



Child maltreatment and emergency department visits: a longitudinal birth cohort study from infancy to early adulthood

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ABSTRACT

Background: Child maltreatment (CM) is a serious global public health issue, with documented impacts on health.

Objective: To examine the association between different levels of CM concern, and Emergency Department (ED) visits from infancy to early adulthood.

Participants and setting: Individuals born in Adelaide, South Australia from January 1986 to June 2017 ($N = 443,754$).

Methods: Using linked administrative data, we examined frequency and adjusted rate ratios for all-cause and cause specific ED visits among individuals with varying levels of CM concern.

Results: Cumulative mean ED visits to age 14.5 years were higher for individuals with any CM concern, ranging from 10.2 to 14.8, compared with 6.4 in persons with no recorded CM concern. Adjusted rate ratios for ED visits varied from 1.26 (95% CI: 1.23–1.30) to 1.54 (1.48–1.60) in children (birth to 12 years), 1.98 (CI: 1.92–2.04) to 4.34 (CI: 4.09–4.60) in adolescence and 2.22 (CI: 2.14–3.48) to 3.48 (3.27–3.72) in young adults, increasing with severity of maltreatment concerns. ED visits coded as self-harm or poisoning, injuries, substance use or mental illness were particularly high, with incidence rate ratios mostly 3 to 15 times for mental health/substance related visits and 1.5 to 3.2 for other accidents or injury for individuals with any CM concern versus none.

Conclusions: The high rate ratios for ED visits in children with CM concern, especially for self-harm, substance use and mental health during adolescence and adulthood highlights the enduring mental health needs of victims of child maltreatment, providing further impetus for prevention.

There is strong evidence for serious, immediate, and long-term health consequences of child abuse and neglect (Gilbert, McEwan, Bellew, Mills, & Gale, 2009; Lim et al., 2012; Maniglio, 2009; Widom, 2014). Child maltreatment (CM) increases risk for wide-range of

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mental and physical health conditions (Fryers & Brugha, 2013). Neurological and other scientific research has identified harmful changes to the developing brain and other physiological systems (Child Welfare Information Gateway, 2015; Shonkoff, Boyce, & McEwen, 2009). The damage to the brain and associated behavioural and emotional ramifications, together with the direct impact of sexual and physical assault or of profound neglect are postulated to result in, greater need for and use of health care services during childhood and into adulthood in individuals exposed to CM.

However, research on the impact of CM on healthcare is limited (Brown, Fang, & Florence, 2011). Examinations of the relationship between child maltreatment and health service use is largely restricted to children involved in the child protection system (CPS) alone with limited population level comparisons with children in the community (Karatekin, Almy, Mason, Borowsky, & Barnes, 2018). The Population level comparisons are necessary to ascertain differences in service use between individuals with and without exposure to CM.

Emergency department (ED) visits play an important role in the healthcare of children and adults irrespective of the age group, demographical differences and disease groups (Alpern et al., 2006). Concurrently, EDs are often under considerable pressure reflecting capacity constraints to meet the more urgent needs of presenting individuals in a timely fashion (Hoot & Aronsky, 2008). However, much of the problems of ED crowding and therefore the solutions lie outside the ED system (Morley, Unwin, Peterson, Stankovich, & Kinsman, 2018). Knowing more about the underlying source of ED visits, which groups are more likely to visit and what this might mean for prevention, thus becomes an important area of study.

As detailed earlier, individuals with child maltreatment history are potentially high users of health care services including ED facilities. However, little is known about the nature and extent of these ED visits, or reasons for visiting, indeed there are few studies that examine the relationship between ED utilization in adulthood and childhood adversity (Binnie, Le Brocq, Jessup, & Johnston, 2021). We identified only 17 publications (8 since 2010), including two reviews that compare emergency visits among individuals who experienced maltreatment with those who did not report or did not have a record of maltreatment (see Appendix list A for full list of citations). Most of these studies report higher ED visits among maltreated groups, with a few reporting no differences in ED visits compared to non-maltreated comparison groups (Rhodes et al., 2012).

Fourteen of the 17 studies were in selected populations (such as Medicaid enrolled, incarcerated, and foster care children and various matched controls) with relatively small study populations. Hence, drawing inferences on differential ED visits at the whole of population level is problematic, as, these studies did not have general community or population based comparison groups.

We identified just three studies that were population-based, enabling population risk estimates to be calculated. Two studies used self-report in a community sample - one of caregivers of 6492, 0–17 year olds (Carr et al., 2020) and the other 9953 individuals aged 15 years and over (Chartier, Walker, & Naimark, 2007). Both studies looked at just one-year of self-report data for ED attendance. Self-report is problematic. It is highly susceptible to recall error and for CM socially unfavourable response bias and influenced of local community norms. The third population based study was of 201,866 children born in 2007 and followed up to 5 years of age (Wang, Wu, Chang, & Lu, 2019). This study used administrative data and defined child maltreatment based on child maltreatment-related International Classification of Diseases (ICD) coded diagnosis (995.5x or E960–E969) in hospital claims data.

There is thus an absence of large population-level studies examining ED visits in total or by reason, from birth through adolescence and into early adulthood for persons with child maltreatment exposure (or CPS contact), a critical gap in understating the long-term impact of child maltreatment, failing to show impact across the life course. While some studies considered specific types of abuse, none considered whether severity of CM exposure/seriousness of concern were associated with differential ED visit rates. Only one study (Rhodes et al., 2012) compared ED visit rates by reasons for ED presentations, but in a foster care population.

