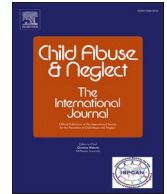




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Investigating the impact of Out-of-Home Care on early childhood development

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ABSTRACT

Background: Early childhood development is influential for life course capability. Children exposed to child maltreatment and at high risk of harm may be removed for their safety, but the effect on child development is uncertain.

Objectives: To assess developmental vulnerability at school commencement across five developmental domains to ascertain whether removal of children with substantiated maltreatment to foster/kinship care is likely protective, or not, of developmental vulnerabilities.

Methods: The study drew on linked-data for a South Australian population birth cohort (2003 to 2014) $N = 74,751$. For children exposed to substantiated child maltreatment meeting study criteria ($N = 2011$, mean age = 5.7 years, 50.7 % boys), the effect of placement in foster/kinship care ($N = 666$) on developmental vulnerability was explored using generalized linear models, adjusted for child and family covariates, maltreatment severity and propensity score.

Results: Children placed in care had a reduced risk of developmental vulnerability on the Physical Health and Wellbeing (aRR = 0.73 [0.64, 0.84]), Language and Cognitive Skills (school based) (aRR = 0.79 [0.68, 0.92]), and Communication Skills and General Knowledge (aRR = 0.81 [0.70, 0.94]) domains, compared to children who were not removed. However, these children had increased risk of vulnerability on Social Competence (aRR = 1.14 [1.01, 1.29]) and Emotional Maturity (aRR = 1.20 [1.05, 1.37]) domains.

Conclusions: These findings suggest placement in out-of-home care supported physical health and wellbeing, communication and cognitive but not social and emotional early childhood development. These results highlighting the need for professional therapeutic support for children in care and better attending to the physical development, communication and cognitive skills in maltreated children remaining at home.

1. Introduction

Conception to 5 years of age, particularly the first 1000 days, is a defining period of brain growth and child development. Exposure to early-life adversity can increase the risk of developmental vulnerability – defined as not meeting age-appropriate milestones for physical, social, emotional, cognitive or language skills (DESE, 2022). Children entering school developmentally vulnerable are at high risk of ongoing health, social and economic disadvantage across the life course, and potentially perpetuating the cycle of disadvantage

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(Armfield, Gnanamanickam, et al., 2021). Developmental vulnerability at school entry is associated with significantly lower school achievement and 3 times the odds of developing mental health disorders in middle childhood (Brinkman et al., 2013; Davies et al., 2016; Green et al., 2019).

To assess early childhood development in Australian children, the Australian Early Development Census (AEDC) (Brinkman et al., 2007; Silburn et al., 2009) was adapted from the Canadian Early Development Instrument (EDI) and implemented every 3 years in the first year of full-time schooling. In the USA, measures of child development are included in large studies, such as the National Survey of Children's Health (Ghandour et al., 2019). Understanding more about who is most at risk, and the domains of greatest vulnerability is valuable for informing practice and policy.

Child maltreatment (CM) has documented associations with a range of poor health, social and educational outcomes (Amos & Segal, 2019; Bellis et al., 2019; Bunting et al., 2018; Gnanamanickam et al., 2020, 2022; Malvaso et al., 2017; Segal et al., 2021). Well-defined causal mechanisms between CM and poor outcomes, suggests preventive opportunities.

Maltreatment can disrupt the establishment of a secure attachment style (Cicchetti et al., 2016; Cyr et al., 2010), and in combination with self-protective behaviors adopted in response to on-going and inescapable threat, undermine the development of a sense of self and capacity for healthy social interactions and emotional resilience (Amos & Segal, 2018). Developmental vulnerability can also be a consequence of damage to developing brains and bodies from assault or profound neglect (Nemeroff & Charles, 2016; Nuño et al., 2018).

It is also the case that child development is influenced by individual, familial, and environmental factors in a complex cyclical manner (Toth & Cicchetti, 2013). And there are reported research findings that certain developmental conditions are associated with increased risk of experiencing maltreatment, such as having an intellectual disability or mental health/behavioral problems, suggesting the possibility of a two way relationship between child maltreatment and developmental vulnerability (Maclean et al., 2017).

Child protection services (CPS) have been developed internationally to address child safety concerns, especially within families. Typically, child protection services receive notifications of child concern reports, conduct formal investigations, possibly offer family support services, and in cases where children are exposed to or at risk of serious harm, place a child in Out-of-Home Care (OoHC) (Berrick et al., 2023). Removing a child from their birth family to OoHC (foster, kinship, or residential care), in over-riding parental rights, in separating children from their parents, and at considerable budget cost is a serious undertaking. Surprisingly, the evidence as to whether OoHC reduces harms and mitigates developmental vulnerability is limited. While studies find children in care have high rates of developmental vulnerabilities relative to other children (Green et al., 2019; Hindmarsh et al., 2021), whether this reflects the maltreatment that precipitated the removal, or the trauma of being placed in OoHC and separation from birth family is unclear.

