classification (ABS, 2011).

2.3.3.4. Early developmental vulnerabilities. The teacher-reported 2009 AEDC (Brinkman, Gregory, Goldfeld, Lynch, & Hardy, 2014) provides a reliable and valid assessment (Brinkman et al., 2011; Janus, Brinkman, & Duku, 2011) of developmental vulnerability across a range of five early childhood functional domains. On each domain, AEDC results report proportions of children who are considered to be "on track" (i.e., children scoring in the top 75 % of the 2009 National AEDC population distribution), "developmentally at risk" (i.e., children scoring between the 10th and 25th percentiles of the 2009 National AEDC population distribution), and "developmentally vulnerable" (i.e., children scoring in the lowest 10 % of the 2009 National AEDC population distribution). For this study, a dichotomous variable differentiated developmentally vulnerable children (coded 1) from the remainder (coded 0) on the *Language and cognitive skills (school based)* domain, which measures children's skills in basic literacy, advanced literacy, basic numeracy, and their interest in literacy, numeracy, and memory.

From the remaining four AEDC domains, which assessed *Physical health and wellbeing, Social competence, Emotional maturity,* and *Communication skills and general knowledge* (detailed in Supplementary Table 1), a categorical variable comprising three levels was created. The first level (coded 1) indicated children who scored in the developmentally vulnerable range (i.e., in the lowest 10 % of the national population distribution) on any one of the four domains; the second level (coded 2) indicated children who scored in the developmentally vulnerable range on two or more of the four domains; and the third level indicated children who were not developmentally vulnerable on any of the four AEDC domains (reference condition; coded 0).

2.4. Statistical analyses

All analyses were conducted using IBM SPSS version 25.0 (IBM, 2017). The prevalence of the exposure, outcome, and covariate measures were determined for the two time periods under investigation (T1 for 3rd-grade NAPLAN outcomes, and T2 for 5th-grade). Separate (bivariate) multinomial regression analyses were used to examine the pattern and magnitude of associations between the exposure variable, and each of the covariate measures, and the 3rd- and 5th-grade reading and numeracy outcomes. All variables were subsequently entered into multivariable multinomial regression analyses to determine the associations between the exposure and outcome measures while adjusting fully for all covariates. These analyses yielded odds ratios (ORs) and their 95 % confidence intervals (CIs) as measures of effect size, with ORs of 1.00–1.49 (or 1.00 to 0.67) interpreted as small effects, 1.50–2.49 (or 0.66 to 0.40) as medium, 2.50–4.00 (or 0.39 to 0.25) as large, and >4.00 (or <0.25) as very large effects (Rosenthal, 1996). Results were statistically significant if the 95 % CIs did not cross 1.00.

3. Results

3.1. Sample characteristics

Table 1 summarises the prevalence of exposure, outcome, and covariate measures at T1 and T2. Almost one in ten children (9.4 %) were reported to child protection services during T1 (by ~8 years of age), rising to almost one in six children (15.5 %) during T2 (by ~10 years of age). Average academic attainment (the reference condition for each analysis) characterised around a third to half of children (36.0 %–53.8 %) on each outcome. The prevalence rates of any covariate varied by a maximum of 0.4 percentage points between T1 and T2.

Table 1
Prevalence of child protection reports (by level of report), NAPLAN reading and numeracy attainment levels, and covariate measures (socio-demographic, pregnancy and birth, and parental factors, and early developmental vulnerabilities) at Time 1 (T1) and Time 2 (T2).

	T1		T2	
	(n = 56,860)		(n = 56,189)	
Variables of interest	n	%	n	%
Exposure variables				
Child protection report hierarchy at T1 (by 31/12/2011) and T2 (by 31/12/2013)				
No child protection report (reference group)	51,507	90.6	47,480	84.5
Non-ROSH report	427	0.8	2,117	3.8
Non-substantiated ROSH report	3,420	6.0	4,731	8.4
Substantiated ROSH report	890	1.6	1,176	2.1
Out-of-Home care placement	616	1.1	685	1.2
Outcome variables				
NAPLAN Reading attainment at T1 (3rd-grade) and T2 (5th-grade) [a]				
Below average	6,706	11.8	8,721	15.5
Average	20,481	36.0	26,744	47.6
Above average	29,673	52.2	20,724	36.9
NAPLAN Numeracy attainment at T1 (3rd-grade) and T2 (5th-grade) [a]				
Below average	23,088	40.6	9,456	16.8
Average	27,334	48.1	30,242	53.8
Above average	6,438	11.3	16,491	29.3
Covariates				
Sociodemographic factors				
Age-group (median split) at T1 (3rd-grade) and T2 (5th-grade) NAPLAN				
Younger half of school year	28,720	50.5	28,607	50.9
Older half of school year	28,138	49.5	27,582	49.1
Child's sex				
Male	28,552	50.2	28,163	50.1
Female	28,308	49.8	28,026	49.9
Socio-economically disadvantaged at T1 (3rd-grade) and T2 (5th-grade) NAPLAN				
Disadvantaged (bottom quintile)	8,873	15.6	8,553	15.2
Non-disadvantaged	47,947	84.4	47,558	84.8
Child speaks English as a Second Language				
English as a Second Language	8,918	15.7	8,896	15.8
Non-English as a Second Language	47,942	84.3	47,293	84.2
Indigenous Status				
Indigenous	3,665	6.4	3,630	6.5
Non-Indigenous	53,195	93.6	52,559	93.5
Pregnancy and birth factors				
Maternal age at child's birth				
25 years and younger	9,324	16.4	9,191	16.4
26–35 years (reference group)	36,130	63.5	35,655	63.5
36 years and older	11,406	20.1	11,343	20.2
Any maternal smoking during pregnancy				
Exposed to maternal smoking *in utero*	7,059	12.4	7,028	12.5
Non-exposed to maternal smoking *in utero*	49,790	87.6	49,150	87.5
No or delayed (>16 weeks) antenatal visit				
Present	12,789	22.6	12,672	22.6
Absent	43,859	77.4	43,298	77.4
Pre-term birth				
Born pre-term (prior to 37 weeks)	3,381	5.9	3,349	6.0
Full-term birth (from 37 weeks)	53,465	94.1	52,826	94.0
Parental factors				
Any parental mental illness				
Present	12,120	21.3	12,051	21.4
Absent	44,740	78.7	44,138	78.6
Any parental criminal offending				
Present	16,450	28.9	16,297	29.0
Absent	40,410	71.1	39,892	71.0
Early Developmental Vulnerability (AEDC kindergarten assessment, age ~5 years)				
Language and Cognitive Skills domain vulnerability (literacy and numeracy)				
Vulnerable (bottom decile)	2,262	4.0	2,254	4.0
Not vulnerable	54,598	96.0	53,935	96.0

