

# Maternal Alcohol Use Disorder and Risk of Child Contact with the Justice System in Western Australia: A Population Cohort Record Linkage Study

Katherine Hafekost , David Lawrence, Colleen O'Leary, Carol Bower, James Semmens, and Stephen R. Zubrick

**Background:** Early contact with the justice system is associated with a multitude of negative outcomes across the life course. This includes an increased risk of ongoing justice contact, social disadvantage and marginalization, and mental health and substance use issues. Children whose mothers have an alcohol use disorder may be at risk of early justice system contact, and we sought to quantify this relationship in a Western Australian cohort.

**Methods:** This population cohort study made use of linked administrative data. Those in-scope for the study were women who had a birth recorded on the Midwives Notification System (1983 to 2007). The exposed cohort were mothers who had an alcohol-related diagnosis (ICD9/10), recorded on administrative data. This included mental and behavioral disorders which were alcohol related, diseases which could be entirely attributed to alcohol and other ICD alcohol codes. These women were considered to have an alcohol use disorder, which was a proxy for heavy drinking. The comparison cohort was frequency-matched sample with no alcohol-related diagnosis identified on administrative data sets.

**Results:** After adjusting for potential confounders, children whose mothers had a maternal alcohol use disorder had a significantly increased odds of justice contact when compared to those whose mothers had no diagnosis (odds ratio [OR] = 1.79, 95% confidence interval [CI] = 1.60 to 1.99). Additional significant maternal factors associated with child justice contact included being Indigenous (OR = 5.14, 95% CI = 4.54 to 5.81), low maternal age, low socioeconomic status, being unmarried, and a history of a mental health problems. Significant child-level factors, which were associated with increased odds of justice contact, included being male, a mental health diagnosis, child protection contact, parity, and academic failure.

**Conclusions:** Children who were exposed to a maternal alcohol use disorder had significantly increased odds of contact with the justice system. Additional risk was associated with being Indigenous and with markers of social disadvantage. These results suggest that prevention and early intervention services should span across agencies in an effort to reduce risk.

**Key Words:** Maternal Health, Alcohol, Justice, Child Outcomes.

JUVENILE DELINQUENCY AND juvenile criminal behavior are associated with a substantially increased risk of repeated contacts with the justice system throughout the life course, and with progression to more serious offenses

(Loeber and Farrington, 2000). Further, delinquency at a young age is associated with increased risk of long-term disadvantage and social marginalization, harmful use of drugs and alcohol, and serious mental and physical health problems (Fazel et al., 2008; Putninš, 1995; Snow and Powell, 2012).

There are a number of risk factors associated with early delinquent behavior. These include child demographic characteristics such as gender and ethnicity, family and household factors including socioeconomic position and parenting styles, and child psychosocial and cognitive characteristics (Australian Institute of Family Studies, 2015). In Australia, a well-identified risk factor for justice contact is Indigenous status, with Indigenous Australians substantially overrepresented in justice contact and incarceration statistics. This increased risk has been attributed to a number of factors including the effects of intergenerational trauma, social and economic disadvantage, community and domestic violence, and high levels of harmful alcohol use in the population (Homel et al., 1999).

Many young people who are in contact with the justice system have multiple risk factors and complex needs (Dowse et al., 2014). One group identified at high risk of contact with

From the Telethon Kids Institute (KH, CB, SRZ), The University of Western Australia, Perth, Western Australia, Australia; Graduate School of Education (DL, SRZ), The University of Western Australia, Perth, Western Australia, Australia; Office of the Chief Psychiatrist (CO), Western Australian Department of Health, Perth, Western Australia, Australia; and Centre for Population Health Research (JS), Faculty of Health Sciences, Curtin University, Perth, Western Australia, Australia.

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Reprint requests: Katherine Hafekost, MSc, Telethon Kids Institute, 100 Roberts Road, Subiaco, WA 6008, Australia; Tel.: +61 08 9489 7777; Fax: +61 08 9489 7700; E-mail: Katherine.hafekost@telethonkids.org.au

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the justice system is children whose mothers had problematic alcohol consumption (Australian Institute of Family Studies, 2015; Carr and Vandiver, 2001).

The relationship between heavy maternal alcohol consumption and poor child outcomes has been attributed to both biological and environmental factors. An extensive body of literature demonstrates that children who are exposed prenatally to alcohol during critical stages of development are at increased risk of suffering alcohol-related cognitive and behavioral deficits (Mattson and Riley, 1998; Vall et al., 2015). The severity of impact resulting from prenatal alcohol exposure is dependent on a number of factors, such as the quantity of alcohol consumed, timing of exposure during child development, and genetic factors. At the severe end of the spectrum, children may acquire fetal alcohol spectrum disorder (FASD) which is characterized by serious cognitive deficits, such as impairment in general intellectual functioning, verbal processing, memory, and executive functioning (Mattson and Riley, 1998). These deficits have been identified as factors that contribute to an increased risk of contact with the law, psychiatric problems, and other maladaptive behaviors (Fast and Conry, 2009; Fryer et al., 2007; Streissguth et al., 2004). Of note, children who were exposed to moderate levels of alcohol during development, which do not result in a FASD diagnosis, have been identified to have cognitive and behavioral deficits, when compared with unexposed children (O'Leary et al., 2010; Sood et al., 2001). This finding is supported by Roebuck and colleagues (1999), who identified that children who experienced both moderate and high levels of alcohol prenatally are at greater risk of being rated disruptive, hyperactive, impulsive, and/or delinquent or be in trouble with the law. Sood and colleagues (2001) identified negative effects on child behavior with intake as low as 1 alcohol drink per week during pregnancy. This literature highlights that alcohol exposure in utero may increase the risk of behavioral problems, even in the absence of a FASD diagnosis, and at relatively low levels of consumption.