An Australian study (Rossen et al., 2019), using linked administrative data found for children with substantiated CM, those who had entered care had the highest odds of vulnerability relative to the no CPS group on social and emotional domains, while those not entering care were the most vulnerable on physical, cognitive and communication domains, adjusting for a number of child and family factors. But this study did not adjust for child maltreatment history, excluded children with special health care needs (SHCN) and did not estimate odds ratios comparing children with substantiated CM who had, and had not entered OoHC.

A 2016 meta-analysis comparing the cognitive, adaptive, and behavioral functioning of children placed in foster care with children at-risk remaining at home found no significant differences between the groups (Goemans et al., 2016). A systematic review conducted by Maclean et al. (2016) on health and wellbeing, including developmental outcomes in children entering OoHC found that most studies had a high risk of bias. Descriptives showed higher levels of disadvantage in the children in OoHC than comparison children, and likelihood of unobserved confounders not adjusted for. Of three studies with low bias risk, just one reported on child development and behavior in children (aged 4–14 years of age at study enrolment to 7–17 years at follow-up) (Berger et al., 2009). Berger et al. (2009) reported no statistically significant differences in outcomes for removed children $N = 342$ compared with children $N = 2111$ who remained at home employing multiple analytic methods using full, and matched samples generated by propensity scoring. Poorer outcomes were observed for internalizing and externalizing behavior and vocabulary for children in OoHC, and better outcomes for cognition, however differences were not statistically significant. Furthermore, differences disappeared after adjusting for base-line differences – for example, children who entered care scored worse on internalizing and externalizing behaviors prior to entry to care.

Maclean et al. (2018) also used propensity score methods to estimate the effect of OoHC on reading scores, school attendance and suspensions, comparing children who had ever entered care to a matched sample of children with substantiated CM who remained with their birth family. Using this method, the authors were able to achieve a close match on key maternal and child characteristics, reducing the risk of selection bias (Rosenbaum & Rubin, 1983). They found no difference in reading achievement or suspensions at year nine (around age 14 years) between the two groups, but school attendance was significantly better in children who had experienced OoHC, compared to children who had not (Maclean et al., 2018).

There remain important gaps in our knowledge of the impact of OoHC on child development. A sound understanding of the potential benefits or harms of child removal to OoHC is critical to developing evidence-informed interventions and policy recommendations to better protect highly vulnerable young children. Child development is an important outcome influencing life trajectories and known to be affected by CM. Child development is measured across several domains. Knowing more about the impacts on each domain could assist in eliciting a more nuanced policy response.

1.1. Study aim

The aim of the current study was to investigate the impact of placement in OoHC (placement durations longer than 7 days) on child development at the start of school (ages 5 to 6 years) among children who had experienced substantiated child maltreatment before the AEDC census. Population level observational data was used to estimate the impact of OoHC on each of the five developmental domains:

i) Physical Health and Wellbeing; ii) Social Competence; iii) Emotional Maturity; iv) Language and Cognitive Skills (school-based); and v) Communication Skills and General Knowledge. Employing methods based on the potential-outcomes framework, including propensity score adjustment, we sought to reduce selection bias and thus disentangle the effect of prior maltreatment from the impacts of OoHC. The overarching purpose was to inform strategies for at-risk children, contributing to policy and practice aimed at ameliorating the effects of early childhood maltreatment on child wellbeing and development.

2. Method

2.1. Study design and participants

This study forms part of the Impacts of Child Abuse and Neglect (iCAN) project, a population birth cohort study using de-identified linked administrative data designed to explore the consequences of CM (Segal et al., 2019). The iCAN study cohort was all individuals born in South Australia between 1 January 1986 and 30 June 2017 ascertained from the birth registry or perinatal statistics collection and individuals who had a South Australian CPS record within the same timeframe. Participants for the current study included children in the iCAN cohort who had a valid Australian Early Development Census (AEDC), $N = 74,751$ (born between 2003 and 2014). An AEDC record was deemed invalid if the child was under 4 years of age or the teacher reported the child had been at school for less than one month. Although the census is conducted every 3 years, the age of children starting school varies which diversified the sample in terms of birth year. To investigate the impact of care placement on developmental vulnerability, a sub-sample was created of children who had been the subject of at least one substantiated maltreatment investigation ($N = 2053$) prior to the estimated AEDC record date (conducted between May and July, 1st of June chosen average). To increase the likelihood of capturing the impact of OoHC on the AEDC outcomes, we excluded children who's only OoHC placement/s were <8 days in duration. Leaving $N = 2011$ children, of whom 666 had entered care and 1345 had not entered care. See Fig. 1.