The evidence thus far suggests higher ED visits among individuals with maltreatment exposure. However, studies from which to estimate robust risk ratios for ED visits for persons with and without child maltreatment exposure, across a wide age range and levels of child maltreatment exposure and examining specific reasons for ED visits are lacking.

This study aims to examine the extent of all-cause and cause-specific ED visits in a population birth cohort spanning infancy to early adulthood (32 years), comparing individuals with a history or high suspicion of child maltreatment (indicated by levels of child protection system (CPS) involvement) to those with no recorded child maltreatment history.

1. Methods

1.1. Study design and setting

This study uses data from the impacts of Child Abuse and Neglect (iCAN) project, a birth cohort study using administrative data of all children born in the state of South Australia (SA), Australia from 1 January 1986 to 30 June 2017, detailed elsewhere (Segal et al., 2019).

Briefly, the iCAN study is a multi-agency study that links together de-identified administrative data from data providers in SA. Of relevance to this study are the data provided through the Department for Health and Wellbeing (ED visits, hospitalizations and perinatal data), Registration Branch of Consumer and Business Services (birth and death registration data) and the Department for Child Protection (See Appendix Table A1 for details). De-identified data linkage was facilitated by SA-NT DataLink, an accredited independent data linkage organization that uses a multi-stage linkage process drawing on identifiable data from over 50 datasets (Schneider, Radbone, Vasquez, Palfy, & Stanley, 2019).

ED data are available from 1 July 2003 to 31 December 2017 for metropolitan EDs, but availability of data for regional EDs is staggered from 2011. Hence, the study cohort for all analysis is restricted to those born in the Adelaide metropolitan region of South Australia ($N = 443,754$). However, all ED visits (to both metropolitan and regional EDs) are reported for this cohort.

A sub-cohort of individuals born from 1 July 2003, for whom ED data is available from birth, was used for calculating lifetime ED visits (to maximum age of 14.5 years). For this group, we estimated cumulative incidence (incidence probability) and mean cumulative count of ED visits from birth to 14.5 years (or to age at 31 December 2017).

1.2. Measures

1.2.1. Exposure variable

The exposure variables of interest was child maltreatment, defined based on records of contacts with the SA Department for Child Protection (DCP). Drawing on DCP risk assessments, individuals were categorized into one of eight mutually exclusive groups of CPS involvement based on lifetime (up to age 18 years or 30 June 2017) involvement, indicating differing risk of child maltreatment ranging from low and moderate risk to confirmed maltreatment and placement in out-of-home-care (OOHC). The eight categories were (See Appendix Table A2),

1. No CPS involvement (No CPS),
2. Notification to the CPS of Notifier only Concern (NOC Only),
3. Notifications other than those classified as a child protection matters (Screened-out notif.),
4. Notifications that are Screened-in - Child protection matter but did not proceed to investigation (CPM),
5. Notifications that are investigated but not substantiated (Investig. only),
6. Substantiated investigation but not placed in OOHC (subst. only),
7. Child ever-placed in OOHC with substantiations (OOHC + subst.), and
8. Child ever-placed in OOHC but no substantiation history (OOHC, no subst.).

Detailed descriptions of the child protection categories are reported elsewhere (Armfield et al., 2020; Gnanamanickam et al., 2020).

1.2.2. Outcome variable and covariates

The reporting of ED visits and selection of covariates were guided by the Andersen's model of healthcare use (Andersen, 1995; Andersen, Davidson, & Baumeister, 2013). This framework emphasises both the contextual as well as individual determinants of health care use, namely predisposing factors, enabling factors and need factors. Predisposing factors include demographic (e.g., Sex and age), social (e.g., education, occupation and ethnicity), and health beliefs. Enabling resources concern factors that influence service access (such as individual and institutional financing arrangements) and physical access and mediate translation of need into demand or service use. Need is identified as a combination of perceived (by the individual) and as evaluated (by clinicians).

All ED visits and ED visits by selected reasons most likely related to CM, based on theoretical and empirical studies were examined (Segal et al., 2021; Segal et al., 2021; Shonkoff, 2012). For ED visits by reason, each ED visit was categorized into one of six mutually-exclusive CM-related categories, namely, 'Child maltreatment or other family violence', 'Rape and seduction', 'Self-harm and Poisoning', 'Injury and accidents', 'Alcohol and substance abuse', and 'Mental health' (Appendix Table A3). These groupings were based primarily on major diagnostic blocks, which are groupings of each ED visit, based on the ED diagnosis, into one of 26 categories (see Appendix Table A4). Where major diagnostic blocks include two or more of the above categories the individual ICD diagnosis codes were used.

Age at ED visit was categorized into five age groups for annualized ED visits; 0–5 years of age (pre-school years), 6–12 years of age (middle childhood), 13–17 years of age (adolescence), 18–24 years of age (youth) and 25+ (early adulthood), following Australian and international recommendations (Clark, Locke, & Bialocerkowski, 2015; National Center for Biomedical Ontology, 2013; Williams et al., 2012). These were simplified into three categories (0–12, 13–17, and 18+ years) for examining reasons for ED visits.

