



The influence of parental offending on the continuity and discontinuity of children's internalizing and externalizing difficulties from early to middle childhood

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Abstract

Purpose Although parental criminal offending is a recognized risk factor for conduct problems among offspring, its impact on the continuity and discontinuity of children's behavioural and emotional difficulties during the early development is less well known. We used data from a large, population-based record-linkage project to examine the relationship between parental offending and the continuity and discontinuity of children's conduct, attentional, and emotional difficulties from early to middle childhood while also considering the role of timing of the parental offending exposure.

Method Data for 19,208 children and their parents were drawn from the New South Wales Child Development Study. Multinomial regression analyses tested associations between mother's and father's history and timing of any and violent offending, and patterns of continuity or discontinuity in offspring emotional, conduct, and attentional difficulties between ages 5 and 11 years.

Results Maternal and paternal offending each conferred a significantly increased risk of all the patterns of developmental difficulties, including those limited to age 5 only (remitting problems), to age 11 only (incident problems), and to difficulties present at both ages 5 and 11 years (persisting problems). Greatest odds were observed for persisting conduct problems. Paternal offending that continued through early and middle childhood had the greatest association with child difficulties, while the timing of maternal offending had a less prominent effect on child developmental difficulties.

Conclusion Parental offending is a strong risk factor for early and pervasive behavioural and emotional problems in offspring, and may be a key indicator of high risk for later antisocial behaviour.

Keywords Conduct problems · Hyperactivity/inattention · Emotional symptoms · Parental offending · Child development · Record linkage

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Introduction

The offspring of parents who engage in criminal or anti-social behaviour are at a greater risk of engaging in similar behaviours themselves [1–5]. Some evidence also suggests that these children are at risk of a broader range of

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developmental difficulties, including problems with conduct [6], emotional regulation [7], and cognition [8]. Early and pervasive conduct problems, and emotional and attentional difficulties (particularly when comorbid with conduct disorder) are widely regarded as some of the strongest risk factors for future offending and other adverse outcomes [9–13]. These difficulties experienced by the children of parents who offend may represent the early manifestations of an intergenerational transmission of criminal behaviour [14, 15].

The risk for offspring (of parents who offend) of a broad range of developmental problems has been recently confirmed in a large population-based study by Laurens and colleagues [16], in which the relationship between maternal and paternal offending and early childhood development was examined by the current study team in a representative population cohort of 66,477 children from the New South Wales Child Development Study (NSW-CDS) in Australia. Children's emotional, social, cognitive, physical, and communication skills development was measured at approximately 5 years of age. Results indicated that the children of parents with a history of offending were more likely to have developmental vulnerabilities in all the developmental domains; a finding that has been replicated recently in another large Australian cohort [17]. Laurens and colleagues [16] also found that children's risk of poor development was magnified when parents had a history of violent offending. Furthermore, maternal offending had a stronger effect on early childhood development than paternal offending, which is supported by a number of other studies where the offending of both parents, as opposed to fathers only, has been considered [18–22].

Parental offending may also have an enduring effect on child development, as some evidence suggests that the children of parents who engage in antisocial behaviour and/or criminal offending are at risk of experiencing difficulties that continue throughout childhood. Findings from a large, representative birth cohort of children from Quebec (Canada) support a link between maternal antisocial behaviour and the continuity of high levels of child physical aggression from 17 to 42 months of age [23] and of chronic conduct problems from 29 to 74 months of age [22], whereas paternal antisocial behaviour predicted the continuity of children's hyperactivity–impulsivity and inattention from 17 months to 8 years of age [24]. This evidence of a link between parental offending and continuity of developmental problems in offspring has not, however, been consistently identified, particularly in samples less representative of the wider population. In one such study, Coley, Carrano, and Lewin-Bizen [25] found that, among low-income families, paternal antisocial behaviour during children's preschool years predicted children's internalizing and externalizing problems in early, but not middle, childhood. Furthermore, in a sample of children to parents with a high risk of violent and delinquent behaviour,

Lizotte and colleagues [26] found a link between parent's criminal history and children's externalizing problems in middle, but not early, childhood.