However, it is possible that risk of delinquent behavior due to maternal alcohol use is conferred through social factors, rather than driven by biological factors alone. Children living in a household with a mother with problematic alcohol use are more likely to be exposed to a negative social environment during their early years compared with other children. Existing research demonstrates that households with an alcoholic parent are at increased risk of economic disadvantage, comorbid substance abuse, mental health problems, family breakup and instability, and poor parenting practices (Burke et al., 2006; Gmel and Rehm, 2003). These factors may contribute to the likelihood of exposure to delinquent behaviors, inappropriate parent discipline, lack of supervision, and poor role modeling, which contribute to greater risk of justice contact (Australian Institute of Family Studies, 2015; Shader, 2001).

While heavy maternal alcohol use, and in particular prenatal alcohol use, has been linked to delinquent behavior, this

has not been explored using linked administrative data at the population level in Western Australia. Therefore, this analysis sought to investigate

- whether a child whose mother has an alcohol use disorder diagnosis has an increased risk of contact with the justice system in comparison with other children; and if so,
- does the relationship between maternal alcohol use disorder and risk of child justice contact persist when known sociodemographic and child risk factors are controlled for?

It was hypothesized that the risk of child contact with the justice system would be higher in children whose mother has a diagnosed alcohol use disorder compared with children whose mothers had no recorded alcohol use disorder diagnosis. In addition, it was anticipated that this risk would remain after controlling for significant maternal and child risk factors.

## MATERIALS AND METHODS

Ethics approval for the conduct of the study was granted by the Princess Margaret Hospital Human Research Ethics Committee (no. 1244/EP), the WA Department of Health Human Research Ethics Committee (no. 2011/34), and the WA Aboriginal Health Ethics Committee (no. 134-04/06).

### *Cohort*

This analysis made use of administrative linked data from the Western Australian Data Linkage System. All women who had a birth recorded on the Midwives Notification System (MNS) between 1983 and 2007 were in-scope for the study (253,714 women: 242,956 (95.8%) non-Indigenous women; and 10,758 (4.2%) Indigenous women). Cohort selection has been described in detail previously (O'Leary et al., 2012b).

The exposed cohort were mothers who had an alcohol use disorder diagnosis, based on the International Classification of Diseases 9/10 (ICD9/10) Revisions. Diagnoses were identified through a number of routinely collected administrative data sets, which included the Hospital Morbidity Data System; Mental Health Information System (inpatient and outpatient records); and the Drug and Alcohol Office. Diagnoses, which were based on previously published ICD9/10 codes included the categories of mental and behavioral disorders (alcohol related), diseases which were 100% attributable to alcohol (e.g., alcoholic liver disease), and other ICD alcohol codes (O'Leary et al., 2012a,b). Women could have multiple diagnoses, and the most frequently identified diagnosis type related to mental and behavioral disorders relating to alcohol use (O'Leary et al., 2013a,b). More than half of mothers in the exposed group had a diagnosis relating to acute intoxication (55%). A diagnosis of a maternal alcohol use disorder provided a proxy for heavy maternal alcohol use. In-scope ICD codes are included in the Table S1.

The comparison cohort was identified via the MNS. Comparison mothers, who had no record of an alcohol-related disorder, were obtained from the records of registered births from 1983 through 2007. Comparison and exposed mothers were frequency matched, based on maternal age within race, and year of child's birth. There were approximately 1:3 and 1:2 exposed to comparison mothers for non-Indigenous and Indigenous mothers, respectively. This population cohort includes 10,211 exposed mothers and 47,688 comparison mothers.

The Western Australian linked database, including the data included in this study, has been identified to have an estimated proportion of mismatches of 0.11%, which is consistent with international benchmarks (Holman et al., 1999), and has been identified to be a valid method of identifying health-related outcomes (Brameld et al., 1999).

#### *Justice Contact*

Child contact with the justice system was determined via the Department of Corrective Services (DCS) data set. This was defined as a record of the major offense and/or community correction order data sets for juveniles (10 to 17 years) and adults (18 years and above) from 1985 through 2011. Community orders are provided by the court when the nature of the crime committed is not seen as serious enough to warrant a custodial sentence, and the young person is not a danger to the community. A community order may require the young person to participate in education, drug or alcohol counseling or admission to a treatment center, or complete community service. Custodial records refer to cases where a young person has been identified as being in custody. This includes both remand records and custodial sentences following a conviction. It is important to note that a custody record does not necessarily mean a young person was convicted of a crime. Custodial remand or custodial sentences are typically provided for more serious crimes than community orders. The DCS includes information regarding offense type, sentencing outcomes, and timing of contact with the justice system. For the purpose of this analysis, the outcome of interest was any contact recorded on the justice system data sets.

In Western Australia, the minimum age of criminal responsibility is 10 years. Therefore, the data set was restricted to those children 10 years or above, who had a linked MNS record. This equated to 18,740 children in exposed cohort and 48,543 children in the comparison cohort.

#### *Academic Outcomes*

Academic achievement data were obtained from the Western Australian Literacy and Numeracy Assessment (WALNA) for years 1999 to 2007 and The National Assessment Program—Literacy and Numeracy (NAPLAN) for years 2008 to 2011. WALNA was a statewide assessment that tested students' numeracy, reading, writing, and spelling. Students completed WALNA in school years 3, 5, and 7. From 2005 to 2007, year 9 students were also assessed in reading, writing, and numeracy. Minimum performance standards were available from the Western Australian Department of Education. NAPLAN is an Australia-wide testing program that is administered annually to all students in school years 3, 5, 7, and 9. It assesses students' performance in reading, writing, language conventions, and numeracy. Performance is evaluated across bands from year 4 through year 9. Students are expected to progress through scoring bands as they age, and minimum standards are provided for each year level.

Of note, school achievement data were not available for children who attended independent or private schools. Therefore, for the purpose of analyses which included educational outcomes, only those children who attended public schools between 1999 and 2011 were included ( $n = 42,106$ , 63% of records).

#### *Mother's Sociodemographic Variables*

Sociodemographic information was predominately obtained from the MNS and therefore includes data recorded at the time of their child's birth. This included socioeconomic status, maternal age, Indigenous status, parity, health service region, and marital status. In addition, history of a mental health diagnosis or record of

illicit drug diagnosis was obtained from the MNS, Hospital Morbidity Data System, and/or Mental Health Information System.

