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TITLE:

The role of pre-existing adversity and child maltreatment on mental health outcomes for children involved in child protection: a population-based data linkage study

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Keywords: child protection, mental health, abuse and neglect, linked data, population

ABSTRACT

Objectives: To determine mental health outcomes for children with a history of child protection system involvement, accounting for pre-existing adversity, and to examine variation in risk across diagnostic groupings and child protection sub-groups.

Design: A longitudinal, population-based record-linkage study.

Participants: All children in Western Australia (WA) with birth records between 1990-2009.

Outcome measures: Mental health diagnoses, mental health contacts, and any mental health event ascertained from ICD codes within WA's Hospital Morbidity Data Collection (HMDC) and Mental Health Information System (MHIS) from birth until 2013.

Results: Compared to children without child protection contact, children with substantiated maltreatment had higher prevalence of mental health events (37.4% versus 5.9%) and diagnoses (20% versus 3.6%). After adjusting for background risks, all maltreatment types were associated with an almost twofold to almost threefold increased hazard for mental health events. Multivariate analysis also showed mental health events were elevated across all child protection groups, ranging from HR:3.54 (95% CI:3.28-3.82) for children who had entered care to HR:2.31 (95% CI:2.18-2.46) for unsubstantiated allegations. Maternal mental health, Aboriginality, young maternal age and living in socially disadvantaged neighbourhoods were all associated with an increased likelihood of mental health events. The increase varied across diagnostic categories, with particularly increased risk for adult personality disorder, and frequent comorbidity of mental health and substance abuse disorders.

Conclusions: Young people who have been involved in the child protection system are at increased risk for mental health events and diagnoses. These findings emphasise the importance of services and supports to improve mental health outcomes in this vulnerable population. Adversities in childhood, along with genetic or environmental vulnerabilities resulting from maternal mental health issues also contribute to young people's mental health outcomes, suggesting a role for broader social supports and early intervention services in addition to targeted mental health programs.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

- Linked population data allows the examination of a sensitive topic such as child maltreatment without the recruitment and sample loss challenges that affect many surveys.
- The longitudinal analysis between mental health diagnoses in the hospital data allowed us to identify the level of increased risk for different mental health problems among subgroups in the child protection system.
- However, data on outpatient mental health services provided by private hospitals, private psychologists/psychiatrists, or managed by general practitioners was not available, therefore this study's estimates of prevalence of mental health events are likely to be underestimates.
- There may also be some under ascertainment of maltreatment types resulting from recording of only one maltreatment type per investigation.

The role of pre-existing adversity and child maltreatment on mental health outcomes for children involved in child protection: a population-based data linkage study

INTRODUCTION

It is established that children who experience child abuse and neglect are at increased risk of poorer mental health outcomes.[1] The National Scientific Council on the Developing Child states that chronic stress to which maltreated children may be exposed, in the absence of consistent and supportive relationships with adult caregivers, has negative impacts on children's developing brain.[2] Furthermore children who experience child abuse and neglect may be exposed to complex and chronic trauma which can result in persistent psychological problems.

There are, however, many factors that increase this risk including the fact that many of these children come from families where parental mental health issues are present. Therefore, there may be genetic and adversity factors that increase the level of vulnerability to poor mental health, in addition to the trauma associated with being a victim of abuse and/or neglect. In fact research has suggested that familial risk factors prior to child maltreatment may be a stronger risk factor for poor mental health outcomes.[3] In order to appropriately support young people involved in child welfare services it is essential that a strong evidence-base regarding the burden of mental health issues, the type of mental health problems and the pre-existing risk that young people are exposed to guides the provision of services to ensure improved outcomes for this group of young people. This is also essential at a time when there is a national focus in Australia on improving the outcomes of young people who have been in out-of-home care and whether out-of-home care experiences reduce the risk of poor mental health outcomes into adulthood.

The challenges in developing a strong evidence-base in this area include:

a) long-term follow-up for children who have been involved in child protection services;
b) accounting for pre-existing adversity for these children prior to their involvement in child protection services;
c) accounting for type of maltreatment, and child protection interventions that may influence mental health outcomes; and
d) having an appropriate comparison group and large enough sample size in the cases to enable valid comparison.

Vinnerljung, Hjern and Lindblad [4] utilised Swedish national register data to overcome some of these challenges, finding that former child welfare clients were five to eight times more likely than peers in the general population to have been hospitalised for serious psychiatric disorders in their teens and four to six times in young adulthood. Even after accounting for parental and socioeconomic factors there was still a three to fourfold increased risk in adolescence and two to threefold in adulthood. The objective of our research was to build on these findings using an Australian population-based cohort of children and linked mental health register and child protection agency data taking into account parental mental health history, sociodemographic factors, level of child protection involvement and type of maltreatment. We could then determine mental health outcomes for children with a history of child protection system involvement, accounting for pre-existing adversity, and examine variation in risk across diagnostic groups and child protection sub-groups.

METHODS

Population and Data Sources

To determine the mental health outcomes for children involved in child protection we conducted a population-based record-linkage study of all children born in Western Australia (WA) between 1990-2009 using de-identified administrative data, resulting in a study sample of 524,534 children. The health data collections utilised were WA's Hospital Morbidity Data Collection (HMDC), Mental Health Information System (MHIS), Midwives Notification System, Birth Register and Mortality Register, linked via the WA Data Linkage System. The HMDC contains information on all hospital discharges (public and private hospitals) with corresponding diagnostic information using the International Classification of Diseases (ICD) recorded for each episode of care for children from 1990-June 2013 and their parents from 1970-June 2013. ICD-8 was used from 1970-1978, ICD-9 from 1979-June 1999, and ICD-10

from July 1999-2013. The MHIS contains information on all mental health-related public and private inpatient discharges and public outpatient contacts for children for the period 1990-June 2013 and parents 1970-2009. It identifies the date of the mental health episode as well as the primary diagnostic code utilising ICD codes as above. The Midwives Notification System and Birth Register were used to identify the birth cohort and contain birth information, including maternal characteristics and infant outcomes for the period 1990-2009.

Mental health diagnostic outcomes were grouped in two ways. The first was a binary indicator of any mental health-related diagnostic code (Yes or No). The second was by type of mental health-related diagnosis, with 7 groups (listed below) which were non-exclusive (therefore for individuals with one or more diagnoses they could be counted in more than one diagnostic group):

1) Organic mental disorder
2) Substance related mental and behavioural disorder
3) Schizophrenia, and psychoses
4) Mood (affective) disorders
5) Stress-related disorders
6) Adult personality disorders
7) Disorders of psychological development or behavioural and emotional disorders with onset usually occurring in childhood and adolescence.

Mental health-related events included hospital contacts or discharges that were mental health-related but did not include a specific mental health diagnosis (for example self-harm injuries or counselling for mental health-related issues). Any mental health event was an inclusive grouping that combined records of mental health contacts/discharges and diagnoses. Each of these groups were included to capture all mental health-related events including those did not reach the threshold of diagnosis.

The Department of Communities child protection records provided data on children's entire history of maltreatment allegations from birth onwards. Allegations consist of reports made to Communities regarding alleged child abuse and neglect. An allegation is substantiated by Communities when following investigation there is reasonable cause to believe the child has been, is being, or is likely to be abused or neglected or otherwise harmed. Following a substantiated allegation, a child could be removed from their family and placed in out-of-home care.

The child protection data were grouped in several ways. The first was grouping all children based on whether they had any substantiated maltreatment allegations versus no substantiated maltreatment. The second was four levels of child protection contact (no allegations, allegations, substantiated allegations, out of home care) where children were included in each level that they had contact and therefore they could be counted more than once across levels (i.e. non-exclusive categories). This grouping is used in Figure 1 to provide overall prevalence aligned with common child protection categories. The third was four mutually exclusive categories based on highest level of child protection involvement used for regression modelling of risk associated with each situation:

1) No allegations (no allegations have been reported);
2) Unsubstantiated allegations (an allegation was reported to Communities but following an investigation the allegation was not substantiated;
3) Substantiated maltreatment allegation (following an investigation the allegation was substantiated); and
4) Out-of-home care (child removed from the home and placed in out-of-home care following a substantiated maltreatment allegation).

The child's gender, Aboriginality, birth weight and gestational age were obtained from Birth Registrations and the Midwives Notification System, along with parents' marital status and age at the time of birth. Neighbourhood-level socio-economic status (SES) was determined by the Index of Relative Social Disadvantage from the Australian Bureau of Statistics using the Birth and Midwives data[5]. Five levels of disadvantage were assigned to census collection districts (approximately 200 households) ranging from 1 (most disadvantaged) to 5 (least disadvantaged). Parents' hospital contacts for mental health, substance-related issues and assault-related injuries were ascertained from Hospital Morbidity Data and the Mental Health Information System.

Statistical Analysis

In addition to descriptive analysis, multivariable Cox regression was used to estimate adjusted and unadjusted hazard ratio (HR) and 95% confidence interval (CI) for the time in months from birth to a mental health contact or diagnosis, with covariates including level of child protection involvement, demographics and family factors. Follow-up time was calculated from birth to first mental health related event. Children without a mental health related event or who died before June 2013 were censored. Secondary analyses assessed the associations between level of child protection involvement and different types of mental health outcomes, and between maltreatment type and mental health outcomes. All ICD diagnosis and external codes were checked when ascertaining all the diagnostic outcomes. Only the first occurring mental health outcome was used in each time to event analysis. Due to the large study sample, listwise deletion was used to handle missing values in the regression models. Results in which the 95% CI's did not include the null value of 1 were considered statistically significant. All analysis was conducted using SAS V.9.3. Analyses were conducted in SAS V9.3.

RESULTS

Of the 524,534 children in the data, 37,343 (7.1%) had any type of mental health-related event, and 4.3% had a mental health diagnosis. In total, 37.4% of children with substantiated maltreatment had any mental health-related event, compared to 5.9% of children with no child protection contact (Figure 1). Likewise, 20% of children with substantiated maltreatment had a mental health diagnosis, compared to 3.6% of children without child protection contact. The percentages of children who had entered out-of-home care and who had any mental health event (38.7%) or a mental health diagnosis (20%) were like those of children with a maltreatment substantiation who did not enter out-of-home care. Children with both mental health events and maltreatment substantiations were more common among families with risk factors, such as living in very disadvantaged neighbourhoods, very young maternal age (<20 years), and parents who were single at the child's birth (Table 1), compared to families without these risk factors.

Table 1. Characteristics of the study population by substantiation status and mental health-related contact