(*continued on next page*)

Table 1 (*continued*)

Variables of interest	T1 (n = 56,860) n	%	T2 (n = 56,189) n	%
Number of other AEDC domain vulnerabilities (out of 4) [b]				
No domains vulnerable (reference group)	47,318	83.2	46,775	83.2
Vulnerability on 1 domain only	5,536	9.7	5,459	9.7
Vulnerability on 2 or more domains	4,006	7.0	3,955	7.0

Note: ROSH = risk of significant harm; NAPLAN = National Assessment Program – Literacy and Numeracy (2012, 3rd-grade; and 2014, 5th-grade); AEDC = Australian Early Development Census; [a] at 3rd-grade assessment, below average = NAPLAN bands 1 and 2, average = bands 3 and 4, above average = bands 5 and 6; at 5th-grade assessment, below average = NAPLAN bands 3 and 4, average = bands 5 and 6, above average = bands 7 and 8; [b] AEDC domains included Physical Health and Wellbeing, Social Competence, Emotional Maturity, and Communication and General Knowledge.

3.2. Predictors of below average reading and numeracy attainment

3.2.1. Unadjusted (bivariate) associations

In unadjusted analyses, for below average attainment relative to average attainment, similar patterns and magnitudes of effect were observed for reading and numeracy, and across the 3rd- and 5th-grade assessments (see Table 2). Relative to children not reported to child protection services, children in all four child protection involvement categories experienced a significantly *increased* risk of below average attainment. These effects were small to medium in magnitude (OR range = 1.85–2.66) for children with non-ROSH reports, of medium to large magnitude for children with non-substantiated ROSH reports (OR range = 2.27–2.62), of large magnitude for children with substantiated ROSH reports (OR range = 3.10–3.67), and of large to very large for children in OOHC (OR range = 2.80–4.12).

For the covariates, unadjusted analyses also evidenced similar patterns and magnitudes of significant association across 3rd- and 5th-grade reading and numeracy outcomes (Table 2 indicates only three occasions of non-significant association). All covariates were associated with increased risk for below average relative to average attainment, apart from the protective effects observed for older maternal age at child's birth on all outcomes, and for English as a Second Language on 3rd-grade reading. The largest increases in risk, comparable in magnitude to those observed for child protection reports, were associated with developmental vulnerability on the AEDC *Language and cognitive skills (school based)* domain (OR range = 4.67–6.60; very large magnitude effects), early developmental vulnerability on ≥ 2 other AEDC domains (OR range = 3.08–3.73; large effects) and on 1 other AEDC domain (OR range = 1.97–2.26; medium effects), Indigenous status (OR range = 2.48–2.93; large effects), and exposure to maternal smoking in utero (OR range = 2.03–2.35; medium effects). All other associations were small to medium in magnitude.

3.2.2. Adjusted associations

In fully adjusted models, all categories of children with child protection reports experienced significantly increased risk of below average attainment relative to children not reported to child protection services, with the exception that children with non-ROSH reports and children in OOHC no longer experienced significantly increased risk of below average reading at the 3rd- grade. The greatest magnitudes of significant effect (medium) were apparent for children with substantiated ROSH reports (OR range = 1.50–1.59), with small to medium effects for children in OOHC (OR range = 1.24–1.64), and small effects for children with non-substantiated ROSH reports (OR range = 1.32–1.49) and children with non-ROSH reports (OR range 1.30–1.47). Comparable magnitudes were associated with the sociodemographic, pregnancy and birth, and parental factors, as well as early developmental vulnerability on other AEDC domains, whereas large effects remained for the association of developmental vulnerability on the AEDC *Language and cognitive skills (school based)* domain with below average attainment (OR range = 3.02–3.88). Almost all covariates retained significant associations with academic outcomes at both assessments, except that any parental mental illness was mostly no longer significantly associated with outcomes in the context of all other covariates.

3.3. Predictors of above average reading and numeracy attainment

3.3.1. Unadjusted (bivariate) associations

In unadjusted analyses, for above average attainment relative to average attainment, similar patterns and magnitudes of effect were likewise observed across the reading and numeracy domains, and 3rd- and 5th-grade outcomes (see Table 3). Children in all four categories reported to child protection services were significantly *less* likely than children without child protection reports to attain above average reading and numeracy skills in the 3rd- and 5th-grades. These reductions were medium in magnitude for children with non-ROSH reports (OR range = 0.60-0.47) and children with non-substantiated ROSH reports (OR range = 0.50 to 0.41), large in magnitude for children with substantiated ROSH reports (OR range = 0.39 to 0.28), and large to very large in magnitude for children in OOHC (OR range = 0.33 to 0.23).