Selected cohort attributes and maternal characteristics (at the time of the individual's birth) were included to adjust for confounding, based on their theoretical and, or empirical associations with both child maltreatment and ED visits and in Alignment with the Andersen's model of health service use (Andersen, 1995; Andersen et al., 2013). We adjusted for 'predisposing factors' such as sex and occupation (using mother's occupation as a proxy), 'enabling and impeding factors' such as family characteristics, in this case other maternal factors as well as socio-economic status, and 'need factors' that included birth outcomes apart from child maltreatment itself. Many of these factors have previously been associated with child maltreatment (Doidge, Higgins, Delfabbro, & Segal, 2017; Landers, Carrese, & Spath, 2019; Walsh, McCartney, Smith, & Armour, 2019; Wu et al., 2004).

Covariates included in the analysis as potential confounders were sex recorded at birth; socio-economic status (SES) determined using the area-based Index for Relative Socio-Economic Disadvantage based on place of residence at the time of the child's birth (Australian Bureau of Statistics, 2018), and categorized into five quintiles based on published Australian population cut-offs. Birth characteristics included in the analyses were gestational age (<37 weeks or ≥37 weeks), baby weight (<2.5 kg or ≥ 2.5 kg), baby still in hospital at 28 days post birth (yes or no), a composite indicator of early life complications and congenital abnormalities. Presence of any complex chronic condition (yes or no) based on the coded diagnoses of any hospitalizations the individual had during the period of the study was another covariate (Feudtner, Feinstein, Zhong, Hall, & Dai, 2014).

Maternal characteristics included as covariates were smoking status (smoker or non-smoker), maternal age (<21 years or ≥21 years), employment status (employed or not employed), and marital status (married/de facto or not married/de facto) all reported at birth of the child. Missing values for these maternal and birth variables were assigned to a third category as 'unknown or unstated'.

1.3. Analyses

Mean cumulative count of ED visits was estimated up to 14.5 years of age for the sub-cohort born from 1 July 2003 censoring at death or 31 December 2017 (Armstrong et al., 2015). All remaining analyses used the full study cohort, i.e., those born in the Adelaide

Table 1

Selected characteristics of full birth cohort and sub-cohort (with ED visit data from birth) by child protection system involvement.

No CPS ^a	NOC only ^b	Screened-out notif. ^c	CPM ^d	Investig. only	Subst. only ^c	OOHC + subst. ^c	OOHC, no Subst. ^c	Total
Full cohort (born from 1 January 1986)								
Persons (n)	358,011	29,037	11,581	14,171	13,381	10,301	5260	443,754
Male (%)	51.44	51.55	40.01	51.39	49.47	47.99	52.59	51.03
Age (in years on 31 Dec 2017) (mean)	15.94	14.51	18.18	14.88	19.46	18.52	16.51	16.08
Socio-economic status at birth								
Most disadvantaged quintile (%)	25.22	40.86	39.13	44.86	46.61	49.50	59.77	28.98
Least disadvantaged quintile (%)	20.67	10.20	12.60	9.04	9.18	7.54	4.09	18.49
In hospital ≥ 28 days after birth (%)	1.79	2.43	2.18	2.58	3.28	3.73	6.12	2.03
Gestation <37 weeks (%)	9.42	9.38	8.97	9.99	9.98	11.76	16.58	9.64
Birth weight < 2.5 Kg (%)	7.76	7.92	7.39	8.41	9.98	10.91	16.24	8.05
At least 1 complex chronic condition (%)	3.12	4.87	4.84	4.82	5.49	6.01	8.12	3.55
Maternal smoking status—smoker (%)	7.35	26.35	33.00	43.45	23.75	22.56	16.35	11.10
Maternal age at birth <21 years (%)	3.80	13.79	12.52	14.97	21.78	22.89	28.42	6.41
Maternal employment status—not employed (%)	23.49	43.69	39.50	50.20	49.34	55.20	69.45	28.27
Maternal marital status—not married/de facto (%)	8.31	23.61	22.73	26.08	33.71	37.71	51.08	12.39
Sub-cohort with ED visit data from birth (born from 1 July 2003)								
Persons (n)	167,087	15,172	3256	7036	3885	3474	2256	202,471
Male (%)	50.97	51.56	47.48	51.76	48.73	50.12	52.08	50.94
Age (in years on 31 Dec 2017) (mean)	6.96	8.47	7.67	8.82	9.30	8.82	7.91	7.24
Socio-economic status at birth								
Most disadvantaged quintile (%)	26.22	42.33	44.99	47.70	47.54	51.18	63.21	29.78
Least disadvantaged quintile (%)	17.75	8.78	8.38	6.71	6.20	4.66	2.84	15.90
In hospital at 28 days after birth (%)	1.73	2.52	2.24	2.67	3.81	5.07	7.85	2.01
Gestation <37 weeks (%)	11.91	10.49	12.22	11.27	12.90	14.62	19.77	11.95
Birth weight < 2.5 Kg (%)	10.01	8.73	9.95	9.34	11.30	12.87	18.22	10.06
At least 1 complex chronic condition (%)	3.73	5.46	5.28	5.51	7.13	7.66	10.42	4.17
Maternal smoking status—smoker (%)	9.89	34.16	35.14	37.98	47.98	54.66	68.75	15.33
Maternal age at birth <21 years (%)	2.74	13.08	14.86	14.23	20.93	21.19	25.66	5.06
Maternal employment status—not employed (%)	26.40	46.41	54.42	54.39	64.14	71.21	81.65	31.51
Maternal marital status—not married/de facto (%)	6.51	23.37	27.61	26.45	34.98	40.99	50.84	10.52

^a CPS—child protection system.

^b NoC—Notifier only Concern.

^c Notif.—Notifications, OOHC—Out-of-home care.