2.2. Study data

Data linkage was conducted through the independent organization SA-NT DataLink, using state-of-the-art deterministic and probabilistic matching of individual identifiers and detailed clerical review, to achieve >99 % match accuracy (Schneider et al., 2019). For our analysis, datasets were merged from health, child protection, education and the birth and death registries, using project specific linkage keys supplied by SA-NT Datalink to create de-identified person-level data.

2.2.1. Outcome variable

The outcome measure used was the Australian Early Development Census (AEDC) (Gregory & Brinkman, 2016), conducted nationally every 3 years since 2009. The AEDC collects information on children's developmental school readiness using a teacher-completed instrument (based on an Australian version of the Early Development Instrument (AvEDI), adapted from Canada) during the second term of the first year of full-time school – children aged predominantly between 5 and 6 years (Janus et al., 2011). The AEDC has been adapted and validated for use in Australia (Silburn et al., 2009). It measures developmental school readiness across five domains of: i) Physical Health and Wellbeing; ii) Social Competence; iii) Emotional Maturity; iv) Language and Cognitive Skills (school-based); and v) Communication Skills and General Knowledge. A list of domains, sub-domains and items covered is provided in supplementary material Table A.2. Selected child and parent sociodemographic data is also recorded (Brinkman et al., 2014). The

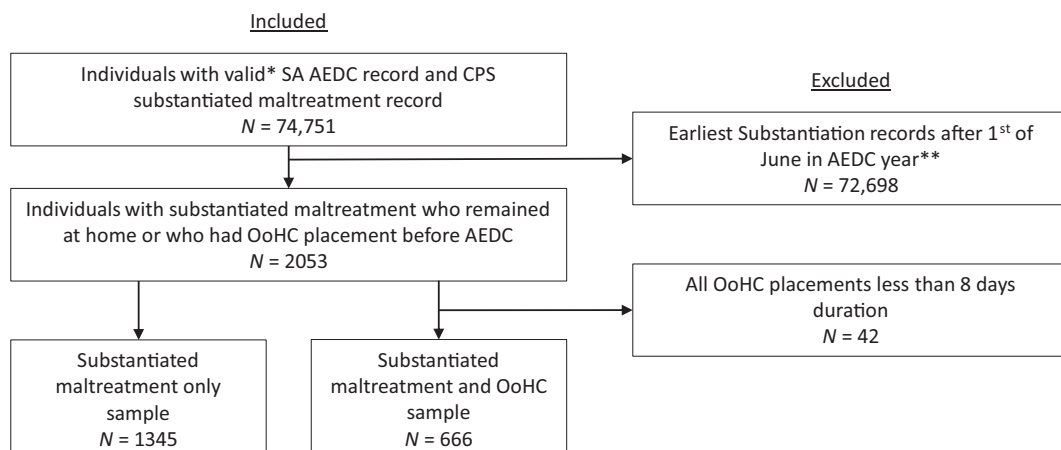


Fig. 1. Study population flow chart.

*Child's first year of schooling was in an AEDC year; Child had been at school for more than one month; Child was over 4 years of age at the time.

**Estimated as 01/06 in AEDC year: AEDC conducted May to July, varies per state, teacher and child. SA= South Australia; CPS= Child Protection Service; AEDC= Australian Early Development Census; OoHC= Out-of-Home Care

AEDC has excellent coverage. The latest (2021) AEDC covered 95.5 % of the estimated child population for whom 2021 was their first year of full-time schooling (DESE, 2022). Validity and reliability studies have found the AEDC predicts later educational outcomes and exhibits similar results to validated child development measures (Brinkman et al., 2013).

Domain scores are calculated (out of 10) by the AEDC from scale responses to ninety-six questions (Brinkman et al., 2014). AEDC domain category cut-off scores were established by the developers during the first national data collection in 2009. Ever since, children falling below the score equivalent to the 10th percentile in the 2009 AEDC data collection were categorised as ‘developmentally vulnerable’; children falling between the score equivalent to the 10th and 25th percentile in the 2009 AEDC data collection were categorised as ‘developmentally at risk’; all other children were categorised as ‘developmentally on track’ (Brinkman et al., 2007). Further information on the risk categories and domain descriptors is described in Supplementary material Table A.4. The dependent variables were coded dichotomously as ‘developmentally vulnerable’ [no/yes] on each domain to reflect these predetermined AEDC cut offs.