It is also possible that children may be particularly susceptible to the timing of parent's offending in relation to their own age and stage of development, with early childhood being arguably the most sensitive period [27]. This may be due to younger children having more direct exposure to an offending parent than older children, thereby increasing the likelihood of modelling their parent's behaviour (i.e., social learning; [28]), and experiencing stressful events associated with parental antisocial behaviour. However, Beseimer [27] was unable to find support for the sensitive period hypothesis with regard to the intergenerational transmission of offending, finding instead that the frequency, rather than timing, of parental offending after the child's birth had the greatest effect on children's offending behaviour.

Given the inconsistency of previous findings, it, thus, remains unclear if maternal and paternal offending is associated with the continuity of children's conduct, emotional, and attention difficulties, and further, whether the timing of parental offending has a substantive impact on these outcomes. We propose to build on the findings of the previous NSW-CDS research [16, 29] which investigated associations between parental offending and offspring developmental problems at one time point (5 years), to examine associations between parental offending and the (dis)continuity of children's emotional, conduct, and attentional difficulties from age 5 to 11 years. We also propose to examine separately the effects of maternal and paternal history of any offending, violent offending, and the timing of any offending, while adjusting for socio-demographic covariates that may influence these relationships.

Methods

Data were drawn from the New South Wales Child Development Study (NSW-CDS; <http://nsw-cds.com.au>), an Australian state-wide longitudinal population-based record-linkage project [30, 31]. The NSW-CDS comprises a cohort of 91,635 children, defined by their inclusion in the 2009 Australian Government Department of Education and Training's Australian Early Development Census (AEDC; [32, 33]) and/or the NSW-CDS investigator-led 2015 Middle Childhood Survey (MCS; [34]). The NSW-CDS began with a cohort of 87,037 children (99.7% of NSW school-starters) who started their first year of full-time schooling in 2009, and linked data available on the children and their parents from multiple government agencies (i.e., health, education, justice, and child protection) with the 2009 AEDC (wave 1). A second record-linkage (wave 2) was completed in 2016, and includes data from the investigator-led MCS: survey

data were obtained for 31.4% ($n=27,792$) of all NSW year six students, and captured 26.6% ($n=23,194$) of the original 2009 AEDC cohort [31]. Children were approximately 5 and 11 years of age at the time of the AEDC and MCS assessments, respectively. Demographic profiles indicate that the population cohort of the NSW-CDS, and specifically the AEDC and MCS sub cohorts, are comparable to the NSW population [31, 34].

Data linkage was completed by the Centre for Health Record-Linkage (<http://www.cherel.org.au/>) using probabilistic linkage methods that adhere to strict privacy protocols. The minimum matching variables used were name, date of birth, residential address, and sex (for more information, see [30, 31]). The majority of children were able to be linked to the parental records of their mothers ($n=73,944$, 80.7% of the cohort) and fathers ($n=71,532$, 78.1% of the cohort) using data from the NSW Register of Births, Deaths, and Marriages Birth Registration data collection. For this study examining the impact of parental offending on the (dis)continuity of developmental difficulties from early (AEDC) to middle (MCS) childhood, the sample was limited to the 19,208 children with no special needs for whom both AEDC and MCS measures, and linked mother and father records, were available.

Measures

Early and middle childhood developmental difficulties

Measures of childhood emotional, conduct, and attentional difficulties were derived from the teacher-rated AEDC and the self-reported MCS assessments (see Table S1 in supplementary materials for the individual items comprising each outcome measure). At 5 years of age, these difficulties were extracted from the Emotional Maturity Scale (EMS) of the AEDC, which has satisfactory reliability and validity [35]. The EMS subdomains of anxious and fearful behaviour (emotional; Cronbach's $\alpha=0.80$), aggressive behaviour (conduct; Cronbach's $\alpha=0.88$), and hyperactive and inattentive behaviour (attentional; Cronbach's $\alpha=0.91$) were used in the current analyses, and provide valid and reliable measures of child emotion and behaviour [36, 37]. Children who scored in approximately the bottom 10% of each subdomain of the national AEDC population distribution were classified as 'vulnerable', while the remaining 90% were classified as 'not vulnerable'. In our subsample, 9.5%, 7.0%, and 8.7% of children were considered vulnerable on the emotional, conduct, and attentional AEDC subdomains, respectively. We note that the AEDC is a teacher-rated population measure of early childhood development and is not intended as a diagnostic tool of developmental difficulty.

