Early risk factors for adolescent antisocial behaviour: an Australian longitudinal study

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Objective: This investigation utilizes data from an Australian longitudinal study to identify early risk factors for adolescent antisocial behaviour.

Method: Analyses are based on data from the Mater University Study of Pregnancy, an on-going longitudinal investigation of women's and children's health and development involving over 8000 participants. Five types of risk factors (child characteristics, perinatal factors, maternal/familial characteristics, maternal pre- and post-natal substance use and parenting practices) were included in analyses and were based on maternal reports, child assessments and medical records. Adolescent antisocial behaviour was measured when children were 14 years old, using the delinquency subscale of the Child Behaviour Checklist.

Results: Based on a series of logistic regression models, significant risk factors for adolescent antisocial behaviour included children's prior problem behaviour (i.e. aggression and attention/restlessness problems at age 5 years) and marital instability, which doubled or tripled the odds of antisocial behaviour. Perinatal factors, maternal substance use, and parenting practices were relatively poor predictors of antisocial behaviour.

Conclusions: Few studies have assessed early predictors of antisocial behaviour in Australia and the current results can be used to inform prevention programs that target risk factors likely to lead to problem outcomes for Australian youth.

Key words: adolescent antisocial behaviour, prevention, risk factors

The report *The Mental Health of Young People in Australia* [1] notes that Australia has unique characteristics that make it risky to exclusively borrow conclusions from overseas research. A case in point is the identification of early risk factors for antisocial behaviour in young people, particularly given evidence that crime and delinquency are significant problems among Australian adolescents. The 2000 International Crime Victims Survey indicates that in terms of the percentage of people victimized, Australia ranks within the top group of industrialized nations (including England, Wales, Netherlands and Sweden) [2]. The Crime and Safety Survey conducted in Queensland [3] found that 52% of respondents perceived crime in their neighbourhoods, including crimes often committed by young people. Likewise, a Western Australian survey on perceptions of neighbourhood crime demonstrated that behaviours typical of young offenders (e.g. burglaries and noisy, reckless driving) were most frequently reported [4]. Victorian police data reveal that juveniles are significantly over-represented in official statistics, committing 21% of all offences [5]. Overall the evidence points to youth crime as a problem within Australia.

There has been increasing recognition of the need to develop programs based on a developmental understanding of the origins of antisocial behaviour [6]. If Australian policy makers are to develop effective prevention programs, they need to plan an agenda based on risk factors known to be present in the Australian population. The overall risk factors for the development of adolescent antisocial behaviour are well known [7,8], but the presence or intensity of risk factors may vary across countries and such variation may help explain differences in official juvenile crime statistics and victimization rates. In fact, a comparison of risk factors for delinquency in London and Pittsburgh identified many similar risk factors, but also found significant differences between the two countries [9]. This evidence demonstrates the necessity of examining risk factors in the Australian context. It is especially important to identify early risk factors, including those occurring during the fetal period, infancy, and the preschool years, as there is mounting evidence that certain, persistent styles of antisocial behaviour have their origins in the early stages of life [6]. Within these periods, early child aggression and hyperactivity [8,10–21], pre- and perinatal complications [15,22–25], family environmental characteristics [7,8,10,17,18,22,26,27], maternal substance use [28–31], and parenting practices [7,17,26,32] have all been linked to adolescent delinquency.

Within Australia, only the Australian Temperament Project (ATP) has investigated risk factors for adolescent antisocial behaviour, with the most important predictors including previous oppositional behaviour, poor school adjustment and association with antisocial peers at 13–14 years [33]. Despite the many strengths of the ATP, its measures of risk are assessed from middle childhood to ages 15–16 years and it is unable to collect prospective data during the fetal period, increasingly identified as a

critical phase of development in terms of future behavioural outcomes [34].