^d CPM—Child Protection Matters.

metropolitan region of SA from 1 January 1986 to 30 June 2017. Annualized mean counts of ED visits were calculated for each age group and each CPS category as the sum of ED visits for each individual within the respective age range divided by the number of years the person contributed data in the respective age range.

Crude rate ratios of ED visits for each CPS category, relative to the 'no CPS' group, were calculated for all ED visits for the three broad age groupings. Crude rate ratios were also calculated for five maltreatment-related reasons across the three age groupings. Because of the low number of visits for 'Rape and seduction' and 'self-harm', they were not reported by age groups, instead reported for the entire cohort in Appendix Table A9. Self-harm was also separated from 'Poisoning' and reported in Appendix Table A9 for the cohort as a whole.

We conducted multiple variable analyses to examine the relationship between categories of CPS involvement and the rate of ED visits adjusting for cohort and maternal characteristics using negative binomial regression models. Three separate models were run for three age groups, namely 0–12 years, 13–17 years and 18–32 years. Adjusted incidence rate ratios were generated for each category of CPS involvement compared to the 'no CPS' group.

All statistical analyses were generated using SAS/STAT software, Version 9.4 of the SAS System for Windows (copyright © 2020 SAS Institute Inc.) SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.

1.4. Ethics

Ethics approval for the study was obtained from the SA Health Human Research Ethics Committee (HREC) (HREC14SAH28), and University of South Australia HREC (000032801).

2. Results

The average age of the study cohort on 31 December 2017 was 16.1 years (range 0–32), and for the sub-cohort born from 1 July 2003 the mean age was 7.2 (0–14.5) years (Table 1). Attributes indicative of disadvantage are considerably more common in persons with CPS contact. For example, 25% of persons with no CPS contact are in the most disadvantaged socio-economic quintile compared with 40.9% to 59.8% of persons with CPS involvement. Likewise, 8.3% of persons with no CPS contact have a mother who was not married or in a de-facto relationship at birth compared with 22.7% to 51.1% of person with CPS contact.

2.1. Main results

Mean cumulative count of ED visits from birth to 14.5 years of age is 6.4 for individuals with no CPS involvement, and 10.2–14.8 for

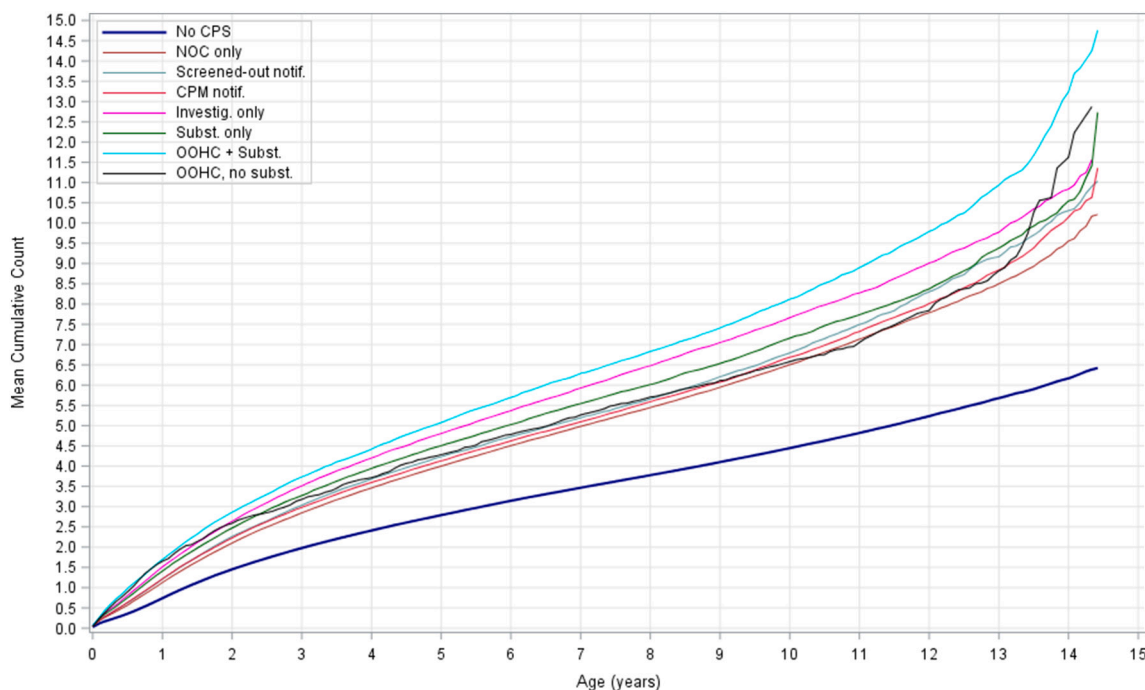


Fig. 1. Cumulative burden (Mean cumulative count) of ED visits by child protection system (CPS) involvement (sub-cohort with ED data from birth, $N = 202,471$).