Characteristics	Total, n (col %)		Substantiated allegation, n (col %)						No substantiated allegation, n (col %)					
			Total		Mental health-related Contact		No Mental health-related contact		Total		Mental health-related contact		No mental health-related contact	
Total	524534	100.0	11560	100.0	4322	100.0	7238	100.0	512974	100.0	33021	100.0	479953	100.0
Gender														
Female	268651	51.2	5472	47.3	2056	47.6	3416	47.2	263179	51.3	17681	53.5	245498	51.2
Male	255831	48.8	6088	52.7	2266	52.4	3822	52.8	249743	48.7	15332	46.4	234411	48.8
Missing	52	0.0	0	0.0	0	0.0	0	0.0	52	0.0	8	0.0	44	0.0
Aboriginality														
Non-Aboriginal	492740	93.9	7771	67.2	2563	59.3	5208	72.0	484969	94.5	27642	83.7	457327	95.3
Aboriginal	31612	6.0	3779	32.7	1754	40.6	2025	28.0	27833	5.4	5361	16.2	22472	4.7
Missing	182	0.0	10	0.1	5	0.1	5	0.1	172	0.0	18	0.1	154	0.0
Socioeconomic Status														
1 (Most dis-adv)	120565	23.0	5811	50.3	2410	55.8	3401	47.0	114754	22.4	11761	35.6	102993	21.5
2	120126	22.9	2749	23.8	920	21.3	1829	25.3	117377	22.9	7749	23.5	109628	22.8
3	99811	19.0	1550	13.4	509	11.8	1041	14.4	98261	19.2	5535	16.8	92726	19.3
4	94009	17.9	923	8.0	308	7.1	615	8.5	93086	18.1	4386	13.3	88700	18.5
5 (least dis-adv)	87330	16.6	445	3.8	146	3.4	299	4.1	86885	16.9	3404	10.3	83481	17.4
Missing	2693	0.5	82	0.7	29	0.7	53	0.7	2611	0.5	186	0.6	2425	0.5
Parental marital status at birth														
Single	51697	9.9	4000	34.6	1645	38.1	2355	32.5	47697	9.3	6119	18.5	41578	8.7
Married/Defacto	470751	89.7	7436	64.3	2642	61.1	4794	66.2	463315	90.3	26797	81.2	436518	91.0
Missing	2086	0.4	124	1.1	35	0.8	89	1.2	1962	0.4	105	0.3	1857	0.4
Maternal age at birth														
<20 years	30019	5.7	2406	20.8	1007	23.3	1399	19.3	27613	5.4	3830	11.6	23783	5.0
20-29 years	252817	48.2	6638	57.4	2482	57.4	4156	57.4	246179	48.0	18201	55.1	227978	47.5
>29 years	241642	46.1	2516	21.8	833	19.3	1683	23.3	239126	46.6	10981	33.3	228145	47.5
Missing	56	0.0	0	0.0	0	0.0	0	0.0	56	0.0	9	0.0	47	0.0
Paternal age at birth														
<20 years	9522	1.8	687	5.9	245	5.7	442	6.1	8835	1.7	1006	3.0	7829	1.6
20-29 years	175262	33.4	4649	40.2	1633	37.8	3016	41.7	170613	33.3	13109	39.7	157504	32.8
>29 years	314549	60.0	3257	28.2	1072	24.8	2185	30.2	311292	60.7	14916	45.2	296376	61.8
Missing	25201	4.8	2967	25.7	1372	31.7	1595	22.0	22234	4.3	3990	12.1	18244	3.8
Maternal mental health contact														
No	437578	83.4	5407	46.8	1823	42.2	3584	49.5	432171	84.2	22517	68.2	409654	85.4
Yes	86956	16.6	6153	53.2	2499	57.8	3654	50.5	80803	15.8	10504	31.8	70299	14.6
Mother substance contact														
No	483384	92.2	5804	50.2	1890	43.7	3914	54.1	477580	93.1	26602	80.6	450978	94.0
Yes	41150	7.8	5756	49.8	2432	56.3	3324	45.9	35394	6.9	6419	19.4	28975	6.0
Father mental health contact														

No	477845	91.1	8804	76.2	3306	76.5	5498	76.0	469041	91.4	27868	84.4	441173	91.9
Yes	46689	8.9	2756	23.8	1016	23.5	1740	24.0	43933	8.6	5153	15.6	38780	8.1
Father substance contact														
No	481103	91.7	8189	70.8	3035	70.2	5154	71.2	472914	92.2	27925	84.6	444989	92.7
Yes	43431	8.3	3371	29.2	1287	30.0	2084	28.8	40060	7.8	5096	15.4	34964	7.3

Note. Percentages for some variables sum to less than 100% because of missing data

Table 2. Cox regression risk of mental health-related events and diagnoses (univariate and multivariate estimates)

Characteristics	Any mental health event		Mental health-related event		Mental health diagnosis	
	Univariate HR (95% CI)	Multivariate HR (95% CI)	Univariate HR (95% CI)	Multivariate HR (95% CI)	Univariate HR (95% CI)	Multivariate HR (95% CI)
Gender						
Female	0.93 (0.91, 0.95)	0.92 (0.90, 0.94)	1.10 (1.08, 1.13)	1.11 (1.08, 1.15)	0.86 (0.84, 0.88)	0.84 (0.82, 0.87)
Male	reference	reference	reference	reference	reference	reference
Aboriginality						
Non-Aboriginal	reference	reference	reference	reference	reference	reference
Aboriginal	4.20 (4.08, 4.33)	1.65 (1.58, 1.73)	6.26 (6.05, 6.48)	2.21 (2.10, 2.32)	2.03 (1.94, 2.12)	0.95 (0.89, 1.01)
Socioeconomic Status						
1 (Most dis-adv)	2.63 (2.53, 2.73)	1.38 (1.32, 1.44)	3.26 (3.10, 3.42)	1.46 (1.38, 1.55)	1.96 (1.87, 2.06)	1.24 (1.17, 1.30)
2	1.62 (1.56, 1.69)	1.20 (1.15, 1.25)	1.74 (1.65, 1.83)	1.22 (1.16, 1.29)	1.51 (1.44, 1.59)	1.17 (1.11, 1.23)
3	1.37 (1.31, 1.43)	1.13 (1.08, 1.18)	1.40 (1.32, 1.48)	1.12 (1.06, 1.19)	1.30 (1.23, 1.37)	1.11 (1.05, 1.17)
4	1.21 (1.15, 1.26)	1.09 (1.04, 1.14)	1.23 (1.16, 1.30)	1.09 (1.03, 1.16)	1.18 (1.12, 1.25)	1.07 (1.01, 1.13)
5 (least dis-adv)	reference	reference	reference	reference	reference	reference
Parental marital status at birth						
Single	2.48 (2.42, 2.55)	1.16 (1.11, 1.20)	2.80 (2.71, 2.89)	1.16 (1.11, 1.22)	2.12 (2.05, 2.20)	1.15 (1.10, 1.21)
Married/Defacto	reference	reference	reference	reference	reference	reference
Maternal age at birth						
<20 years	3.14 (3.03, 3.25)	1.24 (1.18, 1.31)	3.87 (3.71, 4.03)	1.28 (1.19, 1.37)	2.39 (2.28, 2.50)	1.18 (1.10, 1.26)
20-29 years	1.44 (1.40, 1.47)	1.06 (1.03, 1.09)	1.53 (1.49, 1.58)	1.06 (1.02, 1.11)	1.33 (1.29, 1.36)	1.05 (1.01, 1.09)
>29 years	reference	reference	reference	reference	reference	reference
Paternal age at birth						
<20 years	2.69 (2.54, 2.86)	0.97 (0.89, 1.04)	3.38 (3.15, 3.62)	0.98 (0.89, 1.08)	2.04 (1.89, 2.22)	0.95 (0.86, 1.05)
20-29 years	1.47 (1.44, 1.51)	1.08 (1.05, 1.12)	1.56 (1.52, 1.61)	1.08 (1.04, 1.12)	1.38 (1.34, 1.42)	1.08 (1.05, 1.12)
>29 years	reference	reference	reference	reference	reference	reference
Maternal mental health contact						
No	reference	reference	reference	reference	reference	reference
Yes	2.86 (2.80, 2.94)	1.89 (1.84, 1.95)	2.84 (2.75, 2.93)	1.69 (1.62, 1.75)	3.00 (2.91, 3.09)	2.15 (2.08, 2.23)
Mother substance contact						
No	reference	reference	reference	reference	reference	reference
Yes	3.74 (3.64, 3.85)	1.42 (1.36, 1.47)	4.58 (4.43, 4.74)	1.55 (1.48, 1.62)	2.85 (2.75, 2.95)	1.27 (1.21, 1.33)
Father mental health						
No	reference	reference	reference	reference	reference	reference
Yes	2.00 (1.94, 2.06)	1.42 (1.37, 1.47)	1.97 (1.90, 2.04)	1.35 (1.29, 1.41)	2.14 (2.06, 2.22)	1.56 (1.49, 1.63)
Father substance						
No	reference	reference	reference	reference	reference	reference
Yes	2.24 (2.17, 2.30)	1.30 (1.25, 1.35)	2.51 (2.42, 2.60)	1.39 (1.33, 1.45)	1.98 (1.91, 2.06)	1.20 (1.14, 1.26)
Child Protection Involvement						
No Involvement	reference	reference	reference	reference	reference	reference

Unsubstantiated Allegation	3.98 (3.82, 4.15)	2.24 (2.13, 2.36)	4.46 (4.25, 4.68)	2.31 (2.18, 2.46)	3.41 (3.23, 3.59)	2.18 (2.05, 2.32)
Substantiated Allegation	5.34 (5.09, 5.61)	2.71 (2.55, 2.89)	6.36 (6.01, 6.73)	2.84 (2.63, 3.05)	4.28 (4.02, 4.55)	2.69 (2.49, 2.90)
Substantiated Allegation and entered out-of-home care	8.45 (8.07, 8.85)	3.03 (2.83, 3.24)	10.90 (10.36, 11.47)	3.54 (3.28, 3.82)	5.86 (5.53, 6.20)	2.65 (2.45, 2.87)

The hazard ratios from Cox regression analysis, which accounts for time to child's first mental health event, increased with level of child protection contact (Table 2). Univariate results showed that compared to children not involved with child protection, children who had ever entered care had the highest hazard ratio for mental health-related events (contacts) (HR:10.90, 95% CI:10.36-11.47), followed by other children with substantiated maltreatment (HR:6.36, 95% CI:6.01-6.73) then children with unsubstantiated maltreatment allegations (HR:4.46, 95% CI:4.25-4.68). After adjusting for background risk factors, the increased hazards were partially attenuated, but remained elevated for all child protection groups, ranging from HR:3.54 (95% CI:3.28-3.82) for children who had entered care to HR:2.31 (95% CI:2.18-2.46) for children with unsubstantiated allegations. For mental health diagnoses the increased unadjusted hazard ranged from 3.41 (95% CI:3.23-3.59) for children with unsubstantiated allegations to 5.86 (95% CI:5.53-6.20) for children who entered care. In the multivariate analysis, hazard ratios were partially attenuated but still showed around a twofold increase, ranging from HR:2.18 (95% CI:2.05-2.32) for unsubstantiated allegations to HR:2.65 (95% CI:2.45-2.87) for those who entered care.

In addition to maltreatment, all background risk factors were associated with increased risk of mental health events and/or diagnosis. Most notably, compared to non-Aboriginal young people, Aboriginal young people had a higher risk of mental health-related events (HR:6.26, 95% CI:6.05-6.48]) unadjusted, although this was partially attenuated in the multivariate analysis (HR:2.21, 95% CI:2.10-2.32). For mental health diagnosis, however, the increased risk for Aboriginal young people was fully attenuated in the multivariate model. Young maternal age and living in the most socially disadvantaged neighbourhoods were both also associated with more than a threefold unadjusted increased risk for a mental health-related event (HR:3.87, 95% CI:3.71-4.03) and HR:3.26 (95% CI:3.10-3.42) respectively, and around a twofold increased risk for a mental health diagnosis.

Maternal mental health hospital contacts had one of the highest hazard ratios for young people's likelihood of a mental health diagnosis (HR:3.00, 95% CI:2.91-3.09) unadjusted, which was partially attenuated in the multivariate analysis but still associated with a doubled hazard ratio (HR:2.15, 95% CI:2.08-2.23). Maternal substance abuse hospital contacts were associated with a similar increased risk for a mental health diagnosis (HR: 2.85, 95% CI:2.75-2.95), however after adjusting for other risk factors was reduced to HR:1.27 (95% CI:1.21-1.33).

Further analysis examined the risk of different types of mental health diagnoses associated with child protection histories (Table 3). Compared to individuals without a maltreatment substantiation, an increased risk was found across all MH diagnostic categories, with adjusted hazard ratios in the two-threefold increased range. The risk for those with any substantiated maltreatment of having an adult personality disorder diagnosis was particularly high, at HR:6.83 (95% CI:5.81-8.04) unadjusted and HR:3.64 (95% CI:2.94-4.52) adjusted, compared to those without substantiated maltreatment. For the subgroup with a substantiation and out-of-home care placement, the increased likelihood of being diagnosed with an adult personality disorder was even higher at HR:12.63 (95% CI:10.26-15.55) unadjusted and still showed a large increase in risk after adjusting for other risk factors HR:6.82 (95% CI:5.12-9.08).