Comparable indicators of emotional, conduct, and attentional difficulties were measured at 11 years of age in the

MCS using the Strength and Difficulties Questionnaire (SDQ), which is a validated measure of prosocial behaviour and psychopathology [38, 39]. The SDQ subscales measuring emotional symptoms (ordinal $\alpha=0.79$), conduct problems (ordinal $\alpha=0.80$), and hyperactivity/inattention (ordinal $\alpha=0.77$) used in this study are reliable and valid measures of such outcomes [16, 40, 41]. As per the established scoring metric for the SDQ, children who scored in approximately the lowest 10% of each psychopathology subscale, according to UK population norms, were rated 'abnormal' [37]. Using this criterion, 9.0%, 9.1%, and 12.5% of our subsample were considered abnormal for emotional symptoms, conduct problems, and hyperactivity/inattention, respectively. Concurrent validity between the EMS and SDQ subdomains has been demonstrated for teacher and parent ratings of both scales for 3–5 years old [36, 42].

Children were identified as presenting emotional, conduct, or attentional difficulties if they scored at the vulnerable (EMS) level or abnormal (SDQ) level for the relevant domain. Children whose scores represented vulnerable or abnormal functioning on at least one of the three outcomes of interest were also identified as presenting any developmental difficulties. We then designated children to one of the four developmental groups representing continuity or discontinuity of difficulties at age 5 and 11 years in each of the outcomes. The two categories representing continuity between the two time points in the level of difficulties identified were 'persisting' (difficulties identified at both ages 5 and 11 years) and 'none' (no difficulties at either time point). The two categories representing discontinuity in the level of difficulties identified at age 5 and 11 years were 'remitting' (difficulties at age 5 but not at age 11 years) and 'incident' (difficulties at age 11 years only).

Parental offending

Maternal and paternal criminal records were obtained from the NSW Bureau of Crime Statistics and Research (BOCSAR) Reoffending Database, which contains finalized criminal legal matters within the NSW Criminal Justice System for all individuals with at least one proven offence. These data include information on court appearances for charges presented before the Local, District, and Supreme Criminal Courts between January 1994 and December 2015. From these data, we derived six offending variables, indicating whether the child's mother or father was convicted of committing: (1) any offence; (2) a violent offence (e.g., homicide, assault, aggravated robbery, and sexual assault); and (3) the timing of any offence. The timing variable distinguished mothers and fathers who committed offences: (1) prior to their child's birth only; (2) during early childhood (before the AEDC); (3) during middle childhood (before the MCS); or (4) during both early and middle childhood

(parents in the latter three categories may have also offended before their child's birth).

Covariates

This study controlled for five socio-demographic factors commonly considered to be potential confounders of any association between parental offending and child developmental difficulties: (1) child's sex (male/female); (2) mother's age at child's birth (≤ 25 years vs. > 25 years; derived from the NSW Ministry of Health's Perinatal Data Collection); (3) Aboriginal and/or Torres Strait Islander status (yes/no); (4) Language Background Other than English (LBOTE; yes/no); and (5) four groups representing stability or change in children's socio-economic disadvantage (SED), based on the child's school and residential postcode at the time of the AEDC and MCS assessments, respectively. Our measure of SED was derived from the Socio-Economic Indexes for Areas (SEIFA; [43]), which indexes the average income and employment status for each residential postcode in Australia. Lower SEIFA scores indicate greater socio-economic disadvantage. Quintiles were produced from SEIFA and dichotomized to indicate the most disadvantaged (quintile 1) versus the not most disadvantaged (quintile 2–5). We then created four groups indicating stability or change in SED from age 5 to 11 years: (1) among the most disadvantaged at age 5 and 11 years; (2) among the most disadvantaged at age 5 only; (3) among the most disadvantaged at age 11 only; and (4) not among the most disadvantaged at 5 and 11 years.