In Australia, because of their already established substantial developmental needs, children with SHCN are not allocated a domain category by the AEDC, although domain scores (out of 10) are provided. To include these children, the research team calculated 10 % cut-off scores for each domain, by year, from the available South Australian cohort records to assign these children as developmentally vulnerable or not. Although the Canadian version of the AEDC has recently been validated for children with special health care needs (Janus et al., 2019). The choice to focus on the developmentally vulnerable group (score < 10 %), reflected studies showing later school and other outcomes, were most associated with this highest level of developmental vulnerability (Brinkman et al., 2013; Green et al., 2018; Green et al., 2019). For this reason, this dichotomous allocation is the adopted approach of most published studies using the AEDC.

2.2.2. Covariates

A comprehensive set of covariates were selected as possible confounders, based on previous iCAN research, studies in New South Wales (Carr et al., 2016; Green et al., 2021) and Western Australia (Maclean et al., 2018) exploring the impact of out-of-home care, and

Table 1
Covariates used to calculate propensity score and in adjusted analyses.

Covariate	Categories	Source / comment
Child attributes		
Sex	Male/Female	SA Birth Registry.
Child's age at AEDC	<5.4 years	AEDC and SA Birth Registry. Age as at 01/06 of the year the AEDC was recorded
	5.4–5.8 years	
	5.8–6.2 years	
	>6.2 years	
Baby gestation	<37 weeks / 37+ weeks	SA Perinatal Statistics Collection.
Special Health Care Needs	Yes / No	AEDC. Teacher knowledge of a developmental, physical or mental disorder diagnosis
Child speaks English as a second language	Yes / No	AEDC.
Mother attributes		
Mother's age at the child's birth	<21 years/21+ years	SA Birth Registry.
Mother's occupation status at child's birth	Employed / Not employed or unknown	SA Birth Registry and Perinatal Statistics Collection.
Mother smoking status - during pregnancy	Yes / No	SA Perinatal Statistics collection. Smoking status may be undisclosed due to shame, thus missing data was treated as a Yes
Mother's marital status at child's birth	Married or defacto / or not	SA Perinatal Statistics collection. If missing, checked for a recorded marriage date in SA Birth records
Area-based attributes		
Area based socioeconomic status	1st / 2nd / 3rd / 4th / 5th quintile	Birth Registry or AEDC. Using Socio-Economic Index for Areas (SEIFA) of residential location - 1st quintile lowest SES, 5th highest
Rurality of residence	Rural or Remote Yes/No	Birth Registry. Residential location classified according to Australian Statistical Geography Standard (ASGS) Edition 3
Child maltreatment exposure		
Child's age at first CPS notification	<8 months /18 months to 3 years / 3+ years	Child Protection. Based on child's age and date of first maltreatment notification recorded
Physical abuse*	Yes / No	Child Protection. Based on all records of substantiated maltreatment before the AEDC
Emotional abuse*	Yes/No	Child Protection. Based on all records of substantiated maltreatment before the AEDC
Sexual abuse*	Yes/No	Child Protection. Based on all records of substantiated maltreatment before the AEDC
Neglect*	Yes/No	Child Protection. Based on all records of substantiated maltreatment before the AEDC
Maltreatment severity	Tier 1 Yes/No	Child Protection. Based on highest level of urgency on any notification before AEDC. Tier 1 most urgent, must be investigated <24 h, Tier 2 must be investigated <72 h, Tier 3 less urgent

* A child can have more than one type of abuse substantiated within the one substantiation, or across multiple substantiations.

the developmental psychopathology framework (Toth & Cicchetti, 2013). The covariates covered child attributes, maternal attributes (at child’s birth), area-based socioeconomic status, rurality designations and child maltreatment exposure characteristics. See Table 1.

2.3. Statistical analyses

2.3.1. Descriptive analysis

The mean percentage of children who were developmentally vulnerable on each of the five domains were described for each of the five mutually exclusive levels of child protection involvement recorded prior to the AEDC: children with no CPS contact (*no CPS*), children with one or more notification(s) none of which proceeded to investigation (*Not. only*), children who had been the subject of investigation(s) but never substantiated CM (*Inv. only*), children with substantiated CM who had never entered OoHC (*Sub. only*), and