Table 3. Risk of mental health diagnosis types by child protection involvement

Characteristic	Organic mental disorder		Substance related mental and behavioural disorder		Schizophrenia and psychoses		Mood (affective) disorder	
	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*
Child Protection Involvement^								
No Involvement	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Unsubstantiated allegation	2.12 (1.54, 2.92)	1.61 (1.09, 2.38)	4.09 (3.74, 4.47)	2.05 (1.83, 2.31)	3.18 (2.42, 4.18)	1.93 (1.37, 2.72)	3.48 (3.15, 3.85)	2.29 (2.02, 2.58)
Substantiated allegation	2.61 (1.76, 3.88)	2.35 (1.50, 3.68)	4.71 (4.21, 5.27)	2.29 (1.98, 2.65)	4.59 (3.41, 6.18)	2.82 (1.94, 4.10)	4.40 (3.90, 4.96)	2.81 (2.43, 3.25)
Substantiated allegation and entered out-of-home care	5.80 (4.12, 8.17)	4.25 (2.64, 6.83)	8.98 (7.98, 10.11)	2.87 (2.43, 3.38)	8.40 (6.17, 11.42)	3.03 (1.93, 4.75)	5.09 (4.40, 5.89)	2.43 (2.01, 2.94)
Substantiated allegation^								
No	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Yes	3.69 (2.83, 4.82)	2.85 (2.03, 4.01)	5.50 (5.05, 5.99)	2.16 (1.92, 2.42)	5.43 (4.34, 6.78)	2.56 (1.87, 3.50)	4.23 (3.85, 4.66)	2.28 (2.01, 2.58)

*All other covariates included (Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact). ^ Separate Cox regression models, second model compares all children with substantiated allegations (including those who entered out-of-home care) to all children without substantiated allegations (including no contact or only unsubstantiated allegations)

Table 3. Risk of mental health diagnosis types by child protection involvement (continued)

Characteristic	Stress related disorder		Adult personality disorder		Disorders of childhood and psychological development	
	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*
Child Protection Involvement^						
No Involvement	Reference	Reference	Reference	Reference	Reference	Reference
Unsubstantiated allegation	3.99 (3.73, 4.26)	2.62 (2.41, 2.84)	4.44 (3.66, 5.39)	3.07 (2.43, 3.87)	4.00 (3.74, 4.28)	2.82 (2.59, 3.06)
Substantiated allegation	5.04 (4.65, 5.46)	3.29 (2.98, 3.62)	5.22 (4.14, 6.59)	3.40 (2.56, 4.50)	4.14 (3.78, 4.54)	2.95 (2.64, 3.29)
Substantiated allegation and entered out-of-home care	7.46 (6.84, 8.14)	3.52 (3.14, 3.96)	12.63 (10.26, 15.55)	6.82 (5.12, 9.08)	7.16 (6.57, 7.80)	3.72 (3.30, 4.19)
Substantiated allegation^						
No	Reference	Reference	Reference	Reference	Reference	Reference
Yes	5.35 (5.04, 5.68)	2.77 (2.56, 3.01)	6.83 (5.81, 8.04)	3.64 (2.94, 4.52)	4.84 (4.53, 5.16)	2.64 (2.42, 2.87)

*All other covariates included (Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact). ^ Separate Cox regression models, second model compares all children with substantiated allegations (including those who entered out-of-home care) to all children without substantiated allegations (including no contact or only unsubstantiated allegations)

Comorbidity of substance related disorders with other mental and behavioural disorders is common, and Table 4 shows the increased risk of mood and stress disorders respectively, with and without comorbid substance related disorders. The increased risk of comorbid disorders among those with a history of substantiated maltreatment is even higher than the increased risk for a single diagnosis. For stress related disorders, the increased risk for a single diagnosis for young people who have any maltreatment substantiation is HR:4.82 (95% CI:4.50-5.15) unadjusted compared to HR:7.90 (95% CI:6.90-9.04) unadjusted for comorbid stress and substance related diagnoses. Young people who have a substantiation and have entered care appear particularly vulnerable to this type of comorbidity, with an unadjusted HR:14.06 (95% CI:11.81-16.75) for comorbid stress and substance related diagnoses compared to around six-fold increased likelihood of either disorder. Even after adjusting for other risk factors, young people who had been in care had a fourfold increased likelihood of comorbid stress and substance related diagnoses (HR:4.61, 95% CI:3.57-5.94). Young people who had been in care were also at elevated risk for mood and substance related disorders (HR:8.80, 95% CI:6.86-11.29) unadjusted and HR:3.03 (95% CI:2.14-4.31) adjusted compared to those with no child protection involvement.

Table 4. Risk of comorbid mood and substance related mental and behavioural disorders

Characteristic	Mood (affective) disorder[1]		Substance related mental and behavioural disorder[2]		Mood AND Substance related mental and behavioural disorder	
	Univariate HR (95% CI)	Multivariate HR (95% CI)*	Univariate HR (95% CI)	Multivariate HR (95% CI)*	Univariate HR (95% CI)	Multivariate HR (95% CI)*
Child Protection Involvement^						
No Involvement	Reference	Reference	Reference	Reference	Reference	Reference
Unsubstantiated allegation	3.18 (2.83, 3.57)	2.21 (1.92, 2.54)	3.92 (3.55, 4.34)	1.92 (1.68, 2.19)	4.54 (3.75, 5.51)	2.52 (1.97, 3.22)
Substantiated allegation	3.81 (3.31, 4.40)	2.56 (2.16, 3.03)	4.23 (3.71, 4.82)	1.95 (1.64, 2.31)	6.45 (5.17, 8.04)	3.60 (2.73, 4.73)
Substantiated allegation and entered out-of-home care	4.05 (3.38, 4.86)	2.20 (1.75, 2.77)	8.59 (7.54, 9.77)	2.71 (2.26, 3.26)	8.80 (6.86, 11.29)	3.03 (2.14, 4.31)
Substantiated allegation^						
No	Reference	Reference	Reference	Reference	Reference	Reference
Yes	3.59 (3.20, 4.03)	2.10 (1.82, 2.43)	5.13 (4.66, 5.65)	1.96 (1.71, 2.23)	6.39 (5.38, 7.58)	2.78 (2.19, 3.53)

*All other covariates included (Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact). ^ Separate Cox regression models, second model compares all children with substantiated allegations (including those who entered out-of-home care) to all children without substantiated allegations (including no contact or only unsubstantiated allegations) [1] excludes comorbid substance related mental and behavioural disorders [2] excludes mood (affective) disorders

Table 4. Risk of comorbid stress and substance mental and behavioural disorders (continued)

Characteristic	Stress related disorders[1]		Substance related mental and behavioural disorder[2]		Stress AND Substance related mental and behavioural disorder	
	Univariate HR (95% CI)	Multivariate HR (95% CI)*	Univariate HR (95% CI)	Multivariate HR (95% CI)*	Univariate HR (95% CI)	Multivariate HR (95% CI)*
Child Protection Involvement^						
No Involvement	Reference	Reference	Reference	Reference	Reference	Reference
Unsubstantiated allegation	3.75 (3.49, 4.03)	2.61 (2.39, 2.84)	3.62 (3.25, 4.03)	1.83 (1.59, 2.11)	5.14 (4.40, 6.00)	2.54 (2.07, 3.12)
Substantiated allegation	4.72 (4.32, 5.16)	3.23 (2.90, 3.59)	3.98 (3.46, 4.57)	1.86 (1.56, 2.23)	6.48 (5.36, 7.83)	3.34 (2.62, 4.27)
Substantiated allegation and entered out-of-home care	6.29 (5.70, 6.94)	3.24 (2.85, 3.69)	6.35 (5.43, 7.41)	1.97 (1.60, 2.44)	14.06 (11.81, 16.75)	4.61 (3.57, 5.94)
Substantiated allegation^						
No	Reference	Reference	Reference	Reference	Reference	Reference
Yes	4.82 (4.50, 5.15)	2.67 (2.44, 2.91)	4.35 (3.91, 4.84)	1.68 (1.45, 1.94)	7.90 (6.90, 9.04)	3.12 (2.57, 3.78)

*All other covariates included (Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact). ^ Separate Cox regression models, second model compares all children with substantiated allegations (including those who entered out-of-home care) to all children without substantiated allegations (including no contact or only unsubstantiated allegations) [1] excludes comorbid substance related mental and behavioural disorders [2] excludes stress related disorders

All maltreatment types were associated with elevated risk, with similar levels of increased risk across maltreatment types. In the univariate analysis, each of the maltreatment types was associated with an increased risk for a mental health-related event (ranging from HR 5.45 (95% CI: 5.23-5.69) for sexual abuse to HR 7.60 (95% CI: 7.27-7.94) for neglect. In the multivariate analysis, increased risk of a mental health-related event ranged from HR 2.04 (95% CI: 1.86-2.24) for emotional abuse to HR 2.58 (95% CI: 2.44-2.73) for sexual abuse (Table S1).

To assess the possibility that children placed in out-of-home care may be receiving services earlier and more routinely because of entry into care, we examined time to mental health contact following the first substantiation. The average time from first substantiation to any mental health event was similar at 64 months for all children and 66.5 months for those who entered out-of-home care. As the data only provided the dates service use occurred, we cannot be certain whether maltreatment occurred before mental health symptoms developed. Three quarters (73%) of young people with both mental health contact and maltreatment substantiations had the first recorded maltreatment occur prior to the first recorded mental health contact.

DISCUSSION

Only 3.6% of children without child protection contact in Western Australia had a mental health diagnosis, compared to 20% of children with substantiated maltreatment. This significantly increased risk for mental health diagnoses and events is consistent with other studies looking at child welfare or maltreated populations [3 4] and shows the need to support the mental health of children and young people with a history of maltreatment. We found increased risk for mental health events and diagnosis were common across children with different maltreatment histories, levels of child protection, and across different types of mental health diagnosis, however there were marked differences in risk.

Children with a mental health-related contact were more likely than other children to also have parents with a history of mental health contacts. This may reflect both genetic and environmental factors[6 7]. Parenting capacity can be affected by mental illness, with previous research showing that maternal mental illness is associated with increased risk of child maltreatment[8]. After controlling for socio-demographic factors and child protection involvement, maternal mental health contacts were still associated with around a two-fold increased risk of mental health events and diagnoses among young people. This represented one of the factors associated with the highest increased risk among our many risk factors.

Both mental health events and maltreatment substantiations were more common in disadvantaged neighbourhoods, teenage mothers, and parents who were single at the child's birth. This is consistent with previous research[3] and highlights the way social determinants and adverse outcomes tend to cluster together creating problems that are complex to resolve at an individual or societal level. It also highlights the importance of accounting for multiple risk factors when examining the relationship between maltreatment and mental health outcomes.

Aboriginal young people had a higher risk only for mental health events, but not for diagnoses, within the multivariate models. Possible explanations could be not reaching the threshold of diagnoses, concerns about the cultural appropriateness of diagnoses, or lack of psychiatric services in rural and remote areas therefore not getting a diagnosis.

Despite controlling for background adversity and parental mental health hospital contacts, we found maltreated children were at significantly increased risk of mental health outcomes and diagnoses. Our study is congruent with previous research showing an increased risk of mental health problems and service use in child protection/maltreated samples, however we found the association held across many diagnostic groups such as schizophrenia, which has had mixed results in previous studies (e.g. in smaller population study by Spataro et al[9], the relative risk for schizophrenia associated with child maltreatment did not reach significance, whereas Vinnerljung et al[4] found elevated rates of psychosis (which includes schizophrenia) among their out-of-home care groups that were comparable to our findings for maltreated children although somewhat lower than for our out-of-home care group.

The greatest increased risk was for adult personality disorder, with a seven-fold increased likelihood among children with any maltreatment, and twelve-fold increased likelihood among maltreated children who entered care (prior to adjusting for other risk factors). The increase was still sizeable after controlling for background risk. Personality disorder was not included in previous large scale studies such as Vinnerljung, Hjern and Lindblad (2006)[4], with many studies focussing on common and easy to measure disorders such as depression and anxiety. Smaller prior studies have found personality disorders to be more common among people who had experienced child maltreatment [9-11], but have tended to be limited to specific disorders (borderline personality disorder[11] and antisocial personality disorder[10]) or maltreatments types (sexual abuse[9 11]), and results have not always been consistent in multivariate models[10]. The present study suggests young people who have been maltreated may be particularly susceptible to developing personality disorders. Trauma and disrupted attachments as often occur for abused or neglected children are widely believed to contribute to the development of personality disorders [12-14]. To date, treatment of personality disorders has only been modestly successful, reducing symptoms such as self-harm, but often social, vocational and quality of life impairments remain, and a long-term approach is recommended[15].

While not significantly different across all comparisons, we found higher likelihood of mental health events and diagnoses among young people with higher levels of child protection contact. We are not aware of any studies examining mental health outcomes across all four child protection groups (no child protection contact, only unsubstantiated allegations, substantiated allegations, and substantiated allegations with placement in out-of-home care). Vinnerljung et al[4] compared child welfare clients that remained at home and those placed in out-of-home care with the general population, with both child welfare groups showing similarly elevated rates for various mental health outcomes. Among a younger cohort, Hussey found outcomes were equally poor for children with unsubstantiated maltreatment as substantiated maltreatment[16]. Our results showed a general tendency for higher mental health risks associated with higher levels of child protection involvement, however were congruent with the finding that children with maltreatment allegations were at increased risk for mental health diagnoses. Mental health support needs to be made available for children and young people with maltreatment allegations, regardless of whether their case is substantiated and if they enter out-of-home care. This should be used in conjunction with services to parents to improve child safety and family functioning to prevent children from developing mental health issues.