The Mater University Study of Pregnancy (MUSP) provides an opportunity to address two important issues relating to risk factors for adolescent antisocial behaviour. First, it is an Australian longitudinal study, and hence should be able to improve clarity regarding the importance of risk factors within the Australian community. Second, the MUSP has prospectively collected data for a large sample of respondents (both male and female), with measures assessed during the antenatal period, as well as infancy and the preschool years. Many prior studies have been based on more limited sample sizes and characteristics (some focused on male respondents only), and have not been able to simultaneously assess a range of risk factors.

Method

Sample

The Mater University Study of Pregnancy is an ongoing longitudinal investigation of women's and children's health and development. The project began in 1981, with interviews of 8458 pregnant women attending their first clinic visit (on average, at 18 weeks gestation) at the Mater Hospital in Brisbane, Australia: 7661 women gave birth to a live, singleton baby and completed post-natal surveys 3–5 days after the birth. Mothers completed additional surveys when children were 6 months, 5 years, and 14 years and children were also assessed at ages 5 and 14 years. (See Keeping [35] for additional details regarding the project design.)

We investigate early predictors of adolescent antisocial behaviour using data from the 5278 mothers (69% of the mothers who gave birth to a live child) remaining at the 14-year follow-up assessment. It is important to note that attrition analyses at the five-year follow-up demonstrated that those lost during the study were significantly more likely than those remaining to have lower levels of education, live in poverty when children were 0–5 years and be teenagers at the time of their children's birth. Because the final sample includes a lower proportion of socially disadvantaged mothers and children, and these factors may be related to the dependent variable, the current study likely presents a conservative test of predictors of adolescent antisocial behaviour.

Measures

Adolescent antisocial behaviour

Antisocial behaviour is assessed using the delinquency subscale of the Child Behaviour Checklist (CBCL) [36], completed by mothers at the 14-year follow-up. The subscale consists of 13 items (Cronbach's alpha = 0.76), including lying, cheating, setting fires, stealing, swearing, thinking too much about sex, truancy, vandalism, using alcohol or drugs, running away from home, keeping 'bad company' and lacking guilt. Mothers reported whether or not the behaviours described their children 'often', 'sometimes' or 'rarely/never' in the past year. A dichotomous measure was then created, based on the highest decile of antisocial behaviour (n = 437, 8% of the total sample).

Numerous studies have demonstrated the external validity, cross-cultural validity, and reliability of the CBCL and accompanying subscales [37–39]. While the measure only includes information from mothers, and multiple sources may increase the validity of the findings, there is some evidence that adults are better informants than are children with respect to disruptive behaviour problems [40]. Likewise, the parental report of child behaviour was demonstrated as significantly related to CBCL scores recorded by informers who assessed the child's behaviour in similar circumstances [41]. In the MUSP, the validity of the delinquency subscale was further assessed by comparing the continuous measure with maternal reports at the 14-year follow-up of whether or not adolescents had official contact with the police or juvenile aid in the past year. Adolescents with high scores on the delinquency subscale had a significantly greater probability of being in contact with police or juvenile aid. As well, those with official police contacts had significantly higher mean scores on the delinquency subscale (5.9), compared to those with no contact (2.2). Contact with these official agencies is a more objective measure of antisocial behaviour, and its association with maternal reports further establishes the reliability of the selinquency subscale as a marker for adolescent antisocial behaviour.

Independent variables

Based on the literature regarding early (i.e. from the fetal period to preschool/early primary school) risk factors for delinquency, numerous variables in five broad domains were included in the study. Most measures were based upon maternal reports and medical records and child assessments were also utilized, as described later and detailed in Table 1.