For the covariates, unadjusted analyses likewise evidenced similar patterns and magnitudes of significant associations across 3rd- and 5th-grade reading and numeracy outcomes (Table 3 details a single non-significant association). All covariates were associated

Table 2
Associations between child protection reports in Time 1 and Time 2, and covariates, and *below average* (relative to average) reading and numeracy attainment at the 3rd- and 5th-grades, respectively, both as unadjusted (bivariate) odds ratios (uOR) and 95 % confidence intervals (95 % CI) and when adjusted for all covariates (adjusted odds ratios; aOR).

Predictor/Covariate of interest	uOR (95 % CI)	*p*	aOR (95 % CI)	*p*	uOR (95 % CI)	*p*	aOR (95 % CI)	*p*
	3rd-grade *reading* (age ~8 years; n = 56,860) [a]				5th-grade *reading* (age ~10 years; n = 56,189) [a]			
Child protection report hierarchy								
No child protection report	(reference)		(reference)		(reference)		(reference)	
Non-ROSH report	1.91 (1.49 - 2.43)	<0.01	1.14 (0.88 - 1.49)	0.32	1.85 (1.66 - 2.06)	<0.01	1.30 (1.16 - 1.47)	<0.01
Non-substantiated ROSH report	2.27 (2.08 - 2.48)	<0.01	1.32 (1.19 - 1.47)	<0.01	2.36 (2.20 - 2.54)	<0.01	1.49 (1.37 - 1.61)	<0.01
Substantiated ROSH report	3.12 (2.68 - 3.63)	<0.01	1.50 (1.26 - 1.78)	<0.01	3.10 (2.73 - 3.53)	<0.01	1.59 (1.38 - 1.84)	<0.01
Out-of-Home care placement	2.80 (2.33 - 3.36)	<0.01	1.20 (0.97 - 1.48)	0.10	3.90 (3.32 - 4.59)	<0.01	1.64 (1.36 - 1.97)	<0.01
Sociodemographic factors								
Younger half of school year	1.03 (0.97 - 1.08)	0.38	1.02 (0.96 - 1.09)	0.46	1.06 (1.01 - 1.11)	0.02	1.00 (0.95 - 1.05)	1.00
Male sex	1.62 (1.53 - 1.71)	<0.01	1.55 (1.46 - 1.64)	<0.01	1.35 (1.29 - 1.42)	<0.01	1.28 (1.22 - 1.35)	<0.01
Socio-economically disadvantaged	1.68 (1.58 - 1.79)	<0.01	1.48 (1.38 - 1.59)	<0.01	1.90 (1.80 - 2.02)	<0.01	1.57 (1.48 - 1.67)	<0.01
English as a Second Language	0.91 (0.85 - 0.98)	0.01	0.81 (0.74 - 0.88)	<0.01	1.17 (1.10 - 1.24)	<0.01	1.06 (0.99 - 1.14)	0.11
Indigenous	2.48 (2.29 - 2.69)	<0.01	1.54 (1.40 - 1.69)	<0.01	2.71 (2.52 - 2.93)	<0.01	1.59 (1.45 - 1.73)	<0.01
Pregnancy and birth factors								
Maternal age at child's birth								
26–35 years	(reference)		(reference)		(reference)		(reference)	
25 years and younger	1.66 (1.55 - 1.77)	<0.01	1.15 (1.07 - 1.24)	<0.01	1.85 (1.75 - 1.96)	<0.01	1.26 (1.18 - 1.34)	<0.01
36 years and older	0.94 (0.87 - 1.02)	0.12	0.96 (0.88 - 1.04)	0.30	0.87 (0.81 - 0.93)	<0.01	0.88 (0.82 - 0.95)	<0.01
Exposed to maternal smoking *in utero*	2.03 (1.90 - 2.17)	<0.01	1.32 (1.22 - 1.43)	<0.01	2.21 (2.08 - 2.34)	<0.01	1.40 (1.31 - 1.51)	<0.01
No or delayed (>16 weeks) antenatal visit	1.38 (1.30 - 1.47)	<0.01	1.13 (1.06 - 1.20)	<0.01	1.49 (1.41 - 1.57)	<0.01	1.14 (1.07 - 1.21)	<0.01
Pre-term birth (prior to 37 weeks)	1.37 (1.23 - 1.53)	<0.01	1.20 (1.07 - 1.34)	<0.01	1.25 (1.13 - 1.37)	<0.01	1.07 (0.96 - 1.19)	0.21
Parental factors								
Any parental mental illness	1.61 (1.52 - 1.71)	<0.01	1.03 (0.96 - 1.11)	0.38	1.61 (1.52 - 1.69)	<0.01	0.97 (0.91 - 1.04)	0.40
Any parental criminal offending	1.79 (1.69 - 1.89)	<0.01	1.20 (1.12 - 1.28)	<0.01	1.89 (1.79 - 1.98)	<0.01	1.20 (1.13 - 1.27)	<0.01
Early Developmental Vulnerability (age ~5 years)								
Vulnerability on AEDC literacy and numeracy	4.67 (4.26 - 5.12)	<0.01	3.02 (2.72 - 3.34)	<0.01	5.72 (5.22 - 6.26)	<0.01	3.58 (3.24 - 3.97)	<0.01
Vulnerability on other AEDC domains (of 4)								
No vulnerability on any domain [b]	(reference)		(reference)		(reference)		(reference)	
Vulnerability on 1 domain only	1.97 (1.82 - 2.13)	<0.01	1.52 (1.40 - 1.65)	<0.01	2.04 (1.91 - 2.19)	<0.01	1.53 (1.42 - 1.65)	<0.01
Vulnerability on 2 or more domains	3.10 (2.87 - 3.36)	<0.01	1.75 (1.60 - 1.92)	<0.01	3.08 (2.86 - 3.31)	<0.01	1.62 (1.49 - 1.77)	<0.01
	3rd-grade *numeracy* (age ~8 years; n = 56,860) [a]				5th-grade *numeracy* (age ~10 years; n = 56,189) [a]			
Child protection report hierarchy								
No child protection report	(reference)		(reference)		(reference)		(reference)	
Non-ROSH report	2.66 (2.12 - 3.34)	<0.01	1.47 (1.14 - 1.88)	<0.01	2.10 (1.89 - 2.32)	<0.01	1.39 (1.25 - 1.56)	<0.01
Non-substantiated ROSH report	2.62 (2.41 - 2.86)	<0.01	1.37 (1.23 - 1.51)	<0.01	2.46 (2.29 - 2.63)	<0.01	1.44 (1.33 - 1.56)	<0.01
Substantiated ROSH report	3.67 (3.17 - 4.25)	<0.01	1.52 (1.29 - 1.81)	<0.01	3.44 (3.04 - 3.89)	<0.01	1.58 (1.37 - 1.82)	<0.01
Out-of-Home care placement	3.39 (2.84 - 4.03)	<0.01	1.24 (1.01 - 1.52)	0.04	4.12 (3.52 - 4.82)	<0.01	1.43 (1.19 - 1.71)	<0.01