Our study also included all four maltreatment types (neglect, physical, sexual and emotional abuse), and found increased risk of mental health events across all maltreatment types. This differs slightly from Fergusson's study that showed much more consistent results for sexual abuse than physical abuse after adjusting for other risk factors[3]. Our study also found similar mental health outcomes for children who had been neglected, physically or emotionally abused, which haven't received the same level of research attention. Sexual abuse is often singled out as a risk factor for poor mental

health outcomes. Our results showed that while young people who had been sexually abused had the highest hazard ratio for mental health diagnoses, all maltreatment types had an elevated risk. However, only one alleged maltreatment type was supplied in the data per investigation, so children experiencing multiple maltreatment types cannot be identified in this study. Regardless of the abuse type identified in the child protection database, all children with substantiated maltreatment should be provided with access to mental health services as required.

A limitation of our study is that it only captures public outpatient and public and private hospital inpatient mental health events: data on outpatient mental health services provided by private hospitals, private psychologists/psychiatrists, or managed by general practitioners (family doctors) was not available. As a result, mental health service use is better captured for more severe mental health problems where inpatient admissions occur. Although this may be a potential source of bias in our model estimates, these groups are likely to represent the heaviest users of government mental health services, and those most in need. A further issue in using service data to examine mental health outcomes is that accessing services for mental health is both an indicator of an adverse outcome (mental health issues) and a positive indicator that some service needs are being met. It also constitutes a measure of services provided or the service burden associated with subgroups of the population. Diagnoses are a somewhat better indicator of mental health status, but rates may still be affected by different levels of service use – under-ascertainment of mental health disorders may be present for any or groups within the study if an individual does not access mental health services. Other limitations include uncertainty around the true start date of an individual's mental health symptoms or maltreatment, so it is possible that in some cases the order of events differs from that suggested by their recorded service use. As previously noted, there may be some under ascertainment of maltreatment types resulting from recording of only one maltreatment type per investigation.

Despite these limitations, the study had many strengths and provides significant new information regarding the mental health of children in contact with the child protection. Linked population data allows the examination of sensitive topics without the recruitment and sample loss challenges that affect many surveys. The study included a population cohort of children, with data from birth to young adulthood, and accounting for parents' mental health and a range of background adversities. The data enabled our study to build on previous research by detailed examination of the increased risk of mental health problems among subgroups within the child protection system, including those with different levels of child protection involvement, and different maltreatment types, and identifying the level of increased risk for different mental health diagnoses.

Our findings support previous research showing high levels of mental health service needs among the child protection population. An increased risk was found across all subgroups, regardless of what type of maltreatment the child's record showed, and whether maltreatment was substantiated, although children with higher levels of child protection involvement were also at greater risk for mental health events and diagnoses. The strongly increased risk for personality disorders, and comorbid substance and mental health disorders highlights a need for targeted plans to reduce or treat these challenging mental health issues that can severely impact on young people's wellbeing and ability to adjust to independent adult life.

Word count: 3,997

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Contributors: MJM conceptualized and designed the study, and drafted the initial manuscript; SAS carried out the initial analyses and reviewed and revised the manuscript; MOD contributed to the conceptualization and design of the study, and critically reviewed the manuscript; and all authors approved the final manuscript as submitted. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Provenance and peer review: Not commissioned; externally peer reviewed.

Data sharing statement: The data utilised in this paper is owned by our respective Government Departments and therefore would require permissions by these Departments for others to access.

REFERENCES

1. Kaplan S, Pelcovitz D, Labruna V. Child and adolescent abuse and neglect research: A review of the past 10 years. Part I: Physical and emotional abuse and neglect. J Am Acad Child Adolesc Psychiatry 1999;**38**:1214-22.
2. National Scientific Council on the Developing Child. Cambridge MCotDC, Harvard University. The science of neglect: The persistent absence of responsive care disrupts the developing brain: Working Paper 12. Cambridge, MA Center on the Developing Child, Harvard University, (2012).
3. Fergusson DM, Boden JM, Horwood LJ. Exposure to childhood sexual and physical abuse and adjustment in early adulthood. Child Abuse Negl 2008;**32**(6):607-19.
4. Vinnerljung B, Hjern A, Lindblad F. Suicide attempts and severe psychiatric morbidity among former child welfare clients – a national cohort study. Journal of Child Psychology and Psychiatry 2006;**47**(7):723-33.
5. Australian Bureau of Statistics. Socio-Economic Indexes for Areas (SEIFA) - Technical Paper. Canberra: Australian Bureau of Statistics, 2008.
6. Kendler KS, Walters EE, Neale MC, et al. The structure of the genetic and environmental risk factors for six major psychiatric disorders in women: Phobia, generalized anxiety disorder, panic disorder, bulimia, major depression, and alcoholism. . Arch Gen Psychiatry 1995;**52**(5):374-83.
7. Etain B, Henry C, Bellivier F, et al. Beyond genetics: Childhood affective trauma in bipolar disorder. Bipolar disorders 2008;**10**(8):867.
8. O'Donnell M, Maclean MJ, Sims S, et al. Maternal mental health and risk of child protection involvement: mental health diagnoses associated with increased risk. J Epidemiol Community Health 2015;**69**(12):1175-83.
9. Spataro J, Mullen PE, Burgess PM, et al. Impact of child sexual abuse on mental health: Prospective study in males and females. Br J Psychiatry 2018;**184**(5):416-21.
10. Horwitz AV, Widom CS, McLaughlin J, et al. The impact of childhood abuse and neglect on adult mental health: A prospective study. . J Health Soc Behav 2001;**42**(2):184-201.
11. Hillberg T, Hamilton-Giachritsis C, Dixon L. Review of meta-analyses on the association between child sexual abuse and adult mental health difficulties: A systematic approach. . Trauma, Violence & Abuse 2011;**12**(1):38-49.
12. Paris J. Childhood Adversities and Personality Disorders. In: Livesley WJ, Larstone R, eds. Handbook of personality disorders: Theory, research and treatment. 2nd ed. New York: The Guildford Press, 2018.
13. Fonagy P, Luyten P. Attachment, Mentalising and the Self. In: Livesley WJ, Larstone R, eds. Handbook of personality disorders: Theory, research and treatment. 2nd ed. New York: The Guildford Press, 2018.
14. Infurna MR, Brunner R, Holz B, et al. The specific role of childhood abuse, parental bonding, and family functioning in female adolescents with borderline personality disorder Journal of Personality Disorders 2016;**30**(2):177-92.
15. Bateman AW, Gunderson J, Mulder R. Treatment of personality disorder. The Lancet 2015;**385**(9969):735-43.
16. Hussey JM, Marshall JM, English DJ, et al. Defining maltreatment according to substantiation: distinction without a difference? Child Abuse Negl 2005;**29**(5):479-92.

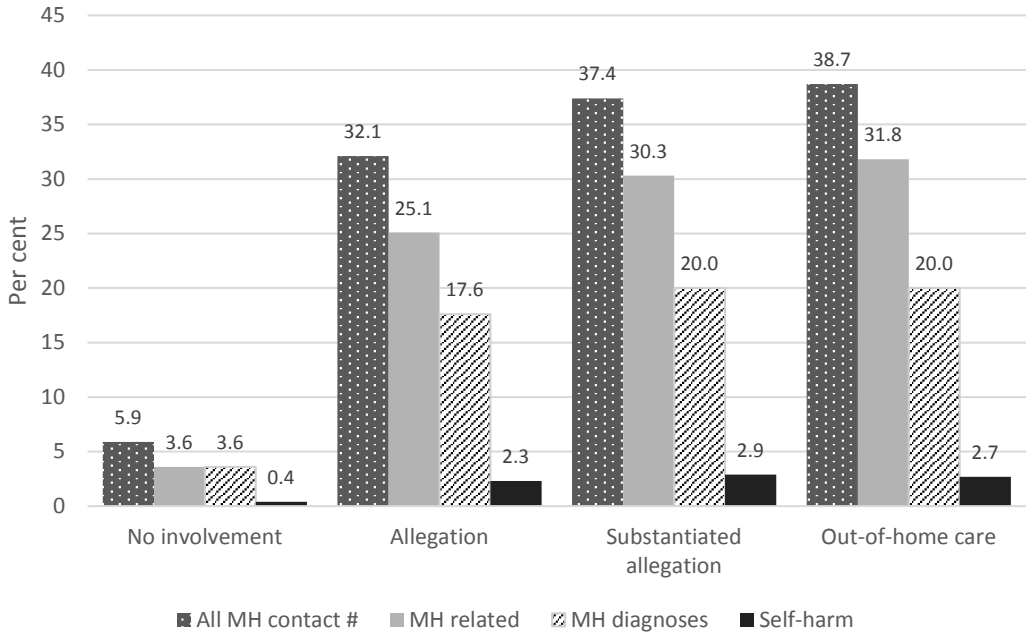

Figure 1. Percentage of children born in WA between 1990-2009 with mental health-related contacts at any time, by level of child protection involvement*

* Includes mental health diagnoses, self-harm and mental health related codes. # Child protection categories were not exclusive and therefore children can be counted more than once across levels of child protection involvement.

Table S1. Risk of mental health contact or mental health diagnoses by maltreatment type (primary concern at notification)

	Any Mental health-related event		Mental health diagnoses	
Maltreatment type	**Univariate OR (95% CI)**	**Multivariate OR (95% CI)***	**Univariate OR (95% CI)**	**Multivariate OR (95% CI)***
Any Physical	6.13 (5.86, 6.40)	2.49 (2.34, 2.65)	4.56 (4.35, 4.78)	2.35 (2.22, 2.50)
Any Sexual	5.45 (5.23, 5.69)	2.58 (2.44, 2.73)	4.32 (4.13, 4.52)	2.70 (2.55, 2.85)
Any Emotional	5.85 (5.46, 6.27)	2.04 (1.86, 2.24)	3.96 (3.66, 4.27)	1.87 (1.70, 2.06)
Any Neglect	7.60 (7.27, 7.94)	2.36 (2.22, 2.52)	4.13 (3.93, 4.35)	1.84 1.71, 1.97)

* Includes adjustment for Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact

Reporting checklist for cohort study.

Based on the STROBE cohort guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the STROBE cohort reporting guidelines, and cite them as:

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		Reporting Item	Page Number
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2

Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	3
Study design	#4	Present key elements of study design early in the paper	3,4
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3,4
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up.	3,4
	#6b	For matched studies, give matching criteria and number of exposed and unexposed	n/a (not a matched study)
Variables	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	3,4

Bias	#9	Describe any efforts to address potential sources of bias	17
Study size	#10	Explain how the study size was arrived at	3
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	5
	#12b	Describe any methods used to examine subgroups and interactions	4
	#12c	Explain how missing data were addressed	5
	#12d	If applicable, explain how loss to follow-up was addressed	5
	#12e	Describe any sensitivity analyses	n/a (none required)
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	3,4 (retrospective population birth cohort)
	#13b	Give reasons for non-participation at each stage	n/a (birth cohort)

	#13c	Consider use of a flow diagram	n/a (not deemed warranted)
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	7
	#14b	Indicate number of participants with missing data for each variable of interest	6
	#14c	Summarise follow-up time (eg, average and total amount)	
Outcome data	#15	Report numbers of outcome events or summary measures over time. Give information separately for exposed and unexposed groups if applicable.	5
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-11
	#16b	Report category boundaries when continuous variables were categorized	8
	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a (we used Hazard Ratios)

Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	13,14,15
Key results	#18	Summarise key results with reference to study objectives	2,5-15
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	17
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	15,16
Generalisability	#21	Discuss the generalisability (external validity) of the study results	17,18
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

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The role of pre-existing adversity and child maltreatment on mental health outcomes for children involved in child protection: a population-based data linkage study

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TITLE:

The role of pre-existing adversity and child maltreatment on mental health outcomes for children involved in child protection: a population-based data linkage study

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Keywords: child protection, mental health, abuse and neglect, linked data, population

ABSTRACT

Objectives: To determine mental health outcomes for children with a history of child protection system involvement, accounting for pre-existing adversity, and to examine variation in risk across diagnostic groupings and child protection sub-groups.