Child characteristics include demographic characteristics (sex and race/ethnicity) and behavioural and cognitive measures. Three child behaviours were assessed, using maternal reports from the five-year follow-up survey. Aggression and attention/restlessness were based upon maternal reports on a shortened form of the CBCL (demonstrated as highly correlated with the long form [42]) The aggression subscale (alpha = 0.83) includes 10 items regarding the frequency with which the child: screams/argues; destroys things; is sullen or stubborn; fights; has a temper; and so on. Children in approximately the top decile of the scale were designated as aggressive. The attention/restlessness subscale (alpha = 0.66) was derived from six items regarding the frequency of children's restlessness, lack of concentration, immaturity, nervousness, clumsiness, and tendency to daydream. A similar cut-off was used to designate children as having attention/restlessness problems. The accidents variable was included as an indicator of children's fearlessness/novelty-seeking and poor motor development. Both these factors have been identified as predictive of antisocial behaviour [10,43,44]. This dichotomous measure corresponds to two summed items asking mothers whether or not children suffered any accidents or injuries needing a doctor's help. The association between antisocial behaviour, children's cognitive ability and poor development has also been established in a number of studies [45–48]. In this study, poor

development and low cognitive ability were assessed by children's scores on the Denver Developmental Screening Test (DDST) [49] and the Peabody Picture Vocabulary Test-Revised (PPVT-R) [50], administered at the five-year follow-up.

Information regarding seven infant, neonatal biological characteristics was obtained from children's medical records at birth. All perinatal variables were dichotomised, with higher scores indicating the presence of perinatal problems.

Maternal and familial characteristics were assessed using both single items and composite measures from the prenatal to five-year maternal reports. All variables are dichotomous, with the exception of family income, which is an ordinal measure from 1 to 3, representing chronic poverty, mid-income, and high income over the prenatal to five-year assessments.

Regarding maternal pre- and post-natal substance use, maternal reports of tobacco and alcohol use during the pre- and postnatal periods were assessed at the corresponding interviews and dichotomised to represent heavy smoking and drinking.

Two broad domains relating to parental warmth/affection and supervision/control have been associated with adolescent delinquency [17]. Based on this literature, maternal reports from the pre-natal to five-year assessments were used to measure maternal affect, supervision, control and physical punishment. All variables are dichotomous, with two exceptions. Whether or not the pregnancy was planned/wanted differentiates between mothers who planned/wanted their pregnancies, those who were unsure, and those with unplanned pregnancies, with dummy variables used to compare the latter two groups with the first group. Physical punishment is an ordinal measure (coded 1–3), representing mothers who never, sometimes, or almost always approve of spanking their children for misbehaviour.

Statistical analysis

Bivariate associations between the independent variables and the dichotomous dependent variable were first examined using Pearson correlation coefficients. Logistic regression analysis was then performed in order to determine whether or not these factors significantly increased the prevalence of antisocial behaviour. In order to minimize the likelihood of sample loss due to missing data, separate regression analyses were conducted for each of the five groups of predictor variables, using only those significantly associated ($p < 0.01$) with the dependent variable according to the Pearson correlation coefficients. A final logistic regression analysis was performed in order to better determine the relative strength of the predictors and included only those factors significantly related ($p < 0.01$) to adolescent antisocial behaviour in the separate models.

Results

As shown in Table 1, about half of the independent variables were significantly ($p < 0.01$) correlated with the dependent variable, adolescent antisocial behaviour, as assessed using the delinquency subscale of the CBCL. All of the maternal and family characteristics, as well as maternal substance use, smoking and drinking during or shortly after pregnancy, were related to adolescent antisocial behaviour and most of the child characteristics were associated with the dependent variable. In contrast, few parenting practices, and only one of the perinatal factors (low birth weight) were significantly related to adolescent problem behaviour.

Logistic regression analysis was next performed to identify factors that significantly increased the likelihood of antisocial behaviour, with separate models for four types of early risk factors (low birth weight, the only perinatal factor associated with antisocial behaviour, was included in the model assessing child characteristics). The unstandardized coefficients and odds ratios for each model are presented in Table 2. As indicated by the significant model χ^2 values, all models demonstrated a good fit to the data. However, the proportion of variance explained [51] indicates that child characteristics were best able to predict the prevalence of antisocial behaviour, followed by maternal/familial characteristics, maternal substance use, and family characteristics.