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Table 2 (*continued*)

Predictor/Covariate of interest	uOR (95 % CI)	*p*	aOR (95 % CI)	*p*	uOR (95 % CI)	*p*	aOR (95 % CI)	*p*
Sociodemographic factors								
Younger half of school year	1.16 (1.10 - 1.22)	<0.01	1.09 (1.02 - 1.15)	<0.01	1.14 (1.09 - 1.20)	<0.01	1.05 (1.00 - 1.10)	0.05
Male sex	1.19 (1.13 - 1.26)	<0.01	1.02 (0.96 - 1.08)	0.51	1.03 (0.98 - 1.08)	0.27	0.89 (0.84 - 0.93)	<0.01
Socio-economically disadvantaged	1.97 (1.85 - 2.10)	<0.01	1.55 (1.45 - 1.67)	<0.01	1.87 (1.77 - 1.98)	<0.01	1.45 (1.36 - 1.54)	<0.01
English as a Second Language	1.20 (1.11 - 1.29)	<0.01	1.02 (0.94 - 1.11)	0.70	1.26 (1.19 - 1.35)	<0.01	1.10 (1.02 - 1.18)	0.01
Indigenous	2.83 (2.61 - 3.06)	<0.01	1.61 (1.47 - 1.77)	<0.01	2.93 (2.73 - 3.16)	<0.01	1.65 (1.52 - 1.80)	<0.01
Pregnancy and birth factors								
Maternal age at child's birth								
26–35 years	(reference)		(reference)		(reference)		(reference)	
25 years and younger	1.86 (1.74 - 1.98)	<0.01	1.21 (1.13 - 1.30)	<0.01	1.92 (1.82 - 2.03)	<0.01	1.24 (1.17 - 1.32)	<0.01
36 years and older	0.87 (0.80 - 0.94)	<0.01	0.89 (0.81 - 0.96)	<0.01	0.86 (0.81 - 0.92)	<0.01	0.89 (0.83 - 0.95)	<0.01
Exposed to maternal smoking *in utero*	2.28 (2.14 - 2.43)	<0.01	1.39 (1.28 - 1.50)	<0.01	2.35 (2.22 - 2.49)	<0.01	1.45 (1.35 - 1.55)	<0.01
No or delayed (>16 weeks) antenatal visit	1.53 (1.44 - 1.62)	<0.01	1.15 (1.07 - 1.22)	<0.01	1.60 (1.52 - 1.68)	<0.01	1.20 (1.13 - 1.27)	<0.01
Pre-term birth (prior to 37 weeks)	1.37 (1.24 - 1.51)	<0.01	1.20 (1.08 - 1.35)	<0.01	1.26 (1.15 - 1.38)	<0.01	1.11 (1.01 - 1.22)	0.04
Parental factors								
Any parental mental illness	1.72 (1.62 - 1.83)	<0.01	1.04 (0.97 - 1.12)	0.28	1.76 (1.67 - 1.85)	<0.01	1.07 (1.01 - 1.14)	0.02
Any parental criminal offending	2.03 (1.92 - 2.15)	<0.01	1.26 (1.18 - 1.35)	<0.01	2.03 (1.94 – 2.13)	<0.01	1.24 (1.17 - 1.31)	<0.01
Early Developmental Vulnerability (age ~5 years)								
Vulnerability on AEDC literacy and numeracy	6.60 (6.03 - 7.22)	<0.01	3.88 (3.50 - 4.30)	<0.01	6.38 (5.83 - 6.99)	<0.01	3.76 (3.39 - 4.16)	<0.01
Vulnerability on other AEDC domains (of 4)								
No vulnerability on any domain [b]	(reference)		(reference)		(reference)		(reference)	
Vulnerability on 1 domain only	2.26 (2.10 - 2.44)	<0.01	1.67 (1.54 - 1.81)	<0.01	2.08 (1.95 - 2.23)	<0.01	1.58 (1.46 - 1.70)	<0.01
Vulnerability on 2 or more domains	3.73 (3.46 - 4.03)	<0.01	1.98 (1.81 - 2.17)	<0.01	3.41 (3.17 - 3.66)	<0.01	1.89 (1.74 - 2.06)	<0.01

Note: ROSH = risk of significant harm; NAPLAN = National Assessment Program – Literacy and Numeracy; AEDC = Australian Early Development Census; [a] at 3rd-grade assessment, below average = NAPLAN bands 1 and 2, average = bands 3 and 4 (reference group), above average = bands 5 and 6; at 5th-grade assessment, below average = NAPLAN bands 3 and 4, average = bands 5 and 6 (reference group), above average = bands 7 and 8; [b] AEDC domains included Physical Health and Wellbeing, Social Competence, Emotional Maturity, and Communication and General Knowledge.