#### *Child Variables*

In addition to justice outcomes and academic performance, data on gender and Indigenous status were available. The data were linked with Intellectual Disability Database to identify youth with an intellectual disability (O'Leary et al., 2013a,b) and the Western Australian Register of Developmental Anomalies (Bower et al., 2007) to identify youth diagnosed with FASD. Information on birthweight and gestation was obtained from the MNS to derive preterm status (<37 weeks gestation) and proportion of optimal birthweight, calculated by comparing observed to optimal birthweight. This measure takes into account gender, gestational age, maternal height, and parity and provides an indication of fetal growth (Blair et al., 2005). Any record of a mental health-related diagnosis for the mother and the child (ICD9/10) was obtained from the Mental Health Information System outpatient's data set and the Hospital Morbidity Data System inpatients' data. Of note, the ICD9/10 mental health diagnoses include those related to intellectual disabilities. Finally, data for contact with child protection services were obtained from the Department for Child Protection and Family Support (data from 1990 to 2010). Contact was defined as a record of a substantiated maltreatment allegation or placement in out-of-home care.

#### *Statistical Analysis*

All analysis was carried out using SAS 9.3 (SAS Institute, Inc., Cary, NC).

Chi-square tests were used to identify significant differences between sociodemographic factors in the exposed and comparison cohorts.

Hierarchical, generalized linear mixed models with a logit link were used to analyze the relationship between maternal alcohol use disorder and justice contact, and demographic and child characteristics. All models included matching variables (i.e., maternal age group, Indigenous status, and baby year of birth). Clustering within families was accounted for in the models.

For analyses relating to academic outcomes, only academic records prior to the first recorded date of contact with the justice system were included. Records that did not include information about the timing of contact with the justice system were not included in the analysis for academic outcomes, as it was not possible to identify whether academic outcomes preceded contact with the justice system.

Possible covariates, relating to both the mother and child, were tested in a univariate model and those considered significant ( $\alpha = 0.05$ ) were assessed for significance in the multivariate model. Covariates tested in modeling which were not significant, were FASD diagnosis, proportion of optimal birthweight, and gestational age. All others are included in the analysis. The most parsimonious model was reported. All models included the frequency-matching variables (baby year of birth, Indigenous status, and maternal age).

## RESULTS

Table 1 provides the demographic characteristics of mothers by maternal alcohol use disorder. A greater proportion of those in the exposed cohort were Indigenous compared with the comparison cohort (41.5 and 33.6%, respectively). In addition, there was a greater proportion of mothers in the exposed cohort who were unmarried (33% vs. 22%) and in

**Table 1.** Demographic Characteristics of Sample of Mothers and Their Children 10 Years of Age and Older, by Alcohol Use Disorder Exposure Status

|   | Comparison<br>(n = 48,543) |      | Exposed<br>(n = 18,740) |      | $\chi^2$ p |
|---|----------------------------|------|-------------------------|------|------------|
|   | n                          | %    | n                       | %    |            |
| Indigenous status <sup>a</sup>              |                            |      |                         |      |            |
| Non-Indigenous                              | 32,219                     | 66.4 | 10,967                  | 58.5 | <0.001     |
| Indigenous                                  | 16,324                     | 33.6 | 7,773                   | 41.5 |            |
| Health service region                       |                            |      |                         |      |            |
| Metropolitan                                | 28,049                     | 57.8 | 10,147                  | 54.2 | <0.001     |
| Nonmetropolitan                             | 20,494                     | 42.2 | 8,593                   | 45.9 |            |
| Maternal age at birth of child <sup>a</sup> |                            |      |                         |      |            |
| <20 years                                   | 8,398                      | 17.3 | 3,658                   | 19.5 | <0.001     |
| 20 < 30 years                               | 29,107                     | 59.9 | 11,074                  | 59.1 |            |
| 30 < 40 years                               | 10,590                     | 21.8 | 3,856                   | 20.5 |            |
| 40+ years                                   | 448                        | 0.9  | 152                     | 0.8  |            |
| Marital groups                              |                            |      |                         |      |            |
| Married                                     | 38,071                     | 78.4 | 12,473                  | 66.6 | <0.001     |
| Never married                               | 9,876                      | 20.4 | 5,638                   | 30.1 |            |
| Separated, widowed, divorced                | 521                        | 1.1  | 569                     | 3.0  |            |
| Missing                                     | 75                         | 0.2  | 60                      | 0.3  |            |
| Socioeconomic status at time of birth       |                            |      |                         |      |            |
| Most advantaged > 10%                       | 2,246                      | 4.6  | 450                     | 2.4  | <0.001     |
| Second group 10% to <25%                    | 4,243                      | 8.7  | 1,026                   | 5.5  |            |
| Third group 25% to <50%                     | 7,989                      | 16.5 | 2,377                   | 12.7 |            |
| Fourth group 50% to <75%                    | 10,265                     | 21.2 | 3,626                   | 19.4 |            |
| Fifth group 75% to <90%                     | 8,192                      | 16.9 | 3,442                   | 18.4 |            |
| Most disadvantaged                          | 7,545                      | 15.5 | 3,832                   | 20.5 |            |
| Bottom 10%                                  |                            |      |                         |      |            |
| Unknown                                     | 8,063                      | 16.6 | 3,987                   | 21.3 |            |
| Child gender                                |                            |      |                         |      |            |
| Male  | 24,829                     | 51.1 | 9,599                   | 51.2 | 0.864      |
| Female                                      | 23,714                     | 48.9 | 9,141                   | 48.8 |            |

<sup>a</sup>Frequency-matching variable.

the lowest 10% of socioeconomic status (bottom 10% socioeconomic status: 21% vs. 16%) at the time of their child’s birth when compared with mothers in the comparison cohort.

Contact with the justice system was significantly higher in the exposed cohort compared with the comparison cohort (16.1% vs. 7.7%, respectively) (Table 2). The overwhelming majority of children (98%) with a record on the custodial data set also had a record of a community order. In addition, around 35% of children with any justice contact had multiple recorded contacts. Contact with the justice system was significantly higher in children who had a mother with an alcohol use disorder diagnosis than comparison children (16% vs. 8%, respectively), males compared with females (14% vs. 6%, respectively), and Indigenous than non-Indigenous young people (21% vs. 4%, respectively) (Table 3).