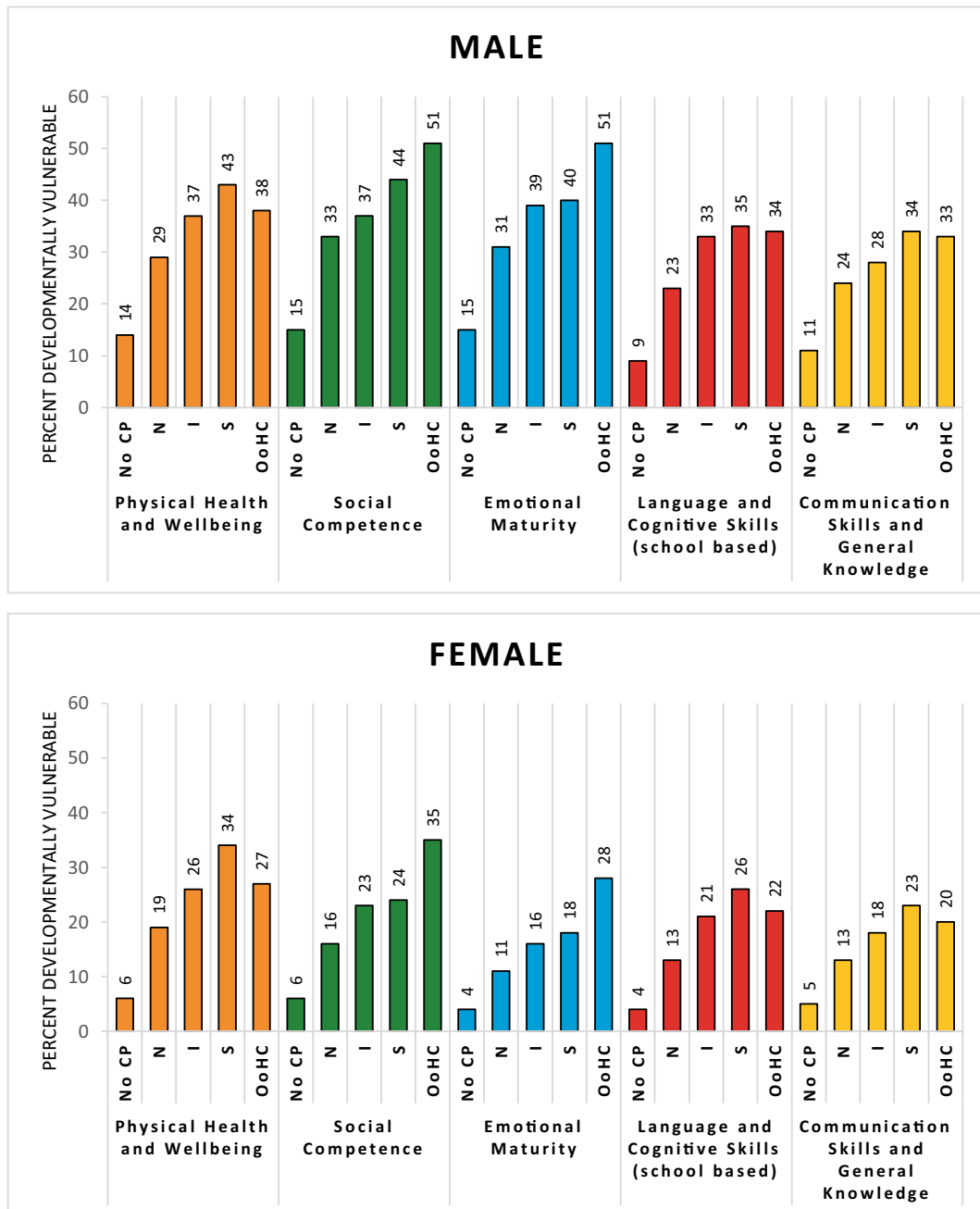


Fig. 2. Percentage of children vulnerable on each AEDC domain sorted by gender and CP contact level.

children with substantiated CM who had been placed in OoHC (OoHC). This descriptive analysis provided context for the exploration of developmental vulnerability in children with the more serious child safety concerns and was reported by sex.

Attributes of children with substantiated CM were described for the OoHC group and the never OoHC cohort. Each attribute was compared between the OoHC group and never OoHC group using a two-tailed *t*-test.

2.3.2. Propensity score calculation

Propensity scores were calculated for inclusion in the adjusted analyses to reduce bias in estimating treatment effects (Rosenbaum & Rubin, 1983; Vansteelandt & Daniel, 2014). Domain specific propensity scores were calculated using logistic regression with module “psmatch2” for Stata 18.0 (Leuven & Sianesi, 2003; StataCorp., 2023). Attributes associated with poor early childhood development and CM/CPS involvement were used to calculate the propensity score (Armfield, Gnanamanickam, et al., 2021; Doidge et al., 2017; Evans et al., 2013; Gnanamanickam et al., 2022; Obradović et al., 2012) and include all variables listed in Table 1.