Table 3
Associations between child protection reports in Time 1 and Time 2, and covariates, and *above average* (relative to average) reading and numeracy attainment at the 3rd- and 5th-grades, respectively, both as unadjusted (bivariate) odds ratios (uOR) and 95 % confidence intervals (95 % CI) and when adjusted for all covariates (adjusted odds ratios; aOR).

Predictor / Covariate of interest	uOR (95 % CI)	*p*	aOR (95 % CI)	*p*	uOR (95 % CI)	*p*	aOR (95 % CI)	*p*
	3rd-grade *reading* (age ~8 years; n = 56,860) [a]				5th-grade *reading* (age ~10 years; n = 56,189) [a]			
Child protection report hierarchy								
No child protection report	(reference)		(reference)		(reference)		(reference)	
Non-ROSH report	0.47 (0.38 - 0.59)	<0.01	0.76 (0.61 - 0.96)	0.02	0.58 (0.53 - 0.65)	<0.01	0.84 (0.75 - 0.94)	<0.01
Non-substantiated ROSH report	0.44 (0.40 - 0.48)	<0.01	0.78 (0.71 - 0.86)	<0.01	0.50 (0.46 - 0.54)	<0.01	0.80 (0.74 - 0.87)	<0.01
Substantiated ROSH report	0.34 (0.29 - 0.41)	<0.01	0.75 (0.63 - 0.91)	<0.01	0.39 (0.33 - 0.46)	<0.01	0.78 (0.65 - 0.93)	<0.01
Out-of-Home care placement	0.32 (0.26 - 0.40)	<0.01	0.83 (0.66 - 1.03)	0.10	0.33 (0.26 - 0.42)	<0.01	0.97 (0.74 - 1.26)	0.80
Sociodemographic factors								
Younger half of school year	0.75 (0.73 - 0.78)	<0.01	0.79 (0.76 - 0.82)	<0.01	0.78 (0.75 - 0.81)	<0.01	0.82 (0.79 - 0.85)	<0.01
Male sex	0.92 (0.89 - 0.96)	<0.01	0.94 (0.91 - 0.98)	<0.01	0.94 (0.90 - 0.97)	<0.01	0.95 (0.92 - 0.99)	0.01
Socio-economically disadvantaged	0.54 (0.51 - 0.57)	<0.01	0.67 (0.64 - 0.71)	<0.01	0.50 (0.47 - 0.53)	<0.01	0.61 (0.58 - 0.65)	<0.01
English as a Second Language	0.76 (0.73 - 0.80)	<0.01	0.91 (0.87 - 0.96)	<0.01	0.78 (0.74 - 0.82)	<0.01	0.93 (0.88 - 0.98)	<0.01
Indigenous	0.40 (0.37 - 0.43)	<0.01	0.64 (0.58 - 0.70)	<0.01	0.37 (0.34 - 0.41)	<0.01	0.62 (0.55 - 0.69)	<0.01
Pregnancy and birth factors								
Maternal age at child's birth								
26–35 years	(reference)		(reference)		(reference)		(reference)	
25 years and younger	0.52 (0.49 - 0.54)	<0.01	0.72 (0.68 - 0.76)	<0.01	0.47 (0.44 - 0.50)	<0.01	0.65 (0.61 - 0.69)	<0.01
36 years and older	1.32 (1.26 - 1.39)	<0.01	1.29 (1.23 - 1.35)	<0.01	1.37 (1.31 - 1.44)	<0.01	1.34 (1.28 - 1.40)	<0.01
Exposed to maternal smoking *in utero*	0.46 (0.43 - 0.49)	<0.01	0.65 (0.61 - 0.70)	<0.01	0.44 (0.41 - 0.47)	<0.01	0.63 (0.59 - 0.68)	<0.01
No or delayed (>16 weeks) antenatal visit	0.70 (0.67 - 0.73)	<0.01	0.87 (0.83 - 0.91)	<0.01	0.70 (0.67 - 0.73)	<0.01	0.87 (0.83 - 0.92)	<0.01
Pre-term birth (prior to 37 weeks)	0.97 (0.90 - 1.05)	0.42	1.02 (0.94 - 1.11)	0.58	0.92 (0.85 - 0.99)	0.03	0.95 (0.87 - 1.03)	0.19
Parental factors								
Any parental mental illness	0.71 (0.68 - 0.74)	<0.01	0.98 (0.94 - 1.03)	0.49	0.68 (0.65 - 0.72)	<0.01	0.95 (0.90 - 0.99)	0.04
Any parental criminal offending	0.54 (0.52 - 0.57)	<0.01	0.75 (0.71 - 0.78)	<0.01	0.50 (0.48 - 0.52)	<0.01	0.69 (0.65 - 0.72)	<0.01
Early Developmental Vulnerability (age ~5 years)								
Vulnerability on AEDC literacy and numeracy	0.15 (0.13 - 0.17)	<0.01	0.25 (0.21 - 0.29)	<0.01	0.16 (0.13 - 0.19)	<0.01	0.27 (0.22 - 0.33)	<0.01
Vulnerability on other AEDC domains (of 4)								
No vulnerability on any domain [b]	(reference)		(reference)		(reference)		(reference)	
Vulnerability on 1 domain only	0.53 (0.50 - 0.56)	<0.01	0.63 (0.59 - 0.67)	<0.01	0.54 (0.50 - 0.58)	<0.01	0.63 (0.59 - 0.68)	<0.01
Vulnerability on 2 or more domains	0.32 (0.30 - 0.35)	<0.01	0.46 (0.42 - 0.50)	<0.01	0.36 (0.33 - 0.39)	<0.01	0.50 (0.45 - 0.56)	<0.01
	3rd-grade *numeracy* (age ~8 years; n = 56,860) [a]				5th-grade *numeracy* (age ~10 years; n = 56,189) [a]			
Child protection report hierarchy								
No child protection report	(reference)		(reference)		(reference)		(reference)	
Non-ROSH report	0.49 (0.39 - 0.62)	<0.01	0.81 (0.63 - 1.05)	0.11	0.60 (0.54 - 0.68)	<0.01	0.86 (0.77 - 0.98)	0.02
Non-substantiated ROSH report	0.41 (0.38 - 0.45)	<0.01	0.77 (0.70 - 0.85)	<0.01	0.46 (0.42 - 0.50)	<0.01	0.75 (0.68 - 0.82)	<0.01
Substantiated ROSH report	0.29 (0.24 - 0.36)	<0.01	0.70 (0.57 - 0.87)	<0.01	0.28 (0.23 - 0.35)	<0.01	0.61 (0.49 - 0.77)	<0.01
Out-of-Home care placement	0.26 (0.21 - 0.34)	<0.01	0.77 (0.59 - 1.00)	0.05	0.23 (0.17 - 0.32)	<0.01	0.73 (0.52 - 1.03)	0.07