Children whose mothers had a diagnosis of a maternal alcohol use disorder were at significantly higher risk of contact with the justice system when compared to those children whose mothers had no alcohol-related diagnosis (Table 4). This relationship remained significant when other available sociodemographic covariates were included in the model (odds ratio [OR] = 1.84, 95% confidence interval [CI] = 1.72 to 1.96). Significant maternal factors associated with an increased risk of contact with the justice system were low socioeconomic status (OR = 1.12 95% CI = 1.04 to 1.20),

**Table 2.** Contact with the Justice System by Maternal Alcohol Use Disorder Exposure Status

|                        | Comparison<br>(n = 48,543) |     | Exposed<br>(n = 18,740) |      | $\chi^2$ p |
|------------------------|----------------------------|-----|-------------------------|------|------------|
|                        | n                          | %   | n                       | %    |            |
| Any contact            | 3,714                      | 7.7 | 3,022                   | 16.1 | <0.001     |
| Custodial record       | 1,143                      | 2.4 | 1,250                   | 6.7  | <0.001     |
| Community order record | 3,691                      | 7.6 | 2,995                   | 16.0 | <0.001     |
| Repeat contact         | 1,120                      | 2.3 | 1,223                   | 6.5  | <0.001     |

**Table 3.** Any Contact with the Justice System by Maternal Alcohol Use Disorder Status

|  | No contact |      | Contact |      | $\chi^2$ p |
|--|------------|------|---------|------|------------|
|  | n          | %    | n       | %    |            |
| Maternal alcohol use disorder exposure |            |      |         |      |            |
| Comparison                             | 44,829     | 74.0 | 3,714   | 55.1 | <0.001     |
| Exposed                                | 15,718     | 26.0 | 3,022   | 44.9 |            |
| Indigenous status                      |            |      |         |      |            |
| Non-Indigenous                         | 41,421     | 68.4 | 1,765   | 26.2 | <0.001     |
| Indigenous                             | 19,126     | 31.6 | 4,971   | 73.8 |            |
| Child gender                           |            |      |         |      |            |
| Male                                   | 29,752     | 49.1 | 4,676   | 69.4 | <0.001     |
| Female                                 | 30,795     | 50.9 | 2,060   | 30.6 |            |
| Fetal alcohol spectrum disorder        |            |      |         |      |            |
| No                                     | 60,478     | 99.9 | 6,727   | 99.9 | 0.653      |
| Yes                                    | 69         | 0.1  | 9       | 0.1  |            |
| Intellectual disability                |            |      |         |      |            |
| No                                     | 59,239     | 97.8 | 6,416   | 95.3 | <0.001     |
| Yes                                    | 1,308      | 2.2  | 320     | 4.8  |            |

being Indigenous (OR = 6.24, 95% CI = 5.81 to 6.71), higher parity (3+ births: OR = 2.00, 95% CI = 1.82 to 2.21), a recorded maternal mental health diagnosis (OR = 1.11, 95% CI = 1.02 to 1.20), and a maternal age of <20 years at the time of the child’s birth (OR = 1.58, 95% CI = 1.46 to 1.71). At the child level, males (OR = 3.54, 95% CI = 3.33 to 3.76), a recorded mental health diagnosis (OR = 2.67, 95% CI = 2.49 to 2.88), and those who had contact with child protection services (OR = 2.27, 95% CI = 2.09 to 2.47) were significantly more likely to have justice contact than other children.

The data displayed in Table 5 are from a restricted sample of 42,106 children who had a linked WALNA or NAPLAN result, which occurred prior to justice system contact. This analysis demonstrates that failure to reach minimum standards in numeracy (OR = 1.18, 95% CI = 1.04 to 1.33) and reading (OR = 1.20, 95% CI = 1.07 to 1.36) was significantly associated with justice contact. In addition, while the inclusion of sociodemographic and academic outcomes in the model reduced the strength of association, maternal alcohol use disorder remained significant in the final model (OR = 1.79, 95% CI = 1.60 to 1.99).

## DISCUSSION

After adjusting for potential confounding factors, children whose mothers had a diagnosis of a maternal alcohol use

**Table 4.** Sociodemographic Characteristics Associated with Any Child Contact with the Justice System

|  | OR   | 95% CI |      |
|--|------|--------|------|
| Maternal alcohol diagnosis                           |      |        |      |
| No   | Ref  |        |      |
| Yes  | 1.84 | 1.72   | 1.96 |
| Indigenous status                                    |      |        |      |
| Non-Indigenous                                       | Ref  |        |      |
| Indigenous   | 6.24 | 5.81   | 6.71 |
| Marital status                                       |      |        |      |
| Married  | Ref  |        |      |
| Never married, separated, divorced, widowed, missing | 1.41 | 1.32   | 1.50 |
| Mother's age at child's birth                        |      |        |      |
| 20 years and above                                   | Ref  |        |      |
| <20 years  | 1.58 | 1.46   | 1.71 |
| Socioeconomic status at child's birth                |      |        |      |
| Above bottom 10%                                     | Ref  |        |      |
| Bottom 10%   | 1.12 | 1.04   | 1.20 |
| Unknown  | 0.81 | 0.75   | 0.88 |
| Parity   |      |        |      |
| 0  | Ref  |        |      |
| 1  | 1.41 | 1.31   | 1.52 |
| 2  | 1.70 | 1.55   | 1.86 |
| 3+   | 2.00 | 1.82   | 2.21 |
| Any maternal mental health record                    |      |        |      |
| No   | Ref  |        |      |
| Yes  | 1.11 | 1.02   | 1.20 |
| Child gender   |      |        |      |
| Female   | Ref  |        |      |
| Male   | 3.54 | 3.33   | 3.76 |
| Any child mental health record                       |      |        |      |
| No   | Ref  |        |      |
| Yes  | 2.67 | 2.49   | 2.88 |
| Any child protection contact                         |      |        |      |
| No   | Ref  |        |      |
| Yes  | 2.27 | 2.09   | 2.47 |

OR are adjusted for all other variables in the model and matching variables (baby year of birth, maternal age, and Indigenous status).

disorder had almost twice the odds of having had contact with the justice system compared with children whose mothers had no diagnosis. In addition to exposure to a maternal alcohol use disorder, a number of other maternal risk factors for child justice contact were identified. These factors included low maternal age at child's birth, low socioeconomic status, higher parity, a record of a mental health diagnosis, and being unmarried. At the child level, significant risk factors included being male, Indigenous, presence of a mental health-related diagnosis, and contact with the justice system. Further, these findings suggest that academic failures, and specifically failure to reach minimum benchmarks for numeracy and/or reading, are significant predictors of justice contact.