Statistical analysis

A series of multinomial logistic regression analyses, unadjusted and adjusted for covariates, were conducted to examine the association between parental history of any and violent offending and the developmental patterns of (dis)continuity of child emotional, conduct, attentional, and any difficulties across early and middle childhood. Another series of multinomial logistic regression tests were used for the subgroup of children with a parent who had a history of offending ($n = 5899$) to examine the association between the timing of parental offending and the developmental groups of child difficulties. These latter analyses were restricted to consideration of parents with a history of any offending and children with any difficulties to maximize statistical power. In all the analyses, children with no difficulties at any age (none) were the reference group. Cell sizes for each of these analyses are reported in Tables S2 and S3 of the supplementary materials. Due to reporting restrictions required to protect privacy, results were omitted for cells with fewer than 15 children. In all regression models, we report the Odds Ratios (OR) and the 95% Confidence Intervals (95% CI) as measures of effect size and precision of the association between

the exposure and outcome variables. Results were considered statistically significant if the 95% CI did not cross 1.00.

Results

Sample characteristics

Table 1 presents demographic characteristics for the child cohort. Approximately half of the total sample of children were male (49.2%), almost one-fifth of children had a young mother at child birth (16.9% aged 25 years or less), 5.9% identified as Aboriginal and/or Torres Strait Islander, 15.8% had a LBOTE, and 10.9% were in the most disadvantaged SED category at ages 5 and 11 years. For reference, the results of univariate analyses testing associations between each of the covariates and the developmental groups of child difficulties are presented in Table S5 of the supplementary materials. The majority of children in the cohort did not have a parent with a history of offending (69.3%). More than twice as many children had a father with a history of offending (28%) than had a mother with a history of offending (9.4%), while a few children had both parents with a history of offending (6.7%). Parental history of violent offending was less common, and observed more often in fathers (10.1%) than mothers (2.7%).

Paternal offending and child developmental difficulties

Table 2 presents the unadjusted and adjusted associations between paternal any or violent offending, and the developmental groups of child emotional, conduct, attentional, and any difficulties. In both the unadjusted and adjusted models, paternal offending had the strongest association with children's persisting difficulties, particularly persisting conduct difficulties (unadjusted: OR = 3.12 [95% CI = 2.42–4.03]; adjusted: OR = 2.63 [95% CI = 2.00–3.46]). Smaller but still significant ORs were observed for any paternal offending and for remitting and incident difficulties for all types of problems, with the exception that there was no significant effect observed for persisting emotional difficulties in the adjusted model. A similar result was observed for paternal violent offending, with the highest ORs again occurring for persisting conduct difficulties (unadjusted: OR = 3.32 [95% CI = 2.46–4.48]; adjusted: OR = 2.55 [95% CI = 1.83–3.55]).

Maternal offending and child developmental difficulties

Presenting a similar pattern to fathers, maternal offending (Table 3) was significantly associated with most groups of child developmental difficulties, with the highest ORs also

Table 1 Sample descriptives for the child cohort ($N=19,208$)

	<i>n</i>	(%)
Outcome variables		
Emotional difficulties		
Persisting	217	1.1
Remitting	1656	8.6
Incident	1443	7.5
None	15,768	82.1
Conduct difficulties		
Persisting	240	1.2
Remitting	1121	5.8
Incident	1413	7.4
None	16,311	84.9
Attention difficulties		
Persisting	387	2.0
Remitting	1302	6.8
Incident	1948	10.1
None	15,450	80.4
Any difficulties		
Persisting	1200	6.2
Remitting	2540	13.2
Incident	3401	17.7
None	12,067	62.8
Exposure variables		
Any parental offending		
Mother	1808	9.4
Father	5371	28.0
No history of parental offending	13,309	69.3
Violent parental offending		
Mother	515	2.7
Father	1946	10.1
Covariates		
Child sex		
Male	9452	49.2
Female	9756	50.8
Mothers age at child's birth		
25 years or less	3250	16.9
26 years or more	15,958	83.1
Aboriginal and/or Torres Strait Islander status		
No	18,082	94.1
Yes	1126	5.9
Language background other than English (LBOTE)		
English	3037	15.8
Language background other than English	16,171	84.2
Child socio-economic Status		
Most disadvantaged at 5 and 11 years	2101	10.9
Most disadvantaged at 5 years only	1309	6.8
Most disadvantaged at 11 years only	2702	14.1
Not most disadvantaged at either 5 or 11 years	13,064	68.0