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Table 3 (*continued*)

Predictor / Covariate of interest	uOR (95 % CI)	*p*	aOR (95 % CI)	*p*	uOR (95 % CI)	*p*	aOR (95 % CI)	*p*
Sociodemographic factors								
Younger half of school year	0.76 (0.73 - 0.78)	<0.01	0.79 (0.76 - 0.82)	<0.01	0.86 (0.83 - 0.89)	<0.01	0.88 (0.85 - 0.92)	<0.01
Male sex	1.37 (1.32 - 1.42)	<0.01	1.47 (1.41 - 1.52)	<0.01	1.50 (1.45 - 1.56)	<0.01	1.61 (1.55 - 1.68)	<0.01
Socio-economically disadvantaged	0.60 (0.57 - 0.64)	<0.01	0.70 (0.66 - 0.74)	<0.01	0.59 (0.56 - 0.63)	<0.01	0.63 (0.59 - 0.67)	<0.01
English as a Second Language	1.06 (1.01 - 1.11)	0.03	1.26 (1.20 - 1.33)	<0.01	1.41 (1.34 - 1.48)	<0.01	1.66 (1.57 - 1.76)	<0.01
Indigenous	0.37 (0.34 - 0.40)	<0.01	0.63 (0.57 - 0.70)	<0.01	0.33 (0.29 - 0.37)	<0.01	0.59 (0.52 - 0.67)	<0.01
Pregnancy and birth factors								
Maternal age at child's birth								
26–35 years	(reference)		(reference)		(reference)		(reference)	
25 years and younger	0.48 (0.45 - 0.50)	<0.01	0.65 (0.61 - 0.69)	<0.01	0.45 (0.43 - 0.48)	<0.01	0.62 (0.58 - 0.66)	<0.01
36 years and older	1.26 (1.21 - 1.32)	<0.01	1.25 (1.19 - 1.30)	<0.01	1.28 (1.22 - 1.34)	<0.01	1.27 (1.21 - 1.33)	<0.01
Exposed to maternal smoking *in utero*	0.42 (0.39 - 0.44)	<0.01	0.62 (0.58 - 0.67)	<0.01	0.34 (0.31 - 0.37)	<0.01	0.51 (0.47 - 0.56)	<0.01
No or delayed (>16 weeks) antenatal visit	0.74 (0.71 - 0.77)	<0.01	0.88 (0.84 - 0.92)	<0.01	0.79 (0.75 - 0.83)	<0.01	0.91 (0.87 - 0.96)	<0.01
Pre-term birth (prior to 37 weeks)	0.81 (0.75 - 0.87)	<0.01	0.83 (0.76 - 0.90)	<0.01	0.78 (0.72 - 0.85)	<0.01	0.81 (0.74 - 0.88)	<0.01
Parental factors								
Any parental mental illness	0.65 (0.62 - 0.68)	<0.01	0.91 (0.87 - 0.96)	<0.01	0.62 (0.59 - 0.65)	<0.01	0.87 (0.83 - 0.92)	<0.01
Any parental criminal offending	0.53 (0.51 - 0.55)	<0.01	0.74 (0.71 - 0.78)	<0.01	0.52 (0.49 - 0.54)	<0.01	0.73 (0.70 - 0.77)	<0.01
Early Developmental Vulnerability (age ~5 years)								
Vulnerability on AEDC literacy and numeracy	0.14 (0.12 - 0.17)	<0.01	0.22 (0.18 - 0.27)	<0.01	0.17 (0.14 - 0.22)	<0.01	0.25 (0.19 - 0.31)	<0.01
Vulnerability on other AEDC domains (of 4)								
No vulnerability on any domain [b]	(reference)		(reference)		(reference)		(reference)	
Vulnerability on 1 domain only	0.56 (0.52 - 0.59)	<0.01	0.59 (0.55 - 0.63)	<0.01	0.64 (0.59 - 0.68)	<0.01	0.63 (0.58 - 0.68)	<0.01
Vulnerability on 2 or more domains	0.37 (0.33 - 0.40)	<0.01	0.44 (0.40 - 0.49)	<0.01	0.45 (0.41 - 0.50)	<0.01	0.50 (0.45 - 0.56)	<0.01