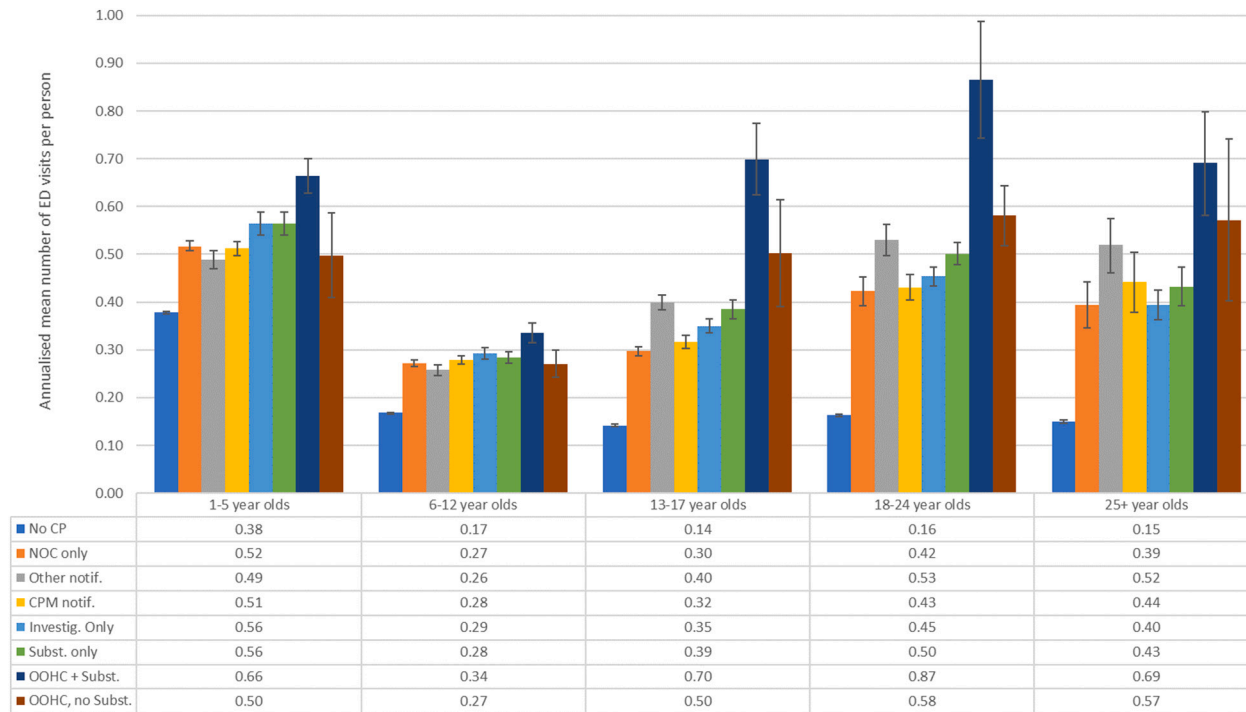


Fig. 2. Annualized mean ED visits (for financial years 2004–2018) by child protection system (CPS) involvement and age groups (full cohort, $N = 443,754$).

individuals with varying CPS involvement (Fig. 1, numeric values in Appendix Table A5). These differences are apparent by one year of age and increase throughout from birth to adolescence. Surviving individuals who were placed in out-of-home care have a steeper increase in average ED visits from 13 years of age compared with individuals with other CPS involvement.

Annualized mean ED visits for the full study cohort show differences across all age ranges between individuals in any CPS involved categories compared to those with no CPS involvement (Fig. 2). In the youngest age group (0–5 years), ED visits are 25–64% higher in children with some CPS contact vs none, 109–392% higher in adolescence, and 162–360% higher in adulthood (ages 18 to 32 years). Adults who in childhood had substantiated maltreatment with time in out-of-home care are most at risk for increased ED visits, with 5.3 times ED visits at ages 18–24 years and 4.6 times ED visits at ages 25–32 years, compared to persons with no CPS involvement.

Crude incidence rate ratios (IRR) show higher ED visit frequency in childhood, adolescence and early adulthood among individuals who were involved in the CPS, irrespective of the level of involvement, when compared to individuals with no CPS involvement (Table 2). After adjustment for potential confounders, IRR for ED visits are still large and significant across all age groups and all CPS categories, varying from 1.24 (95% confidence intervals (CI) 1.15–1.34) to 1.54 (95%CI 1.48–1.60) in childhood (to 12 years), from 1.98 (95% CI 1.92–2.04) to 4.34 (95% CI 4.09–4.60) during adolescence, and 2.22 (2.14–2.3) to 3.48 (95% CI 3.27–3.72) in adulthood. In every age group, highest IRR are observed in the group with a history of substantiation and placed in out-of-home care, 1.54 (95% CI 1.48–1.60) in childhood, 4.34 (95% CI 4.09–4.60) in adolescence and 3.48 (95% CI 3.27–3.72) in adulthood.

For children aged 0–12 years, the rate of ED visits diagnostically coded as child maltreatment, poisonings, injury and accidents, and mental and behavioural disorders are all substantially higher among children with CPS involvement compared to children with no involvement (Table 3). Rates vary from 1.4 (95% CI 1.4–1.5) for injuries in the group with NOC notifications to 96.9 (95% CI 78.2–120.1) for child maltreatment coded visits in individuals placed in out-of-home care with substantiated maltreatment. During adolescence and adulthood, the rates of ED visits for child maltreatment (effects of) and family violence, self-harm and poisonings, alcohol/substance use and mental and behavioural disorders are also substantially higher among individuals with CPS involvement compared with those with no CPS involvement.

Across all age groups, ED visits for mental and behavioral disorders are vastly more common in persons with any CPS involvement compared with none, with IRR ranging from 4.5 (95% CI 3.9–5.1) times to 36.1 (95% CI 29.6–44.1) times in children, 7.3 (95% CI 6.7–8.0) times to 49.0 (95% CI 41.8–57.5) times in adolescence, and 5.7 (95% CI 5.10–6.32) times to 17.5 (95% CI 14.6–21.0) times in adulthood. The IRRs vary by category of CPS involvement but are always largest for OOH with substantiation. ED visits coded as rape and seduction and self-harm are considerably more likely across all CPS categories, relative to none (Appendix Table A9).