Design: A longitudinal, population-based record-linkage study.

Participants: All children in Western Australia (WA) with birth records between 1990-2009.

Outcome measures: Mental health diagnoses, mental health contacts, and any mental health event ascertained from ICD codes within WA's Hospital Morbidity Data Collection (HMDC) and Mental Health Information System (MHIS) from birth until 2013.

Results: Compared to children without child protection contact, children with substantiated maltreatment had higher prevalence of mental health events (37.4% versus 5.9%) and diagnoses (20% versus 3.6%). After adjusting for background risks, all maltreatment types were associated with an almost twofold to almost threefold increased hazard for mental health events. Multivariate analysis also showed mental health events were elevated across all child protection groups, ranging from HR:3.54 (95% CI:3.28-3.82) for children who had entered care to HR:2.31 (95% CI:2.18-2.46) for unsubstantiated allegations. Maternal mental health, Aboriginality, young maternal age and living in socially disadvantaged neighbourhoods were all associated with an increased likelihood of mental health events. The increase varied across diagnostic categories, with particularly increased risk for personality disorder, and frequent comorbidity of mental health and substance abuse disorders.

Conclusions: Young people who have been involved in the child protection system are at increased risk for mental health events and diagnoses. These findings emphasise the importance of services and supports to improve mental health outcomes in this vulnerable population. Adversities in childhood, along with genetic or environmental vulnerabilities resulting from maternal mental health issues also contribute to young people's mental health outcomes, suggesting a role for broader social supports and early intervention services in addition to targeted mental health programs.

Word count: 297

STRENGTHS AND LIMITATIONS OF THIS STUDY

- Linked population data allows the examination of a sensitive topic such as child maltreatment without the recruitment and sample loss challenges that affect many surveys.
- The longitudinal analysis between mental health diagnoses in the hospital data allowed us to identify the level of increased risk for different mental health problems among subgroups in the child protection system.
- However, data on outpatient mental health services provided by private hospitals, private psychologists/psychiatrists, or managed by general practitioners was not available, therefore this study's estimates of prevalence of mental health events are likely to be underestimates.
- There may also be some under ascertainment of maltreatment types resulting from recording of only one maltreatment type per investigation.

The role of pre-existing adversity and child maltreatment on mental health outcomes for children involved in child protection: a population-based data linkage study

INTRODUCTION

It is established that children who experience child abuse and neglect are at increased risk of poorer mental health outcomes.[1] The National Scientific Council on the Developing Child states that chronic stress to which maltreated children may be exposed, in the absence of consistent and supportive relationships with adult caregivers, has negative impacts on children's developing brain.[2] Furthermore children who experience child abuse and neglect may be exposed to complex and chronic trauma which can result in persistent psychological problems.

There are, however, many factors that increase this risk including the fact that many of these children come from families where parental mental health issues are present. Therefore, there may be genetic and adversity factors that increase the level of vulnerability to poor mental health, in addition to the trauma associated with being a victim of abuse and/or neglect. In fact research has suggested that familial risk factors prior to child maltreatment may be a stronger risk factor for poor mental health outcomes.[3] In order to appropriately support young people involved in child welfare services it is essential that a strong evidence-base regarding the burden of mental health issues, the type of mental health problems and the pre-existing risk that young people are exposed to guides the provision of services to ensure improved outcomes for this group of young people. This is also essential at a time when there is a national focus in Australia on improving the outcomes of young people who have been in out-of-home care and whether out-of-home care experiences reduce the risk of poor mental health outcomes into adulthood.

The challenges in developing a strong evidence-base in this area include:

a) long-term follow-up for children who have been involved in child protection services;
b) accounting for pre-existing adversity for these children prior to their involvement in child protection services;
c) accounting for type of maltreatment, and child protection interventions that may influence mental health outcomes; and
d) having an appropriate comparison group and large enough sample size in the cases to enable valid comparison.

Vinnerljung, Hjern and Lindblad [4] utilised Swedish national register data to overcome some of these challenges, finding that former child welfare clients were five to eight times more likely than peers in the general population to have been hospitalised for serious psychiatric disorders in their teens and four to six times in young adulthood. Even after accounting for parental and socioeconomic factors there was still a three to fourfold increased risk in adolescence and two to threefold in adulthood. The objective of our research was to build on these findings using an Australian population-based cohort of children and linked mental health register and child protection agency data taking into account parental mental health history, sociodemographic factors, level of child protection involvement and type of maltreatment. We could then determine mental health outcomes for children with a history of child protection system involvement, accounting for pre-existing adversity, and examine variation in risk across diagnostic groups and child protection sub-groups.

METHODS

Population and Data Sources

To determine the mental health outcomes for children involved in child protection we conducted a population-based record-linkage study of all children born in Western Australia (WA) between 1990-2009 using de-identified administrative data, resulting in a study sample of 524,534 children. The health data collections utilised were WA's Hospital Morbidity Data Collection (HMDC), Mental Health Information System (MHIS), Midwives Notification System, Birth Register and Mortality Register, linked via the WA Data Linkage System. The HMDC contains information on all hospital discharges (public and private hospitals) with corresponding diagnostic information using the International Classification of Diseases (ICD) recorded for each episode of care for children from 1990-June 2013 and their parents from 1970-June 2013. ICD-8 was used from 1970-1978, ICD-9 from 1979-June 1999, and ICD-10

from July 1999-2013. The MHIS contains information on all mental health-related public and private inpatient discharges and public outpatient contacts for children for the period 1990-June 2013 and parents 1970-2009. It identifies the date of the mental health episode as well as the primary diagnostic code utilising ICD codes as above. The Midwives Notification System and Birth Register were used to identify the birth cohort and contain birth information, including maternal characteristics and infant outcomes for the period 1990-2009.

Mental health diagnostic outcomes were grouped in two ways. The first was a binary indicator of any mental health-related diagnostic code (Yes or No). The second was by type of mental health-related diagnosis, with 7 groups (listed below) which were non-exclusive (therefore for individuals with one or more diagnoses they could be counted in more than one diagnostic group):

1) Organic mental disorder
2) Substance related mental and behavioural disorder
3) Schizophrenia, and psychoses
4) Mood (affective) disorders
5) Stress-related disorders
6) Personality disorders
7) Disorders of psychological development or behavioural and emotional disorders with onset usually occurring in childhood and adolescence.

Mental health-related events included hospital contacts or discharges that were mental health-related but did not include a specific mental health diagnosis (for example self-harm injuries or counselling for mental health-related issues). Any mental health event was an inclusive grouping that combined records of mental health contacts/discharges and diagnoses. Each of these groups were included to capture all mental health-related events including those did not reach the threshold of diagnosis.

The Department of Communities child protection records provided data on children's entire history of maltreatment allegations from birth onwards. Allegations consist of reports made to Communities regarding alleged child abuse and neglect. An allegation is substantiated by Communities when following investigation there is reasonable cause to believe the child has been, is being, or is likely to be abused or neglected or otherwise harmed. Following a substantiated allegation, a child could be removed from their family and placed in out-of-home care.

The child protection data were grouped in several ways. The first was grouping all children based on whether they had any substantiated maltreatment allegations versus no substantiated maltreatment. The second was four levels of child protection contact (no allegations, allegations, substantiated allegations, out of home care) where children were included in each level that they had contact and therefore they could be counted more than once across levels (i.e. non-exclusive categories). This grouping is used in Figure 1 to provide overall prevalence aligned with common child protection categories. The third was four mutually exclusive categories based on highest level of child protection involvement used for regression modelling of risk associated with each situation:

1) No allegations (no allegations have been reported);
2) Unsubstantiated allegations (an allegation was reported to Communities but following an investigation the allegation was not substantiated;
3) Substantiated maltreatment allegation (following an investigation the allegation was substantiated); and
4) Out-of-home care (child removed from the home and placed in out-of-home care following a substantiated maltreatment allegation).

The child's gender, Aboriginality, birth weight and gestational age were obtained from Birth Registrations and the Midwives Notification System, along with parents' marital status and age at the time of birth. Neighbourhood-level socio-economic status (SES) was determined by the Index of Relative Social Disadvantage from the Australian Bureau of Statistics using the Birth and Midwives data[5]. Five levels of disadvantage were assigned to census collection districts (approximately 200 households) ranging from 1 (most disadvantaged) to 5 (least disadvantaged). Parents' hospital contacts for mental health, substance-related issues and assault-related injuries were ascertained from Hospital Morbidity Data and the Mental Health Information System.

Patient and public involvement

The children and parents included in the study population were not directly involved in the development of the research questions, study design, or the outcome measures. However, our consumer and community reference group provided guidance on our research and findings from this study will be disseminated through this group and the government agencies involved in the study.

Statistical Analysis

In addition to descriptive analysis, multivariable Cox regression was used to estimate adjusted and unadjusted hazard ratio (HR) and 95% confidence interval (CI) for the time in months from birth to a mental health contact or diagnosis, with covariates including level of child protection involvement, demographics and family factors. Follow-up time was calculated from birth to first mental health related event. Children without a mental health related event or who died before June 2013 were censored. Secondary analyses assessed the associations between level of child protection involvement and different types of mental health outcomes, and between maltreatment type and mental health outcomes. All ICD diagnosis and external codes were checked when ascertaining all the diagnostic outcomes. Only the first occurring mental health outcome was used in each time to event analysis. Due to the large study sample, listwise deletion was used to handle missing values in the regression models. Results in which the 95% CI's did not include the null value of 1 were considered statistically significant. Analyses were conducted in SAS V9.3.

RESULTS

Of the 524,534 children in the data, 37,343 (7.1%) had any type of mental health-related event, and 4.3% had a mental health diagnosis. In total, 37.4% of children with substantiated maltreatment had any mental health-related event, compared to 5.9% of children with no child protection contact (Figure 1). Likewise, 20% of children with substantiated maltreatment had a mental health diagnosis, compared to 3.6% of children without child protection contact. The percentages of children who had entered out-of-home care and who had any mental health event (38.7%) or a mental health diagnosis (20%) were like those of children with a maltreatment substantiation who did not enter out-of-home care. Children with both mental health events and maltreatment substantiations were more common among families with risk factors, such as living in very disadvantaged neighbourhoods, very young maternal age (<20 years), and parents who were single at the child's birth (Table 1), compared to families without these risk factors.

Insert Figure 1 here

Table 1. Characteristics of the study population by substantiation status and mental health-related contact

Characteristics	Total, n (col %)		Substantiated allegation, n (col %)						No substantiated allegation, n (col %)					
			Total		Mental health-related Contact		No Mental health-related contact		Total		Mental health-related contact		No mental health-related contact	
Total	524534	100	11560	100	4322	100	7238	100	512974	100	33021	100	479953	100
Gender														
Female	268651	51.2	5472	47.3	2056	47.6	3416	47.2	263179	51.3	17681	53.5	245498	51.2
Male	255831	48.8	6088	52.7	2266	52.4	3822	52.8	249743	48.7	15332	46.4	234411	48.8
Missing	52	0.0	0	0.0	0	0.0	0	0.0	52	0.0	8	0.0	44	0.0
Aboriginality														
Non-Aboriginal	492740	93.9	7771	67.2	2563	59.3	5208	72.0	484969	94.5	27642	83.7	457327	95.3
Aboriginal	31612	6.0	3779	32.7	1754	40.6	2025	28.0	27833	5.4	5361	16.2	22472	4.7
Missing	182	0.0	10	0.1	5	0.1	5	0.1	172	0.0	18	0.1	154	0.0
Socioeconomic Status														
1 (Most dis-adv)	120565	23.0	5811	50.3	2410	55.8	3401	47.0	114754	22.4	11761	35.6	102993	21.5
2	120126	22.9	2749	23.8	920	21.3	1829	25.3	117377	22.9	7749	23.5	109628	22.8
3	99811	19.0	1550	13.4	509	11.8	1041	14.4	98261	19.2	5535	16.8	92726	19.3
4	94009	17.9	923	8.0	308	7.1	615	8.5	93086	18.1	4386	13.3	88700	18.5
5 (least dis-adv)	87330	16.6	445	3.8	146	3.4	299	4.1	86885	16.9	3404	10.3	83481	17.4
Missing	2693	0.5	82	0.7	29	0.7	53	0.7	2611	0.5	186	0.6	2425	0.5
Parental marital status at birth														
Single	51697	9.9	4000	34.6	1645	38.1	2355	32.5	47697	9.3	6119	18.5	41578	8.7
Married/Defacto	470751	89.7	7436	64.3	2642	61.1	4794	66.2	463315	90.3	26797	81.2	436518	91.0
Missing	2086	0.4	124	1.1	35	0.8	89	1.2	1962	0.4	105	0.3	1857	0.4
Maternal age at birth														
<20 years	30019	5.7	2406	20.8	1007	23.3	1399	19.3	27613	5.4	3830	11.6	23783	5.0
20-29 years	252817	48.2	6638	57.4	2482	57.4	4156	57.4	246179	48.0	18201	55.1	227978	47.5
>29 years	241642	46.1	2516	21.8	833	19.3	1683	23.3	239126	46.6	10981	33.3	228145	47.5
Missing	56	0.0	0	0.0	0	0.0	0	0.0	56	0.0	9	0.0	47	0.0
Paternal age at birth														
<20 years	9522	1.8	687	5.9	245	5.7	442	6.1	8835	1.7	1006	3.0	7829	1.6
20-29 years	175262	33.4	4649	40.2	1633	37.8	3016	41.7	170613	33.3	13109	39.7	157504	32.8