Note: ROSH = risk of significant harm; NAPLAN = National Assessment Program – Literacy and Numeracy; AEDC = Australian Early Development Census; [a] at 3rd-grade assessment, below average = NAPLAN bands 1 and 2, average = bands 3 and 4 (reference group), above average = bands 5 and 6; at 5th-grade assessment, below average = NAPLAN bands 3 and 4, average = bands 5 and 6 (reference group), above average = bands 7 and 8; [b] AEDC domains included Physical Health and Wellbeing, Social Competence, Emotional Maturity, and Communication and General Knowledge.

with *decreased* likelihood of attaining above average relative to average attainment, apart from the protective effects observed for older maternal age at child's birth on all outcomes, and for male sex and English as a Second Language on 3rd- and 5th-grade numeracy. The largest reductions in likelihood of achieving above average, comparable in magnitude to those observed for the child protection exposure, were also associated with developmental vulnerability on the AEDC *Language and cognitive skills (school based)* domain (OR range = 0.17–0.14; very large magnitude effects), early developmental vulnerability on ≥ 2 other AEDC domains (OR range = 0.45–0.32; medium to large effects) and on 1 other AEDC domain (OR range = 0.64–0.53; medium effects), Indigenous status (OR range = 0.40–0.33; large effects), exposure to maternal smoking in utero (OR range = 0.46–0.34; medium to large effects), and young maternal age at birth (OR range = 0.52–0.45; medium effects). All other associations were small to medium in magnitude.

3.3.2. Adjusted associations

In fully adjusted models, children with ROSH reports (non-substantiated or substantiated) experienced significantly *decreased* likelihood of achieving above average relative to children not reported to child protection. So too did children with non-ROSH reports, except on 3rd-grade numeracy. Conversely, children in OOHC were as likely as children without child protection reports to experience above average attainment on all outcomes. The greatest effects (small to medium in magnitude) were apparent for children with substantiated ROSH reports (OR range = 0.78–0.61), with effects of small magnitude observed for children with non-substantiated ROSH reports (OR range = 0.80–0.75). These effects were, again, broadly comparable in magnitude to the adjusted effects associated with the sociodemographic, pregnancy and birth, and parental factors, though the significant reductions in above average attainment associated with developmental vulnerability on the AEDC *Language and cognitive skills (school based)* domain remained large to very large in magnitude (OR range = 0.27–0.22), and medium for early developmental vulnerability on 1 or ≥ 2 other AEDC domains (OR range = 0.63–0.44). Most covariates retained significant associations with academic outcomes at both assessments in the context of all other covariates, including any parental mental illness (except for 3rd-grade reading only).

4. Discussion

In this large cohort of more than 56,000 individuals, children with any child protection contact were at increased risk of *below* average attainment on 3rd- and 5th-grade reading and numeracy, relative to children without child protection reports, according to the overall pattern of results in models fully adjusted for important covariates. The largest effects were of medium magnitude for children with substantiated ROSH reports who were not removed from their homes, while children who had been placed in OOHC, and children with non-substantiated reports, showed small increases in risk for educational under-attainment; however, it is notable that the significant association of OOHC with poor 3rd-grade reading was eliminated in the adjusted model, implying a potential beneficial effect of care placement/s. Children with non-ROSH reports were also significantly more likely to attain below average reading and numeracy (except on 3rd-grade reading), with these small associations comparable in magnitude to those characterising the OOHC and non-substantiated ROSH groups. In similar vein, significantly reduced likelihoods of achieving *above* average attainment were apparent for children with substantiated and non-substantiated ROSH reports relative to children without child protection reports. Conversely, following adjustment, children placed in OOHC were no less likely to attain above average 3rd- and 5th-grade reading and numeracy skills than children without child protection reports, again implying a potential protective effect of OOHC placement in this cohort (see also Rossen et al., 2019). Children with non-ROSH reports were significantly less likely to attain above average reading and numeracy skills (except on 3rd-grade numeracy). These patterns of attainment were demonstrated in the context of controlling for the prominent effects of early (kindergarten) literacy and numeracy skills on later reading and numeracy, as well as multiple other risk factors. The key implications of these findings are twofold: (i) that OOHC placement may confer some support of educational attainment for maltreated children relative to substantiated cases not removed into care, and (ii) that children with any level of report to child protection, even those deemed not to meet the risk threshold for further investigation, report adverse attainment outcomes that might be remediated via the establishment of cross-agency services to support their attainment of primary school reading and numeracy milestones. In large part, findings were consistent across 3rd- and 5th-grade and reading and numeracy outcomes, implying that the risk and protective processes that may underpin the observed associations are general rather than specific to a particular cognitive skill or stage of development during middle childhood/primary schooling years. This does not, however, imply that age-appropriate supports are not required or that skill-specific programs are not of benefit in remediating poor outcomes and in supporting children to achieve their educational potential.

In terms of the covariates included in the study, all were significant predictors of above- and below-average reading and numeracy skills in the 3rd- and 5th-grades. The strongest associations, greater even than those observed for the child protection exposure, were apparent for kindergarten teacher-ratings of developmental vulnerability on the AEDC *Language and cognitive skills (school based)* domain (i.e., achieving in the lowest 10th percentile of the population for literacy and numeracy competencies). Attainment of literacy and numeracy skills is progressive, with subsequent skills built on the foundation of earlier achievements, and these results emphasise the importance of delivering early childhood education (preschool) programs that provide a strong base of literacy and numeracy to be further developed and enhanced by school personnel throughout the student's learning journey (Goldfeld et al., 2016). Other covariates characterised by associations with 3rd- and 5th-grade outcomes that were comparable in magnitude to those observed for the child protection exposure were the presence of one or multiple developmental vulnerabilities across the *Social*

competence, Emotional maturity, Physical health and wellbeing, and *Communication skills and general knowledge* domains at the time of entry to formal schooling, Indigenous status, socio-economic disadvantage, and exposure to maternal smoking in utero. These factors underscore that preventive interventions to safeguard the educational attainments of all children (regardless of child protection involvement) might be achieved through delivery of public health programs to support pregnant mothers, universal preschool programs to promote social and emotional health, and interventions to support disadvantaged communities (COAG Education Council, 2015; Goldfeld et al., 2016; Woolfenden et al., 2013).