Existing research provides that children who are exposed to alcohol prenatally have cognitive and behavioral deficits compared to unexposed children (Mattson and Riley, 1998; Vall et al., 2015). This includes greater risk of developmental delay, learning and memory deficits, poor attention, inhibition, and self-regulation (Mattson and Riley, 1998; Streissguth and O'Malley, 2000). Further, it has been identified that heavy alcohol exposure during development results in an

increased risk of externalizing and aggressive behaviors, hyperactivity, and poor psychosocial functioning (Mattson and Riley, 1998; O'Connor and Paley, 2009; Roebuck et al., 1999). These deficits could lead to an increased likelihood of contact with the justice system. This is supported by a systematic review of Canadian data that suggested young people with FASD were 19 times more likely to be incarcerated in a given year when compared to youth without FASD (Popova et al., 2011). It is likely that behavioral or cognitive deficits, which resulted from alcohol exposure during development, contributed to the increased risk of justice contact observed in the current analysis. However, due to the use of administrative data, we are unable to weigh the relative contribution of these deficits, against environmental and genetic factors associated with heavy maternal alcohol use, to risk of justice contact.

In addition to the biological effects of prenatal alcohol exposure, children whose mothers have a diagnosis of maternal alcohol use disorder are more likely to be exposed to environmental risk factors, such as comorbid substance use, social and economic disadvantage, and poor parenting practices. This is supported by a substantial body of South African literature which has examined the epidemiology of FASD. This literature identifies that women who are socially and economically disadvantaged, or are exposed to heavy intergenerational, social, and partner alcohol use, are at greater risk of having a child with FASD (May et al., 2000, 2005). In addition, this literature links higher parity to both increased risk and increased severity of effects of alcohol exposure. Social risk factors may have an indirect effect on risk of delinquency. For example, young, single mothers with low socioeconomic status may live in poorer areas, which increases the risk of early exposure or involvement in crime. Or, there may be a more direct relationship via lack of parenting skills, education, or lower levels of child supervision. While the specific mechanism for increased risk associated with these measures is not able to be determined in this study, these results indicate that ongoing support for disadvantaged families, which spans across agencies, may assist in reducing the risk of justice contact in young people.

The odds of contact with the justice system were 5 times higher for Indigenous young people than non-Indigenous young people. The overrepresentation of Indigenous Australians in the justice system is well known (Homel et al., 1999; Weatherburn et al., 2003). This has been attributed to a number of factors including inherited trauma, low socioeconomic status, and compounding disadvantage which disproportionately effect the Indigenous community in Australia. Further, the high rates of alcohol use and alcohol-related harm are well documented in this population, and these factors have contributed to an increased risk of justice contact (Conseur et al., 1997; Dowse et al., 2014; Higgins and Davis, 2014). In spite of widespread recognition of the disproportionate representation of Indigenous young people in contact with the justice system, Higgins and Davis (2014) suggest that there is little evidence demonstrating that

**Table 5.** Sociodemographic Characteristics and Academic Benchmarks Associated with Child Contact with the Justice System. Dataset Restricted to Those with Education Records ( $n = 42,106$ )

|                                       | OR <sup>a</sup> | 95% CI |      | OR <sup>b</sup> | 95% CI |      | OR <sup>c</sup> | 95% CI |      |
|---------------------------------------|-----------------|--------|------|-----------------|--------|------|-----------------|--------|------|
| Maternal alcohol use disorder         |                 |        |      |                 |        |      |                 |        |      |
| Comparison                            | Ref             |        |      | Ref             |        |      |                 |        |      |
| Exposed                               | 2.34            | 2.11   | 2.59 | 1.82            | 1.63   | 2.03 | 1.79            | 1.60   | 1.99 |
| Indigenous status                     |                 |        |      |                 |        |      |                 |        |      |
| Non-Indigenous                        |                 |        |      | Ref             |        |      |                 |        |      |
| Indigenous                            |                 |        |      | 5.79            | 5.16   | 6.51 | 5.14            | 4.54   | 5.81 |
| Marital status                        |                 |        |      |                 |        |      |                 |        |      |
| Married                               |                 |        |      | Ref             |        |      |                 |        |      |
| Unmarried, missing                    |                 |        |      | 1.32            | 1.18   | 1.46 | 1.29            | 1.16   | 1.44 |
| Maternal age                          |                 |        |      |                 |        |      |                 |        |      |
| 20 years and above                    |                 |        |      | Ref             |        |      |                 |        |      |
| <20 years                             |                 |        |      | 1.79            | 1.57   | 2.03 | 1.72            | 1.52   | 1.96 |
| Socioeconomic status at child's birth |                 |        |      |                 |        |      |                 |        |      |
| Above bottom 10%                      |                 |        |      | Ref             |        |      |                 |        |      |
| Bottom 10%                            |                 |        |      | 1.20            | 1.08   | 1.35 | 1.18            | 1.06   | 1.33 |
| Parity                                |                 |        |      |                 |        |      |                 |        |      |
| Unknown                               |                 |        |      | 0.80            | 0.70   | 0.91 | 0.77            | 0.67   | 0.88 |
| Para 0                                |                 |        |      | Ref             |        |      |                 |        |      |
| Para 1                                |                 |        |      | 1.46            | 1.28   | 1.66 | 1.44            | 1.27   | 1.63 |
| Para 2                                |                 |        |      | 1.74            | 1.50   | 2.03 | 1.69            | 1.45   | 1.96 |
| Para 3+                               |                 |        |      | 2.04            | 1.74   | 2.38 | 1.94            | 1.66   | 2.27 |
| Any maternal mental health record     |                 |        |      |                 |        |      |                 |        |      |
| No                                    |                 |        |      | Ref             |        |      |                 |        |      |
| Yes                                   |                 |        |      | 1.13            | 1.00   | 1.28 | 1.14            | 1.01   | 1.28 |
| Child gender                          |                 |        |      |                 |        |      |                 |        |      |
| Female                                |                 |        |      | Ref             |        |      |                 |        |      |
| Male                                  |                 |        |      | 2.89            | 2.62   | 3.19 | 2.85            | 2.58   | 3.15 |
| Any child mental health record        |                 |        |      |                 |        |      |                 |        |      |
| No                                    |                 |        |      | Ref             |        |      |                 |        |      |
| Yes                                   |                 |        |      | 2.77            | 2.45   | 3.13 | 2.74            | 2.42   | 3.09 |
| Any child protection contact          |                 |        |      |                 |        |      |                 |        |      |
| No                                    |                 |        |      | Ref             |        |      |                 |        |      |
| Yes                                   |                 |        |      | 2.23            | 1.97   | 2.53 | 2.19            | 1.93   | 2.48 |
| Below reading benchmark               |                 |        |      |                 |        |      |                 |        |      |
| No                                    |                 |        |      |                 |        |      | Ref             |        |      |
| Yes                                   |                 |        |      |                 |        |      | 1.20            | 1.07   | 1.36 |
| Below numeracy benchmark              |                 |        |      |                 |        |      |                 |        |      |
| No                                    |                 |        |      |                 |        |      | Ref             |        |      |
| Yes                                   |                 |        |      |                 |        |      | 1.18            | 1.04   | 1.33 |