observed for persisting difficulties. The children of mothers with a history of any offending had the greatest odds of persisting any difficulties (unadjusted: OR = 2.79 [95% CI = 2.36–3.29]; adjusted: OR = 2.05 [95% CI = 1.72–2.45]), while the children of mothers with a history of violent offending had the highest odds of persisting conduct difficulties (unadjusted: OR = 4.96 [95% CI = 3.19–7.73]; adjusted: OR = 3.22 [95% CI = 1.98–5.23]). The association between maternal violent offending and persisting emotional difficulties was omitted because of the small cell sizes.

Timing of maternal and paternal offending and child developmental difficulties

Next, we examined the association between the timing of parental any offending and the occurrence of any childhood developmental difficulties. A sensitivity analysis indicated that, in both unadjusted and adjusted models, the children of mothers or fathers with a history of offending only before the child's birth were more likely to have any persisting, remitting, and incident difficulties relative to the children of parents with no history of offending (see Supplementary Table S4). We then limited our analyses to the children of parents with a history of any offending to determine if parental any offending during the early or middle childhood was associated with any offspring developmental difficulties, relative to the children of parents who offended only before their child's birth.

The results presented in Table 4 indicate that the children of fathers with a history of offending in both early and middle childhood had greater odds of persisting, remitting, and incident difficulties compared to children whose father offended only before their birth. The children of mothers who offended in both early and middle childhood also had greater odds of persisting difficulties compared to children whose mother offended only before their birth. The odds of persisting or remitting difficulties were also significantly greater if a child's mother had offended in early or middle childhood, respectively.

Maternal and paternal offending and child developmental difficulties

Finally, we explored the association between any offending by mothers and fathers and offspring developmental difficulties after adjusting for any offending by the other parent. Again, in the interest of conserving statistical power, these analyses were undertaken only for the any offending exposures and any child difficulties (see Supplementary Table S6). Analyses were also adjusted for child's sex, mother's age at birth, Aboriginal and/or Torres Strait Islander status, LBOTE, and SED. Adjustment for any offending by the other parent reduced, but did not eliminate, the associations

Table 2 Unadjusted and adjusted multinomial regression analyses for paternal offending (any and violent) and developmental groups (persisting, remitting, and incident) of child difficulties