>29 years	314549	60.0	3257	28.2	1072	24.8	2185	30.2	311292	60.7	14916	45.2	296376	61.8
Missing	25201	4.8	2967	25.7	1372	31.7	1595	22.0	22234	4.3	3990	12.1	18244	3.8
Maternal mental health contact														
No	437578	83.4	5407	46.8	1823	42.2	3584	49.5	432171	84.2	22517	68.2	409654	85.4
Yes	86956	16.6	6153	53.2	2499	57.8	3654	50.5	80803	15.8	10504	31.8	70299	14.6
Maternal substance contact														
No	483384	92.2	5804	50.2	1890	43.7	3914	54.1	477580	93.1	26602	80.6	450978	94.0
Yes	41150	7.8	5756	49.8	2432	56.3	3324	45.9	35394	6.9	6419	19.4	28975	6.0
Paternal mental health contact														
No	477845	91.1	8804	76.2	3306	76.5	5498	76.0	469041	91.4	27868	84.4	441173	91.9
Yes	46689	8.9	2756	23.8	1016	23.5	1740	24.0	43933	8.6	5153	15.6	38780	8.1
Paternal substance contact														
No	481103	91.7	8189	70.8	3035	70.2	5154	71.2	472914	92.2	27925	84.6	444989	92.7
Yes	43431	8.3	3371	29.2	1287	30.0	2084	28.8	40060	7.8	5096	15.4	34964	7.3

Note. Percentages for some variables sum to less than 100% because of missing data

Table 2. Risk of mental health-related events and diagnoses when exposed to different levels of child protection involvement

Characteristics	Any mental health event		Mental health-related event		Mental health diagnosis	
	Univariate HR (95% CI)	Multivariate HR (95% CI)*	Univariate HR (95% CI)*	Multivariate HR (95% CI)*	Univariate HR (95% CI)	Multivariate HR (95% CI)*
Gender						
Female	0.93 (0.91, 0.95)	0.92 (0.90, 0.94)	1.10 (1.08, 1.13)	1.11 (1.08, 1.15)	0.86 (0.84, 0.88)	0.84 (0.82, 0.87)
Male	reference	reference	reference	reference	reference	reference
Aboriginality						
Non-Aboriginal	reference	reference	reference	reference	reference	reference
Aboriginal	4.20 (4.08, 4.33)	1.65 (1.58, 1.73)	6.26 (6.05, 6.48)	2.21 (2.10, 2.32)	2.03 (1.94, 2.12)	0.95 (0.89, 1.01)
Socioeconomic Status						
1 (Most dis-adv)	2.63 (2.53, 2.73)	1.38 (1.32, 1.44)	3.26 (3.10, 3.42)	1.46 (1.38, 1.55)	1.96 (1.87, 2.06)	1.24 (1.17, 1.30)
2	1.62 (1.56, 1.69)	1.20 (1.15, 1.25)	1.74 (1.65, 1.83)	1.22 (1.16, 1.29)	1.51 (1.44, 1.59)	1.17 (1.11, 1.23)
3	1.37 (1.31, 1.43)	1.13 (1.08, 1.18)	1.40 (1.32, 1.48)	1.12 (1.06, 1.19)	1.30 (1.23, 1.37)	1.11 (1.05, 1.17)
4	1.21 (1.15, 1.26)	1.09 (1.04, 1.14)	1.23 (1.16, 1.30)	1.09 (1.03, 1.16)	1.18 (1.12, 1.25)	1.07 (1.01, 1.13)
5 (least dis-adv)	reference	reference	reference	reference	reference	reference
Parental marital status at birth						
Single	2.48 (2.42, 2.55)	1.16 (1.11, 1.20)	2.80 (2.71, 2.89)	1.16 (1.11, 1.22)	2.12 (2.05, 2.20)	1.15 (1.10, 1.21)
Married/Defacto	reference	reference	reference	reference	reference	reference
Maternal age at birth						
<20 years	3.14 (3.03, 3.25)	1.24 (1.18, 1.31)	3.87 (3.71, 4.03)	1.28 (1.19, 1.37)	2.39 (2.28, 2.50)	1.18 (1.10, 1.26)
20-29 years	1.44 (1.40, 1.47)	1.06 (1.03, 1.09)	1.53 (1.49, 1.58)	1.06 (1.02, 1.11)	1.33 (1.29, 1.36)	1.05 (1.01, 1.09)
>29 years	reference	reference	reference	reference	reference	reference
Paternal age at birth						
<20 years	2.69 (2.54, 2.86)	0.97 (0.89, 1.04)	3.38 (3.15, 3.62)	0.98 (0.89, 1.08)	2.04 (1.89, 2.22)	0.95 (0.86, 1.05)
20-29 years	1.47 (1.44, 1.51)	1.08 (1.05, 1.12)	1.56 (1.52, 1.61)	1.08 (1.04, 1.12)	1.38 (1.34, 1.42)	1.08 (1.05, 1.12)
>29 years	reference	reference	reference	reference	reference	reference
Maternal mental health contact						
No	reference	reference	reference	reference	reference	reference
Yes	2.86 (2.80, 2.94)	1.89 (1.84, 1.95)	2.84 (2.75, 2.93)	1.69 (1.62, 1.75)	3.00 (2.91, 3.09)	2.15 (2.08, 2.23)
Maternal substance contact						

No	reference	reference	reference	reference	reference	reference
Yes	3.74 (3.64, 3.85)	1.42 (1.36, 1.47)	4.58 (4.43, 4.74)	1.55 (1.48, 1.62)	2.85 (2.75, 2.95)	1.27 (1.21, 1.33)
Paternal mental health contact						
No	reference	reference	reference	reference	reference	reference
Yes	2.00 (1.94, 2.06)	1.42 (1.37, 1.47)	1.97 (1.90, 2.04)	1.35 (1.29, 1.41)	2.14 (2.06, 2.22)	1.56 (1.49, 1.63)
Paternal substance contact						
No	reference	reference	reference	reference	reference	reference
Yes	2.24 (2.17, 2.30)	1.30 (1.25, 1.35)	2.51 (2.42, 2.60)	1.39 (1.33, 1.45)	1.98 (1.91, 2.06)	1.20 (1.14, 1.26)
Child Protection Involvement						
No Involvement	reference	reference	reference	reference	reference	reference
Unsubstantiated Allegation	3.98 (3.82, 4.15)	2.24 (2.13, 2.36)	4.46 (4.25, 4.68)	2.31 (2.18, 2.46)	3.41 (3.23, 3.59)	2.18 (2.05, 2.32)
Substantiated Allegation	5.34 (5.09, 5.61)	2.71 (2.55, 2.89)	6.36 (6.01, 6.73)	2.84 (2.63, 3.05)	4.28 (4.02, 4.55)	2.69 (2.49, 2.90)
Substantiated Allegation and entered out-of-home care	8.45 (8.07, 8.85)	3.03 (2.83, 3.24)	10.90 (10.36, 11.47)	3.54 (3.28, 3.82)	5.86 (5.53, 6.20)	2.65 (2.45, 2.87)

*All other covariates included (Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact).

The hazard ratios from Cox regression analysis, which accounts for time to child's first mental health event, increased with level of child protection contact (Table 2). Univariate results showed that compared to children not involved with child protection, children who had ever entered care had the highest hazard ratio for mental health-related events (contacts) (HR:10.90, 95% CI:10.36-11.47), followed by other children with substantiated maltreatment (HR:6.36, 95% CI:6.01-6.73) then children with unsubstantiated maltreatment allegations (HR:4.46, 95% CI:4.25-4.68). After adjusting for background risk factors, the increased hazards were partially attenuated, but remained elevated for all child protection groups, ranging from HR:3.54 (95% CI:3.28-3.82) for children who had entered care to HR:2.31 (95% CI:2.18-2.46) for children with unsubstantiated allegations. For mental health diagnoses the increased unadjusted hazard ranged from 3.41 (95% CI:3.23-3.59) for children with unsubstantiated allegations to 5.86 (95% CI:5.53-6.20) for children who entered care. In the multivariate analysis, hazard ratios were partially attenuated but still showed around a twofold increase, ranging from HR:2.18 (95% CI:2.05-2.32) for unsubstantiated allegations to HR:2.65 (95% CI:2.45-2.87) for those who entered care.

In addition to maltreatment, all background risk factors were associated with increased risk of mental health events and/or diagnosis. Most notably, compared to non-Aboriginal young people, Aboriginal young people had a higher risk of mental health-related events (HR:6.26, 95% CI:6.05-6.48]) unadjusted, although this was partially attenuated in the multivariate analysis (HR:2.21, 95% CI:2.10-2.32). For mental health diagnosis, however, the increased risk for Aboriginal young people was fully attenuated in the multivariate model. Young maternal age and living in the most socially disadvantaged neighbourhoods were both also associated with more than a threefold unadjusted increased risk for a mental health-related event (HR:3.87, 95% CI:3.71-4.03) and HR:3.26 (95% CI:3.10-3.42) respectively, and around a twofold increased risk for a mental health diagnosis.

Maternal mental health hospital contacts had one of the highest hazard ratios for young people's likelihood of a mental health diagnosis (HR:3.00, 95% CI:2.91-3.09) unadjusted, which was partially attenuated in the multivariate analysis but still associated with a doubled hazard ratio (HR:2.15, 95% CI:2.08-2.23). Maternal substance abuse hospital contacts were associated with a similar increased risk for a mental health diagnosis (HR: 2.85, 95% CI:2.75-2.95), however after adjusting for other risk factors was reduced to HR:1.27 (95% CI:1.21-1.33).

Further analysis examined the risk of different types of mental health diagnoses associated with child protection histories (Table 3). Compared to individuals without a maltreatment substantiation, an increased risk was found across all MH diagnostic categories, with adjusted hazard ratios in the two-threefold increased range. The risk for those with any substantiated maltreatment of having a personality disorder diagnosis was particularly high, at HR:6.83 (95% CI:5.81-8.04) unadjusted and HR:3.64 (95% CI:2.94-4.52) adjusted, compared to those without substantiated maltreatment. For the subgroup with a substantiation and out-of-home care placement, the increased likelihood of being diagnosed with a personality disorder was even higher at HR:12.63 (95% CI:10.26-15.55) unadjusted and still showed a large increase in risk after adjusting for other risk factors HR:6.82 (95% CI:5.12-9.08).