As shown in Model 1 (Table 2), and consistent with the bivariate results, children's problem behaviour at age 5 was strongly related to antisocial behaviour, with aggression more than tripling the odds of engaging in antisocial behaviour, and attention problems/restlessness more than doubling the odds. Male children also had an increased likelihood of antisocial behaviour.

The results further indicate that some maternal and familial characteristics were important predictors of antisocial behaviour. The results in Model 2 demonstrate that being a single parent at the time of the child's birth, having one or more marital changes, and experiencing marital conflict each increase the likelihood of antisocial behaviour, nearly doubling the odds in each case.

Maternal substance use (see Model 3) and parenting practices (see Model 4) were less strongly related to adolescent antisocial behaviour. Regarding maternal substance use, post-natal smoking increased the prevalence of adolescent antisocial behaviour, but none of the other behaviours was significantly ($p < 0.01$) related to the dependent variable. Three of the four parenting practices were significantly related to antisocial behaviour, but the variance explained in the model was very low, indicating a relatively poor model fit. The effects of perinatal factors on antisocial behaviour were not explored in detail, as only low birth weight was significantly related to the outcome in bivariate analyses. Low birth weight did not significantly increase the likelihood of antisocial behaviour when included in the model with other child characteristics (see Model 1).

A final logistic regression analysis was performed which included all significant predictors ($p < 0.01$) listed in Table 2. The unstandardized coefficients and odds ratios of the variables are shown in Table 3. As before, child characteristics and maternal/family characteristics demonstrated stronger associations with adolescent antisocial behaviour, compared to parenting practices, maternal substance use, and perinatal factors. Aggression at age 5 tripled the odds of antisocial behaviour, while attention/restlessness more than doubled the odds (OR = 2.51). Change in marital status also emerged as a strong predictor, with an odds ratio of approximately 2.37. Being a teenager at the time of the child's birth, and using physical punishment, were also

significantly related to antisocial behaviour. Overall, the significant model χ^2 value indicated a good fit to the data, although the variance explained (0.12) was relatively modest, suggesting that other variables may have been better able to predict the prevalence of antisocial behaviour at age 14.

Discussion

This research has identified a range of significant risk factors for adolescent antisocial behaviour using longitudinal Australian data. The strongest predictors are child characteristics, in particular those that measure prior problem behaviour. As shown in the final model, high levels of aggression and attention problems/restlessness more than double the likelihood of later antisocial behaviour. Similar findings have been found previously in many countries [8,10–21] and there appears to be general agreement in the literature that one of the strongest predictors of problem behaviour is previous problem behaviour.

Other findings are also consistent with research regarding risk factors for adolescent antisocial behaviour. Children whose mothers experienced more than one marital change were at increased risk and others have noted the importance of marital disruption in leading to adolescent involvement in crime [17,26].

The findings indicated that poor language ability increases the risk for antisocial behaviour. This result is consistent with the work of Moffitt and Harrington [10] who argue that a deficit in language ability is one of the early steps in the pathway to persistent antisocial outcomes. This and other research [45–48] suggests overcoming early language deficits may decrease the risk for adolescent antisocial behaviour.

Unlike other research [15,22–25], this study did not identify perinatal factors (with the exception of low birth weight) as directly influencing adolescent antisocial behaviour. While this lack of significance may indicate an area of cross-national difference, it is important to note that there is some consensus perinatal influences wane over the life course, while family, social, and environmental factors grow in importance [8]. Likewise, perinatal experiences may predict early childhood outcomes [15], such as preschool behavioural maladjustment, which may lead to adolescent antisocial behaviour or there may be interactive effects between perinatal and other risk factors [52]. However, this study did not examine such mediating or moderating effects.