<sup>a</sup>Maternal alcohol use disorder only.

<sup>b</sup>Maternal alcohol use disorder, and significant sociodemographic factors.

<sup>c</sup>Maternal alcohol use, sociodemographic and academic factors (significance  $\alpha = 0.05$ ), OR are adjusted for all other variables within each model and matching variables (baby year of birth, maternal age, Indigenous status).

existing programs are successfully addressing the issue. However, some evidence suggests that deterrence or intervention programs that include community and family involvement, addressing parenting issues, recognizing and addressing complex needs, and ensuring cultural competence of the program and staff are required (Higgins and Davis, 2014).

The increased odds of justice contact for young people with a mental health disorder again matches the findings of existing research. A report examining the health of incarcerated young people in New South Wales identified that 87% had a mental health diagnosis, and over 70% had multiple diagnoses (Indig et al., 2011). Further, a study of incarcerated Tasmanian young people reported that mental health problems were 5 times higher in incarcerated youth when compared to the general adolescent population (Bickel and Campbell, 2002). Of note, given mental health diagnosis was obtained from administrative records for the purpose of this

analysis, it is likely that there are children with mental health problems who have not sought treatment or been admitted to a clinic or hospital. Therefore, it is likely to be a conservative estimate of mental health burden in this population. This study indicated that, after adjusting for other significant factors, the odds of justice contact were twice as high for children who had contact with the child protection system when compared with children without a child protection record. Existing literature indicates that children who are exposed to abuse, neglect, or family violence are at significantly greater risk of both externalizing behaviors, including physical aggression, and internalizing behaviors in adolescents (Cullerton-Sen et al., 2008; Evans et al., 2008; Moylan et al., 2010). This is likely to contribute to the observed increased risk in justice contact. Again, these factors indicate that targeted, culturally appropriate, cross-agency interventions and support are required to address justice contact.

Previous research has demonstrated that academic failure and disengagement from school are risk factors for delinquency and contact with the justice system (Henry et al., 2012). We were not able to examine the underlying factors contributing to academic failure in this cohort. However, this may include disengagement of students and/or parents, exclusion, poor attendance, poor academic ability, or a combination of these factors. These may be associated with early justice contact or directly contribute to increased risk of delinquency.

Due to the high rates of FASD in vulnerable populations in South Africa, there has been substantial interest in identifying effective strategies to reduce alcohol-related harm, and in particular rates of FASD, in the population. Chersich and colleagues (2012) identified, in high-risk populations where knowledge of the risk of maternal alcohol use is low, universal intervention with the aims of improving community-level knowledge and shifting drinking norms in the population may be effective means of intervention. Further, Marais and colleagues (2011) identified, in a disadvantaged high-risk population of pregnant women, antenatal screening followed by brief intervention was effective in reducing alcohol-related harms. This has particular relevance to Indigenous communities in Australia, who are also disproportionately affected by socioeconomic disadvantage and the negative effects of alcohol (Calabria et al., 2010). While developing effective methods of reducing alcohol-related harm during pregnancy should be central to intervention efforts, for those children who are exposed to a maternal alcohol use disorder, coordinated service delivery and support across multiple agencies, such as education, child protection, justice, and health, are required to address complex risk factors to reduce the risk of negative outcomes such as early justice contact.