3. Discussion

Using linked administrative data for 443,754 individuals, with follow-up of up to 32 years, we compared frequency and reasons for ED visits among children with varying levels of CM concern. The results show significantly more ED visits among individuals with any level of CM compared to those with no reported concern. Significant impacts of child maltreatment remained after adjusting for a range of demographic, health, perinatal, and maternal factors.

We also examined selected reasons for ED visits, using International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) diagnosis codes for child maltreatment, and for five broad reasons, which may be consequences or manifestations of child abuse or neglect. ED visits for all these reasons are quite substantially higher across all levels of CM concern compared to no recorded concerns. This is consistent with studies that find higher rates of mental illness, drug and alcohol abuse, and suicide in persons with CM history (Fryers & Brugha, 2013; Karatekin et al., 2018).

Our study's findings are consistent with existing work, in that the direction of relationship between maltreatment and ED visits is positive (Carr et al., 2020; Chartier et al., 2007; Karatekin et al., 2018; Wang et al., 2019). However, our study shows that the

Table 2

Incidence rate ratios of ED visit frequency by child protection system (CPS) involvement (full cohort).

CPS involvement	0–12 years ^c (n = 376,340)		13–17 years ^d (n = 258,000)		18+ years ^e (n = 194,740)	
	Crude IRR ^a (95% CI)	Adjusted IRR ^{a,b} (95% CI)	Crude IRR ^a (95% CI)	Adjusted IRR ^{a,b} (95% CI)	Crude IRR ^a (95% CI)	Adjusted IRR ^{a,b} (95% CI)
No CPS	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
NOC only	1.43 (1.40–1.45)	1.30 (1.28–1.33)	2.19 (2.13–2.26)	1.98 (1.92–2.04)	2.57 (2.48–2.67)	2.22 (2.14–2.30)
Screened-out notif.	1.24 (1.21–1.27)	1.26 (1.23–1.30)	3.03 (2.92–3.15)	2.85 (1.74–2.96)	3.26 (3.13–3.40)	2.81 (2.69–2.92)
CPM	1.41 (1.38–1.44)	1.29 (1.26–1.32)	2.30 (2.21–2.40)	2.05 (1.97–2.13)	2.69 (2.56–2.82)	2.30 (2.19–2.42)
Investig. only	1.42 (1.39–1.46)	1.40 (1.36–1.43)	2.56 (2.47–2.66)	2.29 (2.21–2.38)	2.78 (2.67–2.88)	2.32 (2.24–2.41)
Subst. only	1.45 (1.41–1.49)	1.36 (1.32–1.40)	2.86 (2.74–2.98)	2.51 (2.41–2.62)	3.00 (2.87–3.13)	2.47 (2.36–2.58)
OOHC + subst.	1.78 (1.72–1.85)	1.54 (1.48–1.60)	5.42 (5.11–5.75)	4.34 (4.09–4.60)	4.84 (4.54–5.17)	3.48 (3.27–3.72)
OOHC, no subst.	1.18 (1.10–1.27)	1.24 (1.15–1.34)	3.53 (3.25–3.83)	2.96 (2.72–3.21)	3.53 (3.26–3.82)	2.64 (2.44–2.86)

CPS—Child protection system, NOC—Notifier only Concern, Notif.—Notifications, OOH—Out-of-home care, CPM—Child Protection Matters.

^a Reference groups for all IRRs are 'no CPS' involvement.

^b Adjusted for demographic, maternal and birth characteristics with an offset for age/period of risk of ED visits.

^c IRRs for all variables in Appendix Table A6.

^d IRRs for all variables in Appendix Table A7.

^e IRRs for all variables in Appendix Table A8.

Table 3

Incidence rate ratios (IRRs) of ED visit frequency for each visit reason by age groups and child protection system (CPS) involvement