Table 3. Risk of mental health diagnosis types for children by level of child protection involvement

Characteristic	Organic mental disorder		Substance related mental and behavioural disorder		Schizophrenia and psychoses		Mood (affective) disorder	
	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*
Child Protection Involvement^								
No Involvement	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Unsubstantiated allegation	2.12 (1.54, 2.92)	1.61 (1.09, 2.38)	4.09 (3.74, 4.47)	2.05 (1.83, 2.31)	3.18 (2.42, 4.18)	1.93 (1.37, 2.72)	3.48 (3.15, 3.85)	2.29 (2.02, 2.58)
Substantiated allegation	2.61 (1.76, 3.88)	2.35 (1.50, 3.68)	4.71 (4.21, 5.27)	2.29 (1.98, 2.65)	4.59 (3.41, 6.18)	2.82 (1.94, 4.10)	4.40 (3.90, 4.96)	2.81 (2.43, 3.25)
Substantiated allegation and entered out-of-home care	5.80 (4.12, 8.17)	4.25 (2.64, 6.83)	8.98 (7.98, 10.11)	2.87 (2.43, 3.38)	8.40 (6.17, 11.42)	3.03 (1.93, 4.75)	5.09 (4.40, 5.89)	2.43 (2.01, 2.94)
Substantiated allegation^								
No	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Yes	3.69 (2.83, 4.82)	2.85 (2.03, 4.01)	5.50 (5.05, 5.99)	2.16 (1.92, 2.42)	5.43 (4.34, 6.78)	2.56 (1.87, 3.50)	4.23 (3.85, 4.66)	2.28 (2.01, 2.58)

*All other covariates included (Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact). ^ Separate Cox regression models, second model compares all children with substantiated allegations (including those who entered out-of-home care) to all children without substantiated allegations (including no contact or only unsubstantiated allegations)

Table 3. Risk of mental health diagnosis types for children by level of child protection involvement (continued)

Characteristic	Stress related disorder		Personality disorder		Disorders of childhood and psychological development	
	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*
Child Protection Involvement^						
No Involvement	Reference	Reference	Reference	Reference	Reference	Reference
Unsubstantiated allegation	3.99 (3.73, 4.26)	2.62 (2.41, 2.84)	4.44 (3.66, 5.39)	3.07 (2.43, 3.87)	4.00 (3.74, 4.28)	2.82 (2.59, 3.06)
Substantiated allegation	5.04 (4.65, 5.46)	3.29 (2.98, 3.62)	5.22 (4.14, 6.59)	3.40 (2.56, 4.50)	4.14 (3.78, 4.54)	2.95 (2.64, 3.29)
Substantiated allegation and entered out-of-home care	7.46 (6.84, 8.14)	3.52 (3.14, 3.96)	12.63 (10.26, 15.55)	6.82 (5.12, 9.08)	7.16 (6.57, 7.80)	3.72 (3.30, 4.19)
Substantiated allegation^						
No	Reference	Reference	Reference	Reference	Reference	Reference
Yes	5.35 (5.04, 5.68)	2.77 (2.56, 3.01)	6.83 (5.81, 8.04)	3.64 (2.94, 4.52)	4.84 (4.53, 5.16)	2.64 (2.42, 2.87)

*All other covariates included (Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact). ^ Separate Cox regression models, second model compares all children with substantiated allegations (including those who entered out-of-home care) to all children without substantiated allegations (including no contact or only unsubstantiated allegations)

Comorbidity of substance related disorders with other mental and behavioural disorders is common, and Table 4 shows the increased risk of mood and stress disorders respectively, with and without comorbid substance related disorders. The increased risk of comorbid disorders among those with a history of substantiated maltreatment is even higher than the increased risk for a single diagnosis. For stress related disorders, the increased risk for a single diagnosis for young people who have any maltreatment substantiation is HR:4.82 (95% CI:4.50-5.15) unadjusted compared to HR:7.90 (95% CI:6.90-9.04) unadjusted for comorbid stress and substance related diagnoses. Young people who have a substantiation and have entered care appear particularly vulnerable to this type of comorbidity, with an unadjusted HR:14.06 (95% CI:11.81-16.75) for comorbid stress and substance related diagnoses compared to around six-fold increased likelihood of either disorder. Even after adjusting for other risk factors, young people who had been in care had a fourfold increased likelihood of comorbid stress and substance related diagnoses (HR:4.61, 95% CI:3.57-5.94). Young people who had been in care were also at elevated risk for mood and substance related disorders (HR:8.80, 95% CI:6.86-11.29) unadjusted and HR:3.03 (95% CI:2.14-4.31) adjusted compared to those with no child protection involvement.

Table 4. Risk of comorbid mood and substance related mental and behavioural disorders for children by level of child protection involvement

Characteristic	Mood (affective) disorder[1]		Substance related mental and behavioural disorder[2]		Mood AND substance related mental and behavioural disorder	
	Univariate HR (95% CI)	Multivariate HR (95% CI)*	Univariate HR (95% CI)	Multivariate HR (95% CI)*	Univariate HR (95% CI)	Multivariate HR (95% CI)*
Child Protection Involvement^						
No Involvement	Reference	Reference	Reference	Reference	Reference	Reference
Unsubstantiated allegation	3.18 (2.83, 3.57)	2.21 (1.92, 2.54)	3.92 (3.55, 4.34)	1.92 (1.68, 2.19)	4.54 (3.75, 5.51)	2.52 (1.97, 3.22)
Substantiated allegation	3.81 (3.31, 4.40)	2.56 (2.16, 3.03)	4.23 (3.71, 4.82)	1.95 (1.64, 2.31)	6.45 (5.17, 8.04)	3.60 (2.73, 4.73)
Substantiated allegation and entered out-of-home care	4.05 (3.38, 4.86)	2.20 (1.75, 2.77)	8.59 (7.54, 9.77)	2.71 (2.26, 3.26)	8.80 (6.86, 11.29)	3.03 (2.14, 4.31)
Substantiated allegation^						
No	Reference	Reference	Reference	Reference	Reference	Reference
Yes	3.59 (3.20, 4.03)	2.10 (1.82, 2.43)	5.13 (4.66, 5.65)	1.96 (1.71, 2.23)	6.39 (5.38, 7.58)	2.78 (2.19, 3.53)

*All other covariates included (Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact). ^ Separate Cox regression models, second model compares all children with substantiated allegations (including those who entered out-of-home care) to all children without substantiated allegations (including no contact or only unsubstantiated allegations) [1] excludes comorbid substance related mental and behavioural disorders [2] excludes mood (affective) disorders

Table 4. Risk of comorbid stress and substance mental and behavioural disorders for children by level of child protection involvement (continued)

Characteristic	Stress related disorders[1]		Substance related mental and behavioural disorder[2]		Stress AND substance related mental and behavioural disorder	
	Univariate HR (95% CI)	Multivariate HR (95% CI)*	Univariate HR (95% CI)	Multivariate HR (95% CI)*	Univariate HR (95% CI)	Multivariate HR (95% CI)*
Child Protection Involvement^						
No Involvement	Reference	Reference	Reference	Reference	Reference	Reference
Unsubstantiated allegation	3.75 (3.49, 4.03)	2.61 (2.39, 2.84)	3.62 (3.25, 4.03)	1.83 (1.59, 2.11)	5.14 (4.40, 6.00)	2.54 (2.07, 3.12)
Substantiated allegation	4.72 (4.32, 5.16)	3.23 (2.90, 3.59)	3.98 (3.46, 4.57)	1.86 (1.56, 2.23)	6.48 (5.36, 7.83)	3.34 (2.62, 4.27)
Substantiated allegation and entered out-of-home care	6.29 (5.70, 6.94)	3.24 (2.85, 3.69)	6.35 (5.43, 7.41)	1.97 (1.60, 2.44)	14.06 (11.81, 16.75)	4.61 (3.57, 5.94)
Substantiated allegation^						
No	Reference	Reference	Reference	Reference	Reference	Reference
Yes	4.82 (4.50, 5.15)	2.67 (2.44, 2.91)	4.35 (3.91, 4.84)	1.68 (1.45, 1.94)	7.90 (6.90, 9.04)	3.12 (2.57, 3.78)

*All other covariates included (Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact). ^ Separate Cox regression models, second model compares all children with substantiated allegations (including those who entered out-of-home care) to all children without substantiated allegations (including no contact or only unsubstantiated allegations) [1] excludes comorbid substance related mental and behavioural disorders [2] excludes stress related disorders

All maltreatment types were associated with elevated risk, with similar levels of increased risk across maltreatment types. In the univariate analysis, each of the maltreatment types was associated with an increased risk for a mental health-related event (ranging from HR 5.45 (95% CI: 5.23-5.69) for sexual abuse to HR 7.60 (95% CI: 7.27-7.94) for neglect. In the multivariate analysis, increased risk of a mental health-related event ranged from HR 2.04 (95% CI: 1.86-2.24) for emotional abuse to HR 2.58 (95% CI: 2.44-2.73) for sexual abuse (Table S1).

To assess the possibility that children placed in out-of-home care may be receiving services earlier and more routinely because of entry into care, we examined time to mental health contact following the first substantiation. The average time from first substantiation to any mental health event was similar at 64 months for all children and 66.5 months for those who entered out-of-home care. As the data only provided the dates service use occurred, we cannot be certain whether maltreatment occurred before mental health symptoms developed. Three quarters (73%) of young people with both mental health contact and maltreatment substantiations had the first recorded maltreatment occur prior to the first recorded mental health contact.

DISCUSSION

Only 3.6% of children without child protection contact in Western Australia had a mental health diagnosis, compared to 20% of children with substantiated maltreatment. This significantly increased risk for mental health diagnoses and events is consistent with other studies looking at child welfare or maltreated populations [3 4] and shows the need to support the mental health of children and young people with a history of maltreatment. We found increased risk for mental health events and diagnosis were common across children with different maltreatment histories, levels of child protection, and across different types of mental health diagnosis, however there were marked differences in risk.

Children with a mental health-related contact were more likely than other children to also have parents with a history of mental health contacts. This may reflect both genetic and environmental factors[6 7]. Parenting capacity can be affected by mental illness, with previous research showing that maternal mental illness is associated with increased risk of child maltreatment[8]. After controlling for socio-demographic factors and child protection involvement, maternal mental health contacts were still associated with around a two-fold increased risk of mental health events and diagnoses among young people. This represented one of the factors associated with the highest increased risk among our many risk factors.

Both mental health events and maltreatment substantiations were more common in disadvantaged neighbourhoods, teenage mothers, and parents who were single at the child's birth. This is consistent with previous research[3] and highlights the way social determinants and adverse outcomes tend to cluster together creating problems that are complex to resolve at an individual or societal level. It also highlights the importance of accounting for multiple risk factors when examining the relationship between maltreatment and mental health outcomes.

Aboriginal young people had a higher risk only for mental health events, but not for diagnoses, within the multivariate models. Possible explanations could be not reaching the threshold of diagnoses, concerns about the cultural appropriateness of diagnoses, or lack of psychiatric services in rural and remote areas therefore not getting a diagnosis.

Despite controlling for background adversity and parental mental health hospital contacts, we found maltreated children were at significantly increased risk of mental health outcomes and diagnoses. Our study is congruent with previous research showing an increased risk of mental health problems and service use in child protection/maltreated samples, however we found the association held across many diagnostic groups such as schizophrenia, which has had mixed results in previous studies (e.g. in smaller population study by Spataro et al[9], the relative risk for schizophrenia associated with child maltreatment did not reach significance, whereas Vinnerljung et al[4] found elevated rates of psychosis (which includes schizophrenia) among their out-of-home care groups that were comparable to our findings for maltreated children although somewhat lower than for our out-of-home care group.

The greatest increased risk was for personality disorder, with a seven-fold increased likelihood among children with any maltreatment, and twelve-fold increased likelihood among maltreated children who entered care (prior to adjusting for other risk factors). The increase was still sizeable after controlling for background risk. Personality disorder was not included in previous large scale studies such as Vinnerljung, Hjern and Lindblad (2006)[4], with many studies focussing on common and easy to measure disorders such as depression and anxiety. Smaller prior studies have found personality disorders to be more common among people who had experienced child maltreatment [9-11], but have tended to be limited to specific disorders (borderline personality disorder[11] and antisocial personality disorder[10]) or maltreatments types (sexual abuse[9 11]), and results have not always been consistent in multivariate models[10]. The present study suggests young people who have been maltreated may be particularly susceptible to developing personality disorders. Trauma and disrupted attachments as often occur for abused or neglected children are widely believed to contribute to the development of personality disorders [12-14]. To date, treatment of personality disorders has only been modestly successful, reducing symptoms such as self-harm, but often social, vocational and quality of life impairments remain, and a long-term approach is recommended[15].

While not significantly different across all comparisons, we found higher likelihood of mental health events and diagnoses among young people with higher levels of child protection contact. We are not aware of any studies examining mental health outcomes across all four child protection groups (no child protection contact, only unsubstantiated allegations, substantiated allegations, and substantiated allegations with placement in out-of-home care). Vinnerljung et al[4] compared child welfare clients that remained at home and those placed in out-of-home care with the general population, with both child welfare groups showing similarly elevated rates for various mental health outcomes. Among a younger cohort, Hussey found outcomes were equally poor for children with unsubstantiated maltreatment as substantiated maltreatment[16]. Our results showed a general tendency for higher mental health risks associated with higher levels of child protection involvement, however were congruent with the finding that children with maltreatment allegations were at increased risk for mental health diagnoses. Mental health support needs to be made available for children and young people with maltreatment allegations, regardless of whether their case is substantiated and if they enter out-of-home care. This should be used in conjunction with services to parents to improve child safety and family functioning to prevent children from developing mental health issues.