2.3.3. Regression analysis

The relative risk of developmental vulnerability across each AEDC domain comparing the OoHC group and never OoHC group was derived using separate generalized linear models using a modified Poisson regression with robust error variance (Zou, 2004). To reduce the impact of unmeasured confounders, multiple variable models included all covariates used to calculate the propensity score as well as the propensity score itself. Statistical analyses were performed using Stata 18.0 (StataCorp., 2023). Regression results from the adjusted and unadjusted models are presented. *P*-values of <0.05 and non-overlapping confidence intervals were used to ascertain statistical significance.

3. Results

3.1. Descriptives

3.1.1. Child protection contact and child development

Across every domain, children known to CPS were more likely to be developmentally vulnerable than children with no CPS contact,

Table 2
Group characteristics.

Variables	All substantiated CM		<i>p</i> -value
	S only (%) n = 1345	S + OoHC (%) n = 666	
Sex, male*	51.1	50.0	0.85
Age at AEDC			
- <5.4 years	20.7	21.5	0.36
- 5.4 - 5.8 years	40.5	36.8	–
- 5.8 - 6.2 years	33.2	34.8	–
- >6.2 years	5.7	6.9	–
Preterm birth	18.7	24.2	<0.01
Special Health Care Need	12.0	18.0	<0.01
Child ESL	12.2	9.6	0.09
Maternal age < 21	21.0	23.4	0.39
Mother not employed	80.6	90.2	<0.01
Maternal smoking	62.8	76.4	<0.01
Mother not married/defacto	41.2	53	<0.01
SEIFA quintile			
- 1 Most disadvantaged	55.6	60.2	0.36
- 2	24.4	21.5	–
- 3	9.6	9.0	–
- 4	6.9	6.6	–
- 5 Least disadvantaged	3.5	2.7	–
Residence area			
- Major cities	57.0	61.6	0.07
- Regional/outer regional	35.9	33.5	–
- Remote or very remote	7.1	5.0	–
Age at first notification			
- 0-18 m	69.7	84.1	<0.01
- 18 m-3y	16.5	12.2	–
- >3y	13.8	3.8	–
Substantiation type			
- physical abuse	23.4	28.8	0.01
- emotional abuse	46.8	35.6	<0.01
- sexual abuse	5.9	6.5	0.65
- neglect	42.4	69.8	<0.01
Highest urgency tier	30.9	55.1	<0.01

noting children with substantiated CM, whether removed to OoHC or not, had the highest rates of developmental vulnerability (Fig. 2). For example, 43 % of boys with substantiated CM only and 38 % with substantiated CM and OoHC, were developmentally vulnerable on the Physical Health and Wellbeing domain, compared to 14 % of boys with no CPS contact. On Social Competence and Emotional Maturity, 40 %–44 % of boys with substantiated CM only and 51 % of boys with CM and OoHC, were developmentally vulnerable, compared with 15 % (on both) for boys with no CPS contact. We found similar differences for girls, although overall, a smaller proportion of girls were developmentally vulnerable across all domains.

3.1.2. Cohort attributes

Key attributes of children/families with substantiated CM are reported in Table 2, for all children $N = 2011$.

In the cohort of all children with substantiated CM, those entering care were significantly different on 9 of 14 characteristics compared to children not entering care. Largest differences between children entering care versus not entering care were 'having a special health care need' (18 % vs 12 %), receipt of first CM report before 18 months of age (84.1 % vs 68.7 %), substantiation for neglect (69.8 % vs 42.4 %), and being the subject of at least one notification rated at highest urgency (55.1 % vs 30.9 %).

3.2. Regression analyses

The unadjusted and adjusted risks of being developmentally vulnerable are reported in Table 3. The adjusted risk of being developmentally vulnerable for children in the OoHC group compared with children who had not entered care were significantly lower (i.e., less likely to be developmentally vulnerable) on three domains - Physical Health and Wellbeing (aRR = 0.73, 95 % CI [0.64, 0.84]), Language and Cognitive Skills (school based) (aRR = 0.79, 95 % CI [0.68, 0.92]), and Communication Skills and General Knowledge (aRR = 0.81, 95 % CI [0.70, 0.94]). Conversely, children in OoHC had significantly higher risks of being developmentally vulnerable on the Emotional Maturity (aRR = 1.20, 95 % CI [1.05, 1.37]) and Social Competence (aRR = 1.14, 95 % CI [1.01, 1.29]) domains.

4. Discussion

This study found that children with substantiated child maltreatment who had entered OoHC had considerably lower risk of developmental vulnerability in the first year of full-time schooling on Physical health and wellbeing, Language and cognitive skills (school based) and Communication skills and general knowledge domains, but higher risk of being developmentally vulnerable on Social competence and Emotional maturity domains than children with substantiated child maltreatment who had not been removed, after adjusting for a range of child, maternal and family factors and level of child protection concern. These results are consistent with findings based on an indirect comparison against children with no CPS contact (Rossen et al., 2019).