Paternal offending	Persisting		Remitting		Incident	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Any problems (<i>N</i> = 19,208)						
Any paternal offending						
U	2.24	(1.98–2.53)	1.57	(1.43–1.72)	1.58	(1.45–1.72)
A	1.85	(1.62–2.11)	1.46	(1.32–1.61)	1.45	(1.32–1.58)
Paternal violent offending						
U	3.05	(2.61–3.57)	1.90	(1.66–2.17)	1.78	(1.57–2.00)
A	2.37	(2.00–2.81)	1.72	(1.50–1.98)	1.54	(1.36–1.75)
Emotional problems (<i>N</i> = 19,084)						
Any paternal offending						
U	1.47	(1.11–1.95)	1.42	(1.27–1.58)	1.27	(1.33–1.43)
A	1.28	(0.95–1.72)	1.34	(1.20–1.51)	1.19	(1.05–1.34)
Paternal violent offending						
U	1.95	(1.36–2.80)	1.72	(1.49–1.99)	1.40	(1.19–1.65)
A	1.66	(1.13–2.45)	1.60	(1.37–1.87)	1.24	(1.04–1.48)
Conduct problems (<i>N</i> = 19,085)						
Any paternal offending						
U	3.12	(2.42–4.03)	1.73	(1.53–1.97)	1.93	(1.73–2.16)
A	2.63	(2.00–3.46)	1.50	(1.31–1.72)	1.65	(1.46–1.86)
Paternal violent offending						
U	3.32	(2.46–4.48)	1.93	(1.63–2.28)	2.36	(2.04–2.73)
A	2.55	(1.83–3.55)	1.58	(1.31–1.89)	1.88	(1.61–2.20)
Attentional problems (<i>N</i> = 19,087)						
Any paternal offending						
U	2.43	(1.99–2.98)	1.93	(1.72–2.17)	1.47	(1.33–1.62)
A	2.13	(1.71–2.65)	1.76	(1.25–1.52)	1.39	(1.25–1.55)
Paternal violent offending						
U	2.66	(2.07–3.42)	2.07	(1.78–2.42)	1.45	(1.26–1.68)
A	2.15	(1.63–2.84)	1.79	(1.51–2.12)	1.31	(1.13–1.53)

The reference group for all analyses consists of those children with no history of parental offending. *U* unadjusted; *A* adjusted for child's sex, mother's age at birth, Aboriginal and/or Torres Strait Islander status, Language Background Other than English, and Socio-Economic Deprivation

seen across the developmental groups of child difficulties. This reduction in effect sizes was most pronounced for maternal any offending (adjusted for paternal any offending). The odds of persisting, remitting, and incident developmental difficulties appeared to be greater for children exposed to an offending mother than those exposed to an offending father. However, confidence intervals overlapped in all cases, indicating that maternal offending did not have a significantly greater effect than paternal offending.

Discussion

In our sample of 19,208 children and their parents from the NSW-CDS, maternal and paternal offending each conferred a significantly increased risk of all the patterns of developmental difficulties in children, including those

limited to age 5 only (remitting problems), to age 11 only (incident problems), and to difficulties present at both ages 5 and 11 years (persisting problems). Parental offending had the strongest association with persisting conduct problems.

Consistent with research from another Australian population cohort [17], we did not identify any clear differences in the strength of associations for maternal compared to paternal offending, in relation to children's developmental difficulties. In regards to our previous research using data from NSW-CDS limited to child outcome data at age 5 years, we similarly found that the gender of the offending parent had no effect on child aggression [29], but did find evidence of a stronger association for maternal than paternal offending when the full range of cognitive, social, emotional, physical, and communication competencies assessed by the AEDC at age 5 years were considered [16].

Table 3 Unadjusted and adjusted multinomial regression analyses for maternal offending (any and violent) and developmental groups (persisting, remitting, and incident) of child difficulties

Maternal offending	Persisting		Remitting		Incident	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Any problems (<i>N</i> = 19,208)						
Any maternal offending						
U	2.79	(2.36–3.29)	1.95	(1.71–2.24)	1.88	(1.66–2.12)
A	2.05	(1.72–2.45)	1.73	(1.50–2.00)	1.63	(1.43–1.85)
Maternal violent offending						
U	3.75	(2.85–4.93)	2.47	(1.94–3.14)	2.36	(1.89–2.94)
A	2.36	(1.76–3.16)	2.06	(1.60–2.65)	1.82	(1.45–2.30)
Emotional problems (<i>N</i> = 19,084)						
Any maternal offending						
U	1.86	(1.27–2.71)	1.79	(1.54–2.08)	1.46	(1.23–1.73)
A	1.57	(1.05–2.35)	1.65	(1.41–1.94)	1.34	(1.12–1.61)
Maternal violent offending						
U	–	–	2.40	(1.89–3.05)	1.81	(1.37–2.41)
A	–	–	2.10	(1.63–2.71)	1.54	(1.14–2.08)
Conduct problems (<i>N</i> = 19,085)						
Any maternal offending						
U	2.90	(2.11–3.99)	2.11	(1.78–2.50)	2.28	(1.96–2.65)
A	2.04	(1.44–2.89)	1.67	(1.39–2.01)	1.76	(1.50–2.07)
Maternal violent offending						
U	4.96	(3.19–7.73)	2.74	(2.08–3.62)	2.89	(2.25–3.70)
A	3.22	(1.98–5.23)	2.02	(1.50–2.72)	1.97	(1.51–2.57)
Attentional problems (<i>N</i> = 19,087)						
Any maternal offending						
U	2.55	(1.96–3.32)	2.03	(1.72–2.38)	1.61	(1.39–1.86)
A	1.94	(1.46–2.58)	1.66	(1.39–1.98)	1.44	(1.23–1.68)
Maternal violent offending						
U	2.11	(1.30–3.42)	2.16	(1.64–2.84)	1.80	(1.40–2.31)
A	1.32	(0.79–2.21)	1.64	(1.22–2.20)	1.47	(1.13–1.91)