#### *Strengths and Limitations*

A key strength of this study is the use of administrative data, which has been demonstrated to be a valid and efficient method of identifying those who have been admitted to hospital for health-related conditions (Brameld et al., 1999). The use of administrative data removes the need for retrospective self-report of drinking behaviors. Further, we can be certain that those mothers diagnosed with an alcohol use disorder, which was used as a proxy for heavy drinking, were consuming large amounts of alcohol at the time of their diagnosis. However, a disadvantage of the use of administrative data is that only those who came into contact with a service, as a result of their drinking, are captured in the exposed cohort. It is likely that there are women in the comparison cohort who consumed significant amounts of alcohol during this time period but did not come in contact with hospital, drug and alcohol, or mental health services, as evidenced by the small number of children diagnosed with FASD in the comparison cohort as previously reported (Bower et al.,

2007). This under-ascertainment of heavy or problematic drinking in comparison mothers would likely have biased our results toward the null. In addition, the administrative data provide no information about the dose or the long-term drinking patterns of women diagnosed with a disorder. We cannot determine whether women diagnosed pre- or post-pregnancy also consumed large amounts of alcohol during pregnancy, but did not receive a diagnosis at this time point. Further, confounding or explanatory variables not recorded on administrative data sets cannot be included in modeling. This includes information such as maternal and child IQ, genetic factors, family history of justice contact, peer effects, and detailed information regarding maternal poly-drug use and smoking which have previously been identified to be associated with both risk and severity of FASD (May et al., 2004). In addition, while it is known that alcoholism clusters within families, we have no information about paternal or family alcohol use. Further research to investigate the complex causes of youth delinquency, and its relationship to maternal alcohol use, is required to design appropriate interventions for this population.

#### CONCLUSIONS

The results of this study suggest that, after adjusting for known risk factors such as measures of social disadvantage, Indigenous status, and poor academic performance, exposure to a maternal alcohol use disorder confers additional risk for early contact with the justice system. This work adds to the body of existing literature demonstrating the long-term negative effects of maternal alcohol use disorder on child outcomes. Our ability to disentangle the environmental, biological, and genetic factors which drive the relationship between maternal alcohol use and subsequent child contact with the justice system was limited due to the use of administrative data. However, it is likely that the greater risk of justice contact associated with maternal alcohol exposure is a consequence of the complex biological and environmental impacts of heavy maternal alcohol use. Additional risk factors for youth justice contact included being male, Indigenous, having a mental health diagnosis, and poor academic performance. These factors are well identified in the literature and should be considered in the development of targeted prevention programs. These results suggest that the use of universal programs, as well as early intervention for at-risk mothers may be of use to reduce negative child outcomes. For those exposed to maternal alcohol use problems, holistic and culturally appropriate support programs, which span across agencies, need to be developed and implemented in order to reduce the negative impact of maternal alcohol use disorder on child outcomes.

#### CONFLICT OF INTEREST

The authors have no conflict of interests to declare.