Our study might help explain previous work with contradictory findings regarding the impact of OoHC. First, the potential for selection bias is clear. The prevalence of many attributes in our study cohort, even when restricted to children with substantiated CM, differ between children who do and do not enter OoHC. A 2016 systematic review of OoHC and social and health outcomes (Maclean et al., 2016) found just 3 of 31 studies were of acceptable quality in addressing potential selection bias. The studies in the review found some evidence of worse outcomes for children who had been in OoHC in outcomes related to problematic social and emotional adjustment such as criminal justice involvement, substance use, and running away. While studies reporting on outcomes related to language and cognition, education, employment, mental health and behavior and daily living skills either found no difference or better outcomes for children in OoHC.

A meta-analysis by Goemans and colleagues found no significant differences in cognitive, adaptive and behavioral development outcomes in children (aged 2–18) entering foster care and children at risk who remain at home (2016). The authors suggest this could

Table 3

Vulnerability on the Five Domains of the AEDC – children placed in OoHC vs children with Substantiated CM and no OoHC Unadjusted and Adjusted Risk Ratio's (and 95 % CI's).

AEDC domain ^b	All substantiated CM n = 2011			
	Unadjusted		Adjusted ^a	
	RR	95 % CI	RR	95 % CI
Physical Health and Wellbeing	0.86*	[0.76, 0.98]	0.73*	[0.64, 0.84]
Social competence	1.28*	[1.14, 1.43]	1.14*	[1.01, 1.29]
Emotional maturity	1.35*	[1.20, 1.53]	1.20*	[1.05, 1.37]
Language and cognitive skills (school based)	0.94	[0.81, 1.08]	0.79*	[0.68, 0.92]
Communication skills and general knowledge	0.95	[0.82, 1.11]	0.81*	[0.70, 0.94]

RR = Risk Ratio. CI = Confidence Interval. AEDC = Australian Early Development Census. SEIFA Socio-economic index for areas.

^a Adjusted for Child attributes - sex, age at AEDC, gestation <37wks, special health care needs, English as a second language; Mother's attributes at the time of the child's birth - employment status, marital status, smoking status, age; Family/household attributes - rurality of residential location, residential quintile SEIFA Index; Child abuse attributes - age at first notification, maltreatment type, urgency tier; and Propensity score.

^b See table A.4 for a full description of developmentally vulnerable for each of the domains.

* $p < 0.05$.

be positive; that the supportive care environment of OoHC may ameliorate expected developmental difficulties from children's adverse experiences before entering care.

That OoHC may have differential effects across developmental domains is plausible. OoHC may provide a home in which the child's basic needs can be better attended to, in a more enriching environment. Encompassing providing for better nutrition, access to health care (including for special needs), quality sleep, access to books/being read to/engagement in conversation- all aspects pertinent to physical development and enhancing literacy and cognitive skills (Kalb & van Ours, 2014). Noting for example, the Physical Health and Wellbeing domain in the AEDC covers not just motor skills but also whether the child arrives at school hungry, clothed for the weather, or sleep deprived. Studies report children in OoHC tend to have lower rates of absenteeism and chronic truancy (Maclean et al., 2018) and likely greater participation in early childhood education, further supporting aspects of child development.

Children in OoHC may be developmentally benefiting from an increase in financial resources. In the USA foster care children were less likely to live in poverty than children in contact with child protection services not in care (Pac et al., 2017). In SA, payments to foster/kinship carers in 2024 were AU\$529/fortnight (US\$345) for a child aged <5 years (more for older children), with additional loadings for children with special needs. Payments or resources available to foster/kinship carers and residential care homes to support the child's needs, not available to birth families, may be a factor worthy of future investigation and policy discussions.

Indeed the current study results could in part reflect services being allocated to children in OoHC preferentially relative to children who remained at home, as was found by Ringeisen et al. (2009). Noting the better outcomes for children in care in the physical, cognitive and communication domains of child development, children with substantiated CM who remained at home require better access to early intervention services and intensive therapeutic family support services to increase the likelihood of being developmentally on track.