The reference group for all analyses consists of those children with no history of parental offending. *U* unadjusted; *A* adjusted for child's sex, mother's age at birth, Aboriginal and/or Torres Strait Islander status, Language Background Other than English, and Socio-Economic Deprivation

We further found that parental offending need not occur after the child's birth to be associated with children's developmental problems. One possible explanation for this finding may be that mothers with a history of criminal offending are more likely to experience adversity during pregnancy, including prenatal stress, smoking, and drug use [44, 45]; such adversity is linked to behavioural and other problems in offspring later in life, with a direct impact on fetal neurobiological development being implicated [46–49]. Nevertheless, children had the greatest likelihood of persisting developmental difficulties if maternal or paternal offending occurred in both early and middle childhood, though remitting difficulties (limited to early childhood [age 5 years] only) and incident difficulties (limited to middle childhood [age 11 years] only) were also significantly associated with father's offending that persisted across both developmental periods. This finding suggests that the timing of parental

offending during childhood may be less important than the continuity and severity of their offending, as also indicated in a number of other studies on the intergenerational transmission of crime [4, 27].

Our finding that parental offending was particularly associated with persisting conduct difficulties is consistent with the results of other studies on the intergenerational transmission of crime and antisocial behaviour [4, 50], and indicates that parental offending is a risk factor for the genesis of early and pervasive conduct problems in childhood. Whether parental offending is a risk factor for later antisocial behaviour may be determined in follow-up of the cohort. These developmental problems place children at significant risk of future offending, and may represent the manifestations of a genetic and/or environmental liability responsible for the intergenerational transmission of criminal offending behaviour [14, 15]. Some evidence also

Table 4 Multinomial regression analyses for timing of any paternal and maternal offending and developmental groups (persisting, remitting, and incident) of any child difficulties

Timing of any offending	Persisting		Remitting		Incident	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Paternal offending						
Any child problems (unadjusted)						
Pre-birth offending only	–	–	–	–	–	–
Early childhood offending	1.11	(0.86–1.43)	1.12	(0.91–1.37)	1.01	(0.84–1.21)
Middle childhood offending	1.15	(0.87–1.52)	1.18	(0.94–1.48)	1.04	(0.85–1.26)
Offending in both early and middle childhood	2.13	(1.63–2.77)	1.98	(1.60–2.46)	1.66	(1.36–2.02)
Any child problems (adjusted)						
Pre-birth offending only	–	–	–	–	–	–
Early childhood offending	1.08	(0.83–1.40)	1.11	(0.90–1.37)	0.99	(0.83–1.18)
Middle childhood offending	1.15	(0.87–1.53)	1.17	(0.93–1.47)	1.04	(0.85–1.27)
Offending in both early and middle childhood	1.94	(1.48–2.55)	1.95	(1.56–2.44)	1.51	(1.23–1.84)
Maternal offending						
Any child problems (unadjusted)						
Pre-birth offending only	–	–	–	–	–	–
Early childhood offending	1.49	(0.98–2.26)	1.38	(0.97–1.97)	0.94	(0.68–1.28)
Middle childhood offending	1.17	(0.77–1.79)	1.38	(0.98–1.95)	0.94	(0.70–1.28)
Offending in both early and middle childhood	1.76	(1.11–2.79)	1.51	(1.01–2.26)	1.00	(0.69–1.43)
Any child problems (adjusted)						
Pre-birth offending only	–	–	–	–	–	–
Early childhood offending	1.52	(1.00–2.33)	1.37	–	0.94	(0.68–1.28)
Middle childhood offending	1.23	(0.80–1.89)	1.42	(1.00–2.02)	0.95	(0.70–1.29)
Offending in both early and middle childhood	1.64	(1.02–2.64)	1.50	(0.99–2.26)	0.90	(0.62–1.30)