CPS involvement	Persons (n)	Visit reasons				
		Child maltreatment	Self-harm and poisoning	Injury and accidents	Alcohol/substance use	Mental health
		IRRs (95% CI)	IRRs (95% CI)	IRRs (95% CI)	IRRs (95% CI)	IRRs (95% CI)
0–12 years		Visits = 899	Visits = 6008	Visits = 124,806	–	Visits = 2047
No CPS	300,132	Ref.*	Ref.	Ref.	–	Ref.
NOC only	27,408	5.6 (4.3–7.3)	2.4 (2.2–2.6)	1.4 (1.4–1.5)	–	4.5 (3.9–5.1)
Screened-out notif.	10,118	6.6 (4.5–9.5)	1.8 (1.6–2.1)	1.4 (1.4–1.5)	–	5.8 (4.7–7.1)
CPM	13,513	8.3 (6.2–11.1)	2.4 (2.2–2.7)	1.5 (1.5–1.5)	–	5.5 (4.7–6.6)
Investig. only	10,778	28.7 (22.8–35.9)	2.5 (2.2–2.8)	1.6 (1.6–1.7)	–	9.6 (8.1–11.5)
Subst. only	8416	42.9 (34.5–53.4)	3.4 (3.0–3.8)	1.6 (1.6–1.7)	–	12.9 (10.7–15.4)
OOHC + subst.	4572	96.9 (78.2–120.1)	4.5 (3.8–5.2)	1.8 (1.7–1.9)	–	36.1 (29.6–44.1)
OOHC, no subst.	1403	28.7 (17.4–17.5)	2.1 (1.4–3.0)	1.4 (1.3–1.6)	–	18.9 (12.5–28.5)
13–17 years		Visits = 506	Visits = 3045	Visits = 49,091	Visits = 2390	Visit = 6454
No CPS	203,257	Ref.	Ref.	Ref.	Ref.	Ref.
NOC only	15,658	6.1 (4.5–8.2)	4.8 (4.2–5.5)	1.8 (1.8–1.9)	3.3 (2.8–3.8)	7.3 (6.7–8.0)
Screened-out notif.	8742	9.9 (7.2–13.5)	12.1 (10.5–13.9)	2.0 (2.0–2.1)	6.3 (5.4–7.3)	15.3 (13.7–17.1)
CPM	8030	7.2 (5.0–10.4)	5.3 (4.5–6.3)	2.0 (1.9–2.1)	3.6 (3.0–4.3)	7.5 (6.6–8.4)
Investig. only	10,018	8.1 (5.9–11.2)	5.7 (4.8–6.6)	1.9 (1.9–2.0)	4.7 (4.1–5.5)	8.7 (7.8–9.8)
Subst. only	7288	14.0 (10.3–19.1)	7.0 (5.9–8.3)	2.1 (2.0–2.2)	6.0 (5.1–7.1)	11.6 (10.2–13.1)
OOHC + subst.	3253	38.8 (28.3–53.4)	33.5 (27.5–40.9)	3.0 (2.8–3.2)	24.1 (20.2–28.9)	49.0 (41.8–57.5)
OOHC, no subst.	1754	22.2 (13.9–35.6)	11.0 (8.1–14.9)	2.3 (2.1–2.5)	8.7 (6.5–11.6)	21.1 (16.8–26.4)
18 years and over		Visits = 725**	Visits = 3947	Visits = 48,793	Visits = 6107	Visits = 9643
No CPS	156,762	Ref.*	Ref.	Ref.	Ref.	Ref.
NOC only	9434	5.1 (3.9–6.7)	3.9 (3.4–4.5)	2.0 (1.9–2.1)	3.0 (2.7–3.4)	5.7 (5.1–6.3)
Screened-out notif.	6518	7.6 (5.8–9.8)	6.7 (5.8–7.7)	2.1 (2.0–2.3)	4.1 (3.6–4.6)	7.8 (6.9–8.8)
CPM	4881	5.1 (3.5–7.5)	4.1 (3.4–4.9)	2.1 (1.9–2.2)	3.5 (3.0–4.0)	5.6 (4.8–6.5)
Investig. only	7794	6.3 (4.9–8.1)	4.1 (3.5–4.7)	2.1 (2.0–2.2)	2.9 (2.6–3.3)	5.4 (4.8–6.0)
Subst. only	5468	7.2 (5.5–9.4)	4.4 (3.7–5.1)	2.2 (2.1–2.3)	3.3 (2.9–3.8)	6.3 (5.6–7.2)
OOHC + subst.	2348	15.6 (11.7–20.9)	10.0 (8.1–12.4)	3.2 (2.9–3.4)	7.0 (5.8–8.3)	17.5 (14.6–21.0)
OOHC, no subst.	1535	11.1 (7.5–16.4)	8.2 (6.4–10.6)	2.5 (2.3–2.7)	3.6 (2.9–4.6)	10.8 (8.6–13.5)

CPS—Child Protection System, NOC—Notifier Only Concern, Notif.—Notifications, OOHC—Out-of-home care, CPM—Child Protection Matters.

* Poisson regression, all others negative binomial regression.

** Includes spouse/partner violence and effects of child maltreatment.

magnitude of relationship is alarmingly larger than previously reported. For instance, the population study examining ED visits up to 5 years of age reported an odds of 2.0 for maltreatment related ED visits, while our study found rate ratios from 5.6 to and up to 96.7 among children 0–12 years. Our study also extends previous work in several important ways; we studied ED utilization over a longer time-period, across childhood and into adulthood, across escalating levels of child maltreatment concern, and examined cause-specific diagnostic reasons for ED visits.

These results are similar to those reported for all-cause hospitalizations in this birth cohort (Gnanamanickam et al., 2020). Our adjusted results across successive age groups further show that the excess rate of ED visits increases in adolescence and adulthood. While these results are from a cohort in Australia, it is very well established that CM has serious detrimental effects on individuals worldwide and there is no reason to believe that emergency health service utilization outcomes in maltreated populations in other jurisdictions would not also be substantially higher. We recognize that access to ED services will vary across jurisdictions. In some health systems, access to ED services is restricted to those with the means to pay, or to individuals covered by employer subsidised insurance systems. There may also be transport or cultural barriers, or simply limited provision of ED services relative to need. As such, not all health care need may translate into service use. This may be a potential barrier for individuals who have CM exposure to accessing ED services that they need. However, our study, being set in Australia in a metropolitan region, with a publicly funded universal health care system, providing good access to ED services regardless of means, describes service use that is expected to closely reflect need.

Additionally, consistent access to primary health care, or the lack of it can impact ED visits. In our study, it is plausible that children with CPS involvement have higher risk of ED visits due to the lack of adequate primary care. This could reflect the role of EDs as an alternative to primary care or inadequate primary care resulting in escalation of conditions necessitating ED visits. In Australia, like ED services, primary care services are highly subsidised (no-gap fee for over 87% of services in SA in 2019–20). As such, our cohort would have had good access to community-based primary care services. An assessment of this intermediary relationship was not possible in this study due to the unavailability of primary care data and is a question for future studies.