The study findings have important implications for cross-agency policy and practice to support the educational attainment of *any* child reported to child protection services. The need to enhance and more clearly define the role of other relevant government agencies (e.g., Education, Health, and Police) to deliver a more effective and integrated response for vulnerable families has been recognised already in this NSW jurisdiction (NSW Ombudsman, 2014) and elsewhere (Maclean et al., 2016; Piescher et al., 2014). Individual education plans are only one of a range of interventions to support the educational attainment of children placed in OOHC. Others include tutoring, additional learning materials, education liaison, residential or special education programs, tailored psychological support, parenting interventions, and school readiness interventions, for which some evidence of effectiveness has been demonstrated though rigorous evaluation is required (Dill, Flynn, Hollingshead, & Fernandes, 2012; Evans, Brown, Rees, & Smith, 2017; Forsman & Vinnerljung, 2012). By the 5th-grade, children in OOHC constituted 1.2 % of the sample. Children with substantiated ROSH reports represented another 2.1 % and had the most adverse educational outcomes on all measures. This suggests that education must be recognised and prioritised as a core component of assessment and service delivery protocols for all children with substantiated maltreatment, not just those placed into care (Piescher et al., 2014). In some jurisdictions, this might require legislative changes alongside an increased funding allocation to support the cross-agency sharing of information between child protection and education services for these additional children.

Improvement of the effectiveness of support provided to children whose reports to child protection services currently fall below existing risk thresholds for statutory intervention is also required, with the prospect that this may lower the number of ROSH reports over time (NSW Ombudsman, 2014). In the current sample, this included 8.4 % of children with non-substantiated ROSH reports by the 5th-grade and a further 3.5 % of children with non-ROSH reports. Research from other jurisdictions has demonstrated that children with unsubstantiated child protection reports may be less likely than children with substantiated reports to receive services, not only from child protection agencies but also other services that might help lessen the adverse effects of the multiple adversities they typically experience (Fantuzzo et al., 2011). This calls for investment in effective universal programs, and in early intervention services for vulnerable communities and for individuals who might be referred to allied services provided by non-governmental organisations (NSW Ombudsman, 2014). The importance of interagency professional development and training to generate the common purpose, language, and procedures that can deliver sustainable service enhancements across child protection, education, and other service agencies has also been emphasised (Perlman & Fantuzzo, 2010).

The large sample size and use of multi-agency records that provide capacity to simultaneously account for the multiple risks that maltreated children experience when determining the association between levels of child protection involvement and educational attainment were key strengths of the study, as were the inclusion of both reading and numeracy outcomes at multiple points during learning. Nonetheless, there were inherent limitations associated with the use of administrative records not collected for the purposes of this research study. We did not consider the impact of important factors such as home placement characteristics and instability (Maclean, Taylor, & O'Donnell, 2017), school attendance rates (Maclean et al., 2018), disability (Maclean et al., 2016), or the receipt of educational, psychological, or family support services. School attendance has a critical impact on educational attainment, and in many jurisdictions (including NSW) non-attendance is defined as "educational neglect" and constitutes a child protection issue (NSW Ombudsman, 2014). Any child who repeated a grade in school, which is more likely among maltreated children (Maguire et al., 2015), was lost from the linked sample. We were also limited to an indicator of English as a Second Language status reported by teachers at school entry rather than concurrently with the 3rd- and 5th-grade assessments. This may account for the anomalous finding in which English as a Second Language status was protective against below average 3rd-grade reading attainment, possibly reflecting extra language learning supports provided at school for these children in prior years. We also did not consider the developmental timing of reports to child protection services or the type of abuse (physical, sexual, emotional, and neglect), which have both been demonstrated to differentially impact educational outcomes (Fantuzzo et al., 2011; Rossen et al., 2019).

5. Conclusion

The present study was conducted in collaborative partnership with child protection and education service providers in NSW to inform the development of cross-agency policies and practices. The present study demonstrates that all children reported to child protection services are at increased risk of educational under-attainment. Special provisions for children in OOHC, such as Individual Education Plans, are currently mandated in this jurisdiction and others. This finding endorses previous calls for policies that can support collaboration, training, and information sharing between child protection and education systems, as well as other agencies, in order to support the academic achievement of *all* vulnerable children with child protection reports, including via broader provision of universal and targeted interventions, titrated appropriately by level of risk of harm.

Funding support

This research was conducted by the University of New South Wales with financial support from an Australian Research Council (ARC) Linkage Project [LP110100150, with the NSW Ministry of Health, NSW Department of Education, and the NSW Department of Family and Community Services representing the Linkage Project Partners], an ARC Discovery Project [DP170101403], and ARC Future Fellowship awarded to KRL [FT170100294]; National Health and Medical Research Council (NHMRC) of Australia Project Grants [APP1058652 and APP1148055] and Partnership Project [APP1133833]; and the Australian Rotary Health Mental Health for Young Australians Research Grants [104090 and 162302].

Declaration of Competing Interest

None.

Acknowledgements

This research used population data owned by the NSW Department of Family and Community Services; NSW Education Standards Authority; NSW Ministry of Health; NSW Registry of Births, Deaths and Marriages; and the NSW Bureau of Crime Statistics and Research. This paper also used data from the Australian Early Development Census (AEDC). The AEDC is funded by the Australian Government Department of Education and Training. The findings and views reported are those of the authors and should not be attributed to these Departments or the NSW and Australian Governments. The record linkage was conducted by the Centre for Health and Record Linkage.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.chiabu.2019.104326.

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