The reference group for all analyses consists of children whose parents who only offended before the child's birth. Adjusted analyses control for child's sex, mother's age at birth, Aboriginal and/or Torres Strait Islander status, Language Background Other than English, and Socio-Economic Deprivation

suggests that parents with a history of criminal and anti-social behaviour may pass on to their offspring a genetic liability that manifests as a range of externalizing and internalizing problems [14, 15]. Environmental factors may, subsequently, compound the child's genetic liability for developmental problems, further increasing their risk for poor outcomes [51–53].

The associations of maternal and paternal offending with emotional and hyperactivity/inattention problems also indicate the possibility of a broader impact of parental offending on children's emotional and behavioural development. This implies that offspring born to parents with a history of offending may be an identifiable group at increased risk of a range of developmental problems that may persist from early to middle childhood, requiring consideration of a range of possible preventative interventions. There is evidence, for example, of benefit from targeted programs offered to children exposed to parental offending [54]; these programs might include the Triple P-Positive Parenting Program [55] and the Nurse–Family Partnership [56, 57], both of which have shown the evidence of not only reducing behavioural

problems but also in improving the other outcomes for the children of parents with a history of offending.

This study has the advantage of being nested within a large longitudinal record-linkage cohort that is representative of the NSW population [31]. Despite our analyses being limited to the subsample of the NSW-CDS who had both AEDC and MCS data, these children are comparable with the larger cohort on a range of socio-demographic indices [34]. Furthermore, by drawing data from linked administrative records, the risk of sampling (selection and attrition) and information (recall and observer) biases is reduced. However, this study was not without limitations. First, we were limited to variables available through the linkage of administrative data sets and surveys, thereby preventing our capacity to examine the underlying mechanisms (e.g., poor parenting and social learning) that might explain the associations found between parental offending and developmental difficulties in offspring [25, 52]. Second, the relatively small number of mothers with a history of violent offending limited our statistical power for some analyses. Third, we were unable to analyze results

for children for whom both parents had a history of offending, because the resulting cell sizes for the outcomes of interest (persistent, remitting, and incident difficulties) were too small to report according to the privacy protocols associated with the ethical approval of our study. Fourth, scores on the EMS and SDQ were derived from a single respondent [teacher (age 5 years) and self (age 11 years), respectively], and were not corroborated across multiple sources of information. This may have led to a lack of precision regarding the extent of children's developmental difficulties, particularly for conduct and attention difficulties, where assessment by multiple informants is better able to gauge the magnitude of these problems across different contexts [58, 59]. Finally, our source of parental offending data could not identify parents convicted before 1994, or whose crimes went undetected, which may have resulted in an underestimation of the true number of parents with a history of offending.

The present findings provide a unique contribution to the literature by showing that maternal offending and paternal offending are associated with child developmental difficulties that have a high likelihood of persisting from early to middle childhood; we have demonstrated this in a large representative population-based sample that allowed the consideration of other important confounding factors. We recommend that future research examines the interplay of genetic and environmental mechanisms thought to underpin the relationship between parental offending and poor childhood outcomes, as well as investigating the impact of the timing of parental offending across a wider array of offspring developmental periods, particularly early adolescence. Understanding the scope of the impact of parental offending on children's development is crucial for the creation and implementation of intervention programs that aim to improve vulnerable children's well-being and mitigate their risk for future adversity.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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