The results here provide novel and valuable information on the frequency and nature of ED visits among children, adolescents, and young adults. The high service use in children and young people with maltreatment history suggests a more comprehensive service response is required that seeks to deal with the unresolved trauma and distress that is driving the ED attendances for mental illness and risk-taking behaviors. Our findings highlight the central role of health professionals, including staff in EDs in identifying children at risk of, and experiencing harm, but also in ensuring that these individuals have access to appropriate on-going health care.

Our analyses show that individuals with a history of CPS involvement continue to present to EDs at high rates during adolescence and young adulthood, that is after their CPS involvement may have ended, particularly with drug and alcohol-related harms, poisonings, self-harm, and mental disorders, as well as general injury. The greater number of ED visits among children involved in the CPS starts in infancy and increases into and beyond adolescence. There is clear potential to reduce ED visits in adolescence and adulthood if more effective health and family interventions are delivered starting in childhood. While all societies seek to keep children safe from immediate harm and abuse and neglect, the community response is clearly inadequate, given the high levels of harms indicated in this and related studies around the world. Hence, targeted interventions to address the health needs of children, adolescents and adults are required. The scope of ED or CPS alone is insufficient to meet the needs of vulnerable children; it requires a collaborative approach by the CPS and health and other human services sector (Christian & Schwarz, 2011). Particularly among children who have experienced the extreme levels of concern that lead to removal from birth families, the results identify poor health and high levels of distress that persist well into adulthood. This provides an opportunity—arguably, an imperative—to address the health care needs of this group, both earlier in life and with a more comprehensive response.

There is a call for large population studies including children from varying backgrounds as important for child abuse and neglect research (Stanley & Nigrovic, 2017). Our study meets both of these needs, being based in a large population birth cohort of 443,754 individuals in a diverse metropolitan region, representing 70% of the population of the state of South Australia, Australia. The use of administrative data collected over a long duration provides high quality measurement of CM exposure and supports large-scale studies. Detailed information on the level of CPS involvement, reflecting differing levels of CM risk or concern, allowed for a robust analysis of outcomes by CM exposure.

3.1. Limitations

Our study was limited to persons born in the Adelaide metropolitan region of SA, in order to best align the population with the ED facilities that provided data for the full period for our study, non-metropolitan ED facilities started contributing data to the study in a staggered manner from 2011 onwards. On the other hand, we did not exclude ED visits by our cohort to non-metropolitan facilities. This means that some ED visits by our metro cohort to non-metro EDs before 2011 was not captured in our analysis. The impact of this is likely to be small, noting that non-metropolitan ED facilities account for a very small proportion of ED visits in SA, and there is no reason to expect non-metropolitan ED use to vary across CPS involvement categories.

This study does not take into consideration the temporal relationship between CM and ED visits. CM tends to be chronic in nature interspersed by more acute occurrences that elicit CPS reports and investigations, which can also be interspersed over a period of time. With evidence that reports of child maltreatment are typically starting earlier in life (Segal et al., 2019), and have ongoing consequences after the abuse or neglect has ceased, we propose that using a lifetime approach to examine long-term outcomes is both appropriate and useful. However, further analysis of the temporal relationship between child maltreatment exposure over time and the pattern of outcomes although challenging is warranted. We also recognize that CPS contact may directly impact on health and wellbeing and ED visits, especially periods in OOH, timing of removal (early vs later in life), support for family re-unification, or access to intensive family support services. We did not endeavor to disentangle the effects of CPS contact and CM, an important question for on-going research. Specifically assessing the relationship between other characteristics of CM and CPS involvement such as such as adolescents at risk and ED visits were also beyond the scope of this analysis but are important questions for future research to answer.

In conclusion, individuals with any involvement with the CPS throughout childhood, indicating suspicion of or confirmed child maltreatment exposure, have far higher rates of ED visits during childhood, adolescence, and early adulthood than those who do not. Visits for CM and conditions identified as possible consequences of CM including poisoning, mental and behavioural disorders, and substance abuse are reasons that are substantially more frequent in all age groups for individuals who have been involved with the CPS. The extreme risk ratios for ED visits for self-harm, substance use and mental health during adolescence and adulthood for any CM risk or concern indicates the extent and enduring mental health needs of victims of child maltreatment providing further impetus for prevention as well as adequate services.

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Data sharing

Statutory restrictions and sensitive nature of data prevent sharing of data.

Implications and contribution

Children exposed to child maltreatment have substantially increased risk of ED visits during childhood and early adulthood. Our study findings suggest particularly large impacts on ED visits for mental health related matters, including substance use, with effects increasing in adolescence and early adulthood.

CRedit authorship contribution statement

LS, DSB, DBP and JCD conceived the study and obtained research funding. ESG prepared and analyzed the data, and drafted, reviewed and revised the manuscript. JMA, HN and LS contributed to the preparation of data, analysis design, interpretations of findings and drafting the manuscript. DBP, DSB and JCD contributed to interpretation of findings and revisions to the manuscript. All authors represented by ESG approved the final manuscript as submitted and agree to be accountable for all aspects of the work. ESG, JMA and LS have full access to all the data in the study and verify the integrity and accuracy of the data analysis.

Declaration of competing interest

We declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chiabu.2021.105397>.

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