## REFERENCES

- Australian Institute of Family Studies (2015) The Longitudinal Study of Australian Children Annual Statistical Report 2014. Melbourne: Australian Institute of Family Studies, Melbourne, Australia.
- Bickel R, Campbell A (2002) Mental health of adolescents in custody: the use of the 'Adolescent Psychopathology Scale' in a Tasmanian context. *Aust N Z J Psychiatry* 36:603–609.
- Blair EM, Liu Y, de Klerk NH, Lawrence DM (2005) Optimal fetal growth for the Caucasian singleton and assessment of appropriateness of fetal growth: an analysis of a total population perinatal database. *BMC Pediatr* 5:1.
- Bower C, Rudy E, Callaghan A, Quick J, Cosgrove P, Nassar N (2007) Report of the Birth Defects Registry of Western Australia 1980–2006. King Edward Memorial Hospital, Perth, WA.
- Brameld KJ, Thomas MA, Holman CAJ, Bass AJ, Rouse IL (1999) Validation of linked administrative data on end-stage renal failure: application of record linkage to a 'clinical base population'. *Aust N Z J Public Health* 23:464–467.
- Burke S, Schmied V, Montrose M (2006) Parental Alcohol Misuse and the Impact on Children – A Literature Review. Research, Funding & Business Analysis Division, Centre for Parenting & Research, Ashfield, Australia.
- Calabria B, Doran CM, Vos T, Shakeshaft AP, Hall W (2010) Epidemiology of alcohol-related burden of disease among Indigenous Australians. *Aust N Z J Public Health* 34:S47–S51.
- Carr MB, Vandiver TA (2001) Risk and protective factors among youth offenders. *Adolescence* 36:409–426.
- Chersich MF, Urban M, Olivier L, Davies L-A, Chetty C, Viljoen D (2012) Universal prevention is associated with lower prevalence of fetal alcohol spectrum disorders in Northern Cape, South Africa: a multicentre before-after study. *Alcohol Alcohol* 47:67–74.
- Conseur A, Rivara FP, Barnoski R, Emanuel I (1997) Maternal and perinatal risk factors for later delinquency. *Pediatrics* 99:785–790.
- Cullerton-Sen C, Cassidy AR, Murray-Close D, Cicchetti D, Crick NR, Rogosch FA (2008) Childhood maltreatment and the development of relational and physical aggression: the importance of a gender-informed approach. *Child Dev* 79:1736–1751.
- Dowse L, Cumming TM, Strnadová I, Lee J-S, Trofimovs J (2014) Young people with complex needs in the criminal justice system. *Res Pract Int Dev Disabil* 1:174–185.
- Evans SE, Davies C, Dilillo D (2008) Exposure to domestic violence: a meta-analysis of child and adolescent outcomes. *Aggress Violent Beh* 13:131–140.
- Fast DK, Conry J (2009) Fetal alcohol spectrum disorders and the criminal justice system. *Dev Disabil Res Rev* 15:250–257.
- Fazel S, Doll H, Långström N (2008) Mental disorders among adolescents in juvenile detention and correctional facilities: a systematic review and meta-regression analysis of 25 surveys. *J Am Acad Child Adolesc Psychiatry* 47:1010–1019.
- Fryer SL, McGee CL, Matt GE, Riley EP, Mattson SN (2007) Evaluation of psychopathological conditions in children with heavy prenatal alcohol exposure. *Pediatrics* 119:e733–e741.
- Gmel G, Rehm J (2003) Harmful alcohol use. *Alcohol Res Health* 27:52–62.
- Henry KL, Knight KE, Thornberry TP (2012) School disengagement as a predictor of dropout, delinquency, and problem substance use during adolescence and early adulthood. *J Youth Adolesc* 41:156–166.
- Higgins D, Davis K (2014) Law and justice: prevention and early intervention programs for Indigenous youth. Resource sheet no. 34, in *Closing the Gap Clearinghouse* (Australian Institute of Health and Welfare and Australian Institute of Family Studies ed.). Australian Institute of Health and Welfare & Melbourne: Australian Institute of Family Studies, Canberra, ACT.
- Holman CDAJ, Bass AJ, Rouse IL, Hobbs MST (1999) Population-based linkage of health records in Western Australia: development of a health services research linked database. *Aust N Z J Public Health* 23:453–459.
- Hommel R, Lincoln R, Herd B (1999) Risk and resilience: crime and violence prevention in aboriginal communities. *Aust N Z J Criminol* 32:182–196.
- Indig D, Vecchiato C, Haysom L, Beilby R, Carter J, Champion U, Gaskin C, Heller E, Kumar S, Mamone N, Muir P, van den Dolder P, Whittton G (2011) 2009 NSW young people in custody health survey: full report, in *Justice Health and Juvenile Justice* (Justice Health ed), pp 144–157. Juvenile Justice, Sydney, NSW.
- Loeber R, Farrington DP (2000) Young children who commit crime: epidemiology, developmental origins, risk factors, early interventions, and policy implications. *Dev Psychopathol* 12:737–762.
- Marais S, Jordaan E, Viljoen D, Olivier L, de Waal J, Poole C (2011) The effect of brief interventions on the drinking behaviour of pregnant women in a high-risk rural South African community: a cluster randomised trial. *Early Child Dev Care* 181:463–474.
- Mattson SN, Riley EP (1998) A review of the neurobehavioral deficits in children with fetal alcohol syndrome or prenatal exposure to alcohol. *Alcohol Clin Exp Res* 22:279–294.
- May PA, Brooke L, Gossage JP, Croxford J, Adnams C, Jones KL, Robinson L, Viljoen D (2000) Epidemiology of fetal alcohol syndrome in a South African community in the Western Cape Province. *Am J Public Health* 90:1905.
- May PA, Gossage JP, Brooke LE, Snell CL, Marais A-S, Hendricks LS, Croxford JA, Viljoen DL (2005) Maternal risk factors for fetal alcohol syndrome in the Western Cape Province of South Africa: a population-based study. *Am J Public Health* 95:1190–1199.
- May PA, Gossage JP, White-Country M, Goodhart K, Decoteau S, Trujillo PM, Kalberg WO, Viljoen DL, Hoyme HE (2004) Alcohol consumption and other maternal risk factors for fetal alcohol syndrome among three distinct samples of women before, during, and after pregnancy: the risk is relative. *Am J Med Genet C Semin Med Genet* 127:10–20.
- Moylan CA, Herrenkohl TI, Sousa C, Tajima EA, Herrenkohl RC, Russo MJ (2010) The effects of child abuse and exposure to domestic violence on adolescent internalizing and externalizing behavior problems. *J Fam Viol* 25:53–63.
- O'Connor MJ, Paley B (2009) Psychiatric conditions associated with prenatal alcohol exposure. *Dev Disabil Res Rev* 15:225–234.
- O'Leary CM, Halliday J, Bartu A, D'Antoine H, Bower C (2013a) Alcohol-use disorders during and within one year of pregnancy: a population-based cohort study 1985–2006. *BJOG* 120:744–753.
- O'Leary C, Jacoby P, D'Antoine H, Bartu A, Bower C (2012a) Heavy prenatal alcohol exposure and increased risk of stillbirth. *BJOG* 119:945–952.
- O'Leary C, Leonard H, Bourke J, D'Antoine H, Bartu A, Bower C (2013b) Intellectual disability: population-based estimates of the proportion attributable to maternal alcohol use disorder during pregnancy. *Dev Med Child Neurol* 55:271–277.
- O'Leary CM, Nassar N, Zubrick SR, Kurinczuk JJ, Stanley F, Bower C (2010) Evidence of a complex association between dose, pattern and timing of prenatal alcohol exposure and child behaviour problems. *Addiction* 105:74–86.
- O'Leary CM, Watson L, D'Antoine H, Stanley F, Bower C (2012b) Heavy maternal alcohol consumption and cerebral palsy in the offspring. *Dev Med Child Neurol* 54:224–230.
- Popova S, Lange S, Bekmuradov D, Mihic A, Rehm J (2011) Fetal alcohol spectrum disorder prevalence estimates in correctional systems: a systematic literature review. *Can J Public Health* 102: 336–340.
- Putniš AL (1995) Recent drug use and suicidal behaviour among young offenders. *Drug Alcohol Rev* 14:151–158.
- Roebuck TM, Mattson SN, Riley EP (1999) Behavioral and psychosocial profiles of alcohol-exposed children. *Alcohol Clin Exp Res* 23:1070–1076.
- Shader M (2001) Risk Factors for Delinquency: An Overview. US Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention, Washington, DC.
- Snow P, Powell M (2012) Youth (in)justice: oral language competence in early life and risk for engagement in antisocial behaviour in adolescence. *Trends Issues Crime Criminal Justice* 435:1–6.
- Sood B, Delaney-Black V, Covington C, Nordstrom-Klee B, Ager J, Templin T, Janisse J, Martier S, Sokol RJ (2001) Prenatal alcohol exposure



- and childhood behavior at age 6 to 7 years: I. dose-response effect. *Pediatrics* 108:e34.
- Streissguth AP, Bookstein FL, Barr HM, Sampson PD, O'Malley K, Young JK (2004) Risk factors for adverse life outcomes in fetal alcohol syndrome and fetal alcohol effects. *J Dev Behav Pediatr* 25:228–238.
- Streissguth AP, O'Malley K (2000) Neuropsychiatric implications and long-term consequences of fetal alcohol spectrum disorders. *Semin Clin Neuropsychiatry* 5:177–190.
- Vall O, Salat-Batlle J, Garcia-Algar O (2015) Alcohol consumption during pregnancy and adverse neurodevelopmental outcomes. *J Epidemiol Community Health* 69:927–929.
- Weatherburn D, Fitzgerald J, Hua J (2003) Reducing aboriginal over-representation in prison. *Aust J Public Admin* 62:65–73.

## SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article:

**Table S1.** In-scope ICD9/10 alcohol related diagnoses.