Our study also included all four maltreatment types (neglect, physical, sexual and emotional abuse), and found increased risk of mental health events across all maltreatment types. This differs slightly from Fergusson's study that showed much more consistent results for sexual abuse than physical abuse after adjusting for other risk factors[3]. Our study also found similar mental health outcomes for children who had been neglected, physically or emotionally abused, which haven't received the same level of research attention. Sexual abuse is often singled out as a risk factor for poor mental

health outcomes. Our results showed that while young people who had been sexually abused had the highest hazard ratio for mental health diagnoses, all maltreatment types had an elevated risk. However, only one alleged maltreatment type was supplied in the data per investigation, so children experiencing multiple maltreatment types cannot be identified in this study. Regardless of the abuse type identified in the child protection database, all children with substantiated maltreatment should be provided with access to mental health services as required.

A limitation of our study is that it only captures public outpatient and public and private hospital inpatient mental health events: data on outpatient mental health services provided by private hospitals, private psychologists/psychiatrists, or managed by general practitioners (family doctors) was not available. As a result, mental health service use is better captured for more severe mental health problems where inpatient admissions occur. Although this may be a potential source of bias in our model estimates, these groups are likely to represent the heaviest users of government mental health services, and those most in need. A further issue in using service data to examine mental health outcomes is that accessing services for mental health is both an indicator of an adverse outcome (mental health issues) and a positive indicator that some service needs are being met. It also constitutes a measure of services provided or the service burden associated with subgroups of the population. Diagnoses are a somewhat better indicator of mental health status, but rates may still be affected by different levels of service use – under-ascertainment of mental health disorders may be present for any or groups within the study if an individual does not access mental health services. Other limitations include uncertainty around the true start date of an individual's mental health symptoms or maltreatment, so it is possible that in some cases the order of events differs from that suggested by their recorded service use.

Despite these limitations, the study had many strengths and provides significant new information regarding the mental health of children in contact with the child protection. Linked population data allows the examination of sensitive topics without the recruitment and sample loss challenges that affect many surveys. The study included a population cohort of children, with data from birth to young adulthood, and accounting for parents' mental health and a range of background adversities. The data enabled our study to build on previous research by detailed examination of the increased risk of mental health problems among subgroups within the child protection system, including those with different levels of child protection involvement, and different maltreatment types, and identifying the level of increased risk for different mental health diagnoses.

Our findings highlight a failure in the responsiveness of the child protection system as a whole to assist children with mental health issues, especially as evidenced by an average time of 5 years between a child's first maltreatment substantiation and access to a service. We acknowledge though that children may be involved in child protection at a young age and therefore mental health issues may take time to appear. However, we would argue that given the trauma and adverse social circumstances these children experience, mental service provision should be addressed and seen as a priority, and this may be an opportunity to provide earlier interventions for better outcomes.

Previous research showing high levels of mental health service needs among the child protection population are supported by the results of this study. An increased risk was found across all subgroups, regardless of what type of maltreatment the child's record showed, and whether maltreatment was substantiated, although children with higher levels of child protection involvement were also at greater risk for mental health events and diagnoses. The strongly increased risk for personality disorders, and comorbid substance and mental health disorders highlights a need for targeted plans to reduce or treat these challenging mental health issues that can severely impact on young people's wellbeing and ability to adjust to independent adult life.

Word count: 4,162

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Contributors: MJM drafted the paper, interpreted findings, and revised the paper. SAS cleaned and analysed the data, contributed to the draft and revised the paper. MOD conceptualised the paper, developed the statistical plan, contributed to the draft and revised the paper. All authors approved the final manuscript as submitted. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Provenance and peer review: Not commissioned; externally peer reviewed.

Data sharing statement: The data utilised in this paper is owned by our respective Government Departments and therefore would require permissions by these Departments for others to access.

REFERENCES

1. Kaplan S, Pelcovitz D, Labruna V. Child and adolescent abuse and neglect research: A review of the past 10 years. Part I: Physical and emotional abuse and neglect. J Am Acad Child Adolesc Psychiatry 1999;**38**:1214-22.
2. National Scientific Council on the Developing Child. Cambridge MCotDC, Harvard University. The science of neglect: The persistent absence of responsive care disrupts the developing brain: Working Paper 12. Cambridge, MA Center on the Developing Child, Harvard University, (2012).
3. Fergusson DM, Boden JM, Horwood LJ. Exposure to childhood sexual and physical abuse and adjustment in early adulthood. Child Abuse Negl 2008;**32**(6):607-19.
4. Vinnerljung B, Hjern A, Lindblad F. Suicide attempts and severe psychiatric morbidity among former child welfare clients – a national cohort study. Journal of Child Psychology and Psychiatry 2006;**47**(7):723-33.
5. Australian Bureau of Statistics. Socio-Economic Indexes for Areas (SEIFA) - Technical Paper. Canberra: Australian Bureau of Statistics, 2008.
6. Kendler KS, Walters EE, Neale MC, et al. The structure of the genetic and environmental risk factors for six major psychiatric disorders in women: Phobia, generalized anxiety disorder, panic disorder, bulimia, major depression, and alcoholism. . Arch Gen Psychiatry 1995;**52**(5):374-83.
7. Etain B, Henry C, Bellivier F, et al. Beyond genetics: Childhood affective trauma in bipolar disorder. Bipolar disorders 2008;**10**(8):867.
8. O'Donnell M, Maclean MJ, Sims S, et al. Maternal mental health and risk of child protection involvement: mental health diagnoses associated with increased risk. J Epidemiol Community Health 2015;**69**(12):1175-83.
9. Spataro J, Mullen PE, Burgess PM, et al. Impact of child sexual abuse on mental health: Prospective study in males and females. Br J Psychiatry 2018;**184**(5):416-21.
10. Horwitz AV, Widom CS, McLaughlin J, et al. The impact of childhood abuse and neglect on adult mental health: A prospective study. . J Health Soc Behav 2001;**42**(2):184-201.
11. Hillberg T, Hamilton-Giachritsis C, Dixon L. Review of meta-analyses on the association between child sexual abuse and adult mental health difficulties: A systematic approach. . Trauma, Violence & Abuse 2011;**12**(1):38-49.
12. Paris J. Childhood Adversities and Personality Disorders. In: Livesley WJ, Larstone R, eds. Handbook of personality disorders: Theory, research and treatment. 2nd ed. New York: The Guildford Press, 2018.
13. Fonagy P, Luyten P. Attachment, Mentalising and the Self. In: Livesley WJ, Larstone R, eds. Handbook of personality disorders: Theory, research and treatment. 2nd ed. New York: The Guildford Press, 2018.
14. Infurna MR, Brunner R, Holz B, et al. The specific role of childhood abuse, parental bonding, and family functioning in female adolescents with borderline personality disorder Journal of Personality Disorders 2016;**30**(2):177-92.
15. Bateman AW, Gunderson J, Mulder R. Treatment of personality disorder. The Lancet 2015;**385**(9969):735-43.
16. Hussey JM, Marshall JM, English DJ, et al. Defining maltreatment according to substantiation: distinction without a difference? Child Abuse Negl 2005;**29**(5):479-92.

Figure 1. Percentage of children born in WA between 1990-2009 with mental health-related contacts at any time, by level of child protection involvement*

* Includes mental health diagnoses, self-harm and mental health related codes. # Child protection categories were not exclusive and therefore children can be counted more than once across levels of child protection involvement.

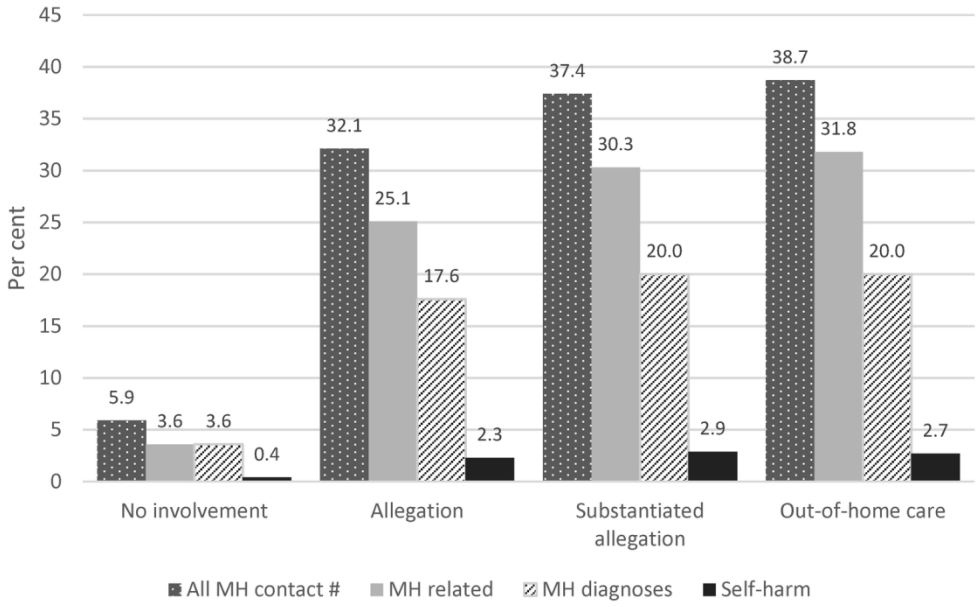

Figure 1. Percentage of children born in WA between 1990-2009 with mental health-related contacts at any time, by level of child protection involvement*

* Includes mental health diagnoses, self-harm and mental health related codes. # Child protection categories were not exclusive and therefore children can be counted more than once across levels of child protection involvement.

139x92mm (300 x 300 DPI)

Table S1. Risk of mental health contact or mental health diagnoses by maltreatment type (primary concern at notification)

Maltreatment type	Any Mental health-related event		Mental health diagnoses	
	Univariate OR (95% CI)	Multivariate OR (95% CI)*	Univariate OR (95% CI)	Multivariate OR (95% CI)*
Any Physical	6.13 (5.86, 6.40)	2.49 (2.34, 2.65)	4.56 (4.35, 4.78)	2.35 (2.22, 2.50)
Any Sexual	5.45 (5.23, 5.69)	2.58 (2.44, 2.73)	4.32 (4.13, 4.52)	2.70 (2.55, 2.85)
Any Emotional	5.85 (5.46, 6.27)	2.04 (1.86, 2.24)	3.96 (3.66, 4.27)	1.87 (1.70, 2.06)
Any Neglect	7.60 (7.27, 7.94)	2.36 (2.22, 2.52)	4.13 (3.93, 4.35)	1.84 1.71, 1.97)

* Includes adjustment for Aboriginality, gender, SES, parent marital status at birth, maternal age at birth, paternal age at birth, maternal MH contact, maternal substance related contact, paternal MH contact, paternal substance related contact

Reporting checklist for cohort study.

Based on the STROBE cohort guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cohort reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2

Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	3
Study design	#4	Present key elements of study design early in the paper	3,4
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3,4
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up.	3,4
	#6b	For matched studies, give matching criteria and number of exposed and unexposed	n/a (not a matched study)
Variables	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	3,4

Bias	#9	Describe any efforts to address potential sources of bias	17
Study size	#10	Explain how the study size was arrived at	3
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	5
	#12b	Describe any methods used to examine subgroups and interactions	4
	#12c	Explain how missing data were addressed	5
	#12d	If applicable, explain how loss to follow-up was addressed	5
	#12e	Describe any sensitivity analyses	n/a (none required)
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	3,4 (retrospective population birth cohort)
	#13b	Give reasons for non-participation at each stage	n/a (birth cohort)

	#13c	Consider use of a flow diagram	n/a (not deemed warranted)
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	7
	#14b	Indicate number of participants with missing data for each variable of interest	6
	#14c	Summarise follow-up time (eg, average and total amount)	
Outcome data	#15	Report numbers of outcome events or summary measures over time. Give information separately for exposed and unexposed groups if applicable.	5
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-11
	#16b	Report category boundaries when continuous variables were categorized	8
	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a (we used Hazard Ratios)

Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	13,14,15
Key results	#18	Summarise key results with reference to study objectives	2,5-15
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	17
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	15,16
Generalisability	#21	Discuss the generalisability (external validity) of the study results	17,18
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18