The finding that children placed in OoHC had higher risk of developmental vulnerability on social competence and emotional maturity domains compared to children who remained at home is of concern. This is consistent with the finding by Rosen and colleagues (2019), and with extensive literature that finds children who enter OoHC are more likely to experience poor mental health, problematic substance use, self-harming behaviors, and death from suicide and substance use during adolescence and into adulthood (Gnanamanickam et al., 2022; Gnanamanickam et al., 2023; Green et al., 2019; Segal et al., 2021). While it has been theorized that these findings primarily reflect the adversities and trauma experienced by these children before entering care (Rossen et al., 2019), the current study suggests that for some children, removal from birth family into care could represent an added trauma, and a new experience of abandonment (Look, 2018). Furthermore, maltreated children may struggle to form a trusting relationship with a new caregiver, reflecting the effects of a disturbed parent-child relationship in the early years, resulting in a disorganized attachment style (Main & Solomon, 1990), hypervigilance, over-alertness to threat, and damaged sense of self (Amos & Segal, 2019). A UK study found significantly higher odds of children in OoHC having reactive attachment disorder compared to maltreated children who had never been in care (Baldwin et al., 2019). Removal may exacerbate insecure attachment behaviors and patterns children utilize for need fulfillment (Main & Solomon, 1990). Placement instability (common for children with high needs or challenging behaviors) could further disrupt emotional and social development (Rubin et al., 2007; Toth & Cicchetti, 2013). Children placed in care may lose connection to wider family networks and their own cultural heritage, especially where maintaining 'best connection' with birth family is not prioritized.

The analysis by sex highlights the developmental vulnerability of boys relative to girls across all domains, with developmental vulnerability increasing with higher child protection involvement. These disturbing findings are consistent with research showing maltreated boys had fewer strengths and less resilience than girls (Armfield, Ey, et al., 2021). With boys experiencing worse educational outcomes and higher rates of criminal justice involvement, the AEDC may reflect a genuine and troubling vulnerability among boys, that spans multiple developmental domains and is not quickly outgrown. Addressing this is vital given the common pathway of intergenerational transmission of maltreatment and disadvantage (Armfield, Gnanamanickam, et al., 2021). Ensuring the teaching environment and activities suit the learning styles of different students and support children to learn self-regulatory behaviors may also help boys gain more from their schooling (Cigman, 2017; Walker & Berthelsen, 2017).

4.1. Strengths and limitations

Strengths of this study include the number of participants and the use of high quality, comprehensive administrative data. The Canadian version of the AEDC has been validated for children with special healthcare needs (Janus et al., 2019). As they account for 18% of children in care, their inclusion in the current study enabled a more complete understanding of the consequences of maltreatment and OoHC than previous research. Examining developmental outcomes for each of five distinct developmental domains added value, allowing for different outcomes to be identified for different domains. We have used a range of measures of family risk and child protection concern, in addition to propensity score to adjust for likely variation in risk between the OoHC group and those never removed. In particular the use of 'urgency tier' – a DCP measure of seriousness of child protection concern, (and associated with profound family dysfunction), will minimize the potential impact of unmeasured confounders. That said, we do acknowledge that it is still possible that unmeasured confounders have impacted the results (Berger et al., 2009).

There are several areas for future research suggested by our study. For example, it would be of interest to include information on access to services prior to school commencement, such as intensive family support, or specialist therapeutic services to address child development deficits. The inclusion of family risk factors not available in this study (such as parental mental health, substance use, and criminality) could further reduce the risk of selection bias. Also, investigating mechanisms and causes of higher early childhood developmental vulnerability for maltreated boys may shed light on gaps in current service delivery and policies.

5. Conclusion

In conclusion, removal of children exposed to substantiated child maltreatment to OoHC, in and of itself, while supporting some aspects of the child's development, may exacerbate others. Greater attention on ensuring the social and emotional wellbeing in this highly traumatized group of children is critically needed, to mitigate the risk of later childhood psychopathology and ill-health. It is also the case that children who remain at home need support, especially in the physical, cognitive and communication development domains. The anomalous financial situation – whereby removed children attract considerable funding, not available to children remaining with birth families might also warrant attention.

Mean results don't tell the full story. It is certain some children will have done better in care, and others worse. The current study highlights the need for future research to investigate in more depth the nature of the OoHC experience (e.g., timing of entry to care, type of care) and type of CM exposure to better understand how they moderate the impact of OoHC on each child developmental domain.

Considering these findings, children with CM history entering care need professional therapeutic support to address social and emotional developmental vulnerability. It cannot be expected that foster, kinship, or residential care will, without professional support, resolve deep-seated serious early life trauma. There is also evidence for a broadening of the scope of mandatory health and development screening in conjunction with adequate funding of high-quality support services to include any child who has experienced maltreatment, regardless of current living situation.

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CRedit authorship contribution statement

Krystal Lanais: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Emmanuel Gnanamanickam:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Miriam Maclean:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Conceptualization. **Leonie Segal:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization.

Declaration of competing interest

The other authors have no conflicts of interest to disclose.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary data

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