While differences in findings between this study and others may reflect cross-national differences, they may also be due to differences in research design and to certain limitations of the current study. The MUSP measures outcomes when respondents are age 14, which may be too early to capture the full range of adolescent antisocial behaviour, which typically peaks in the later teenage years. Thus, the current results may better represent risk factors for early antisocial behaviour. Similarly, this study relied on a somewhat conservative estimate of the proportion of young people observed by mothers to engage in antisocial activities (8% of the sample), and investigations using less stringent measures may result in additional risk factors for offending. Third, the dependent variable is based solely upon maternal reports, using the delinquency subscale of the CBCL. Although the CBCL measure has been demonstrated as a reliable and valid measure, it nonetheless may fail to capture the full range of adolescent antisocial behaviour (as perhaps indicated by the low variance explained in the models). Additional sources of information, particularly respondent self-report or teacher reports would strengthen the findings. Finally, it is likely that other early risk factors for adolescent antisocial behaviour have not been included in the models (as also suggested by the low variance explained). Although the study was able to examine many of the risk factors identified in the literature, there may be other important predictors and additional analyses are needed to more thoroughly examine such relationships.

Despite these limitations, the current findings make an important contribution to understanding adolescent antisocial behaviour in the Australian context. It is noteworthy that a large number of significant risk factors for antisocial behaviour at age 14 have been identified, given that all variables were measured at age 5 or earlier. The results underscore the need for further research assessing cross-national differences, particularly studies that can do so more directly, by utilizing similar measures across different studies.

Most importantly, the identification of risk factors for future antisocial behaviour among Australian young people highlights the need for increased attention to and development of prevention and intervention strategies. That early aggression and attention/restlessness problems emerged as very strong predictors of later problems emphasizes the need to intervene early in the life course, to help stop problem behaviour from continuing into adolescence and adulthood. During the last decade, a more optimistic view regarding the possibility of altering developmental trajectories for antisocial behaviour has emerged, based on reviews of multiple, effective evidence-based programs that decrease problem behaviour. Particularly important may be parenting programs that target preschool children exhibiting externalizing behaviour problems [6,53–56], such as the Triple-P Positive Parenting Program [57] in Australia. The favourable results of this program [58] and others [6] gives hope that developing and implementing early intervention strategies in Australia can reduce the risk of later antisocial behaviour.

Acknowledgements

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Table 1. Variables used in the analyses, descriptive data and correlations with adolescent antisocial behaviour†

Variable	No. of items/ Alpha	Mean	SD	Time of assessment	r
Child					
Sex (male)	1	0.52	0.50	Birth	0.09*
Race/ethnicity					
White	2	0.91	0.28	Prenatal	-0.01
Asian	2	0.04	0.20	Prenatal	-0.02
Aboriginal/Torres Strait Islander	2	0.05	0.21	Prenatal	0.03
Aggression (CBCL)	10/0.83	0.11	0.31	5 years	0.21*
Attention/restlessness (CBCL)	6/0.66	0.06	0.23	5 years	0.15*
Accidents	2	0.04	0.20	5 years	0.05*
Failed DDST‡	–	0.02	0.14	5 years	0.04
Language ability (PPVT-R§)	–	0.88	0.32	5 years	-0.06*
Pre/perinatal					
Fetal distress	4	0.31	0.46	Birth	0.01
APGAR-5 min	1	0.06	0.23	Birth	0.01
Time to establish respiration	1	0.07	0.26	Birth	0.01
Low birth weight	1	0.04	0.20	Birth	0.04*
Premature gestation at delivery	1	0.04	0.19	Birth	0.03
Low/mid percent weightt for gestation	1	0.19	0.39	Birth	0.03
Intensive care at delivery	1	0.07	0.26	Birth	0.03
Maternal/familial					
Teenager at birth	1	0.14	0.35	Prenatal	0.08*
Family income	3	0.21	0.41	Prenatal–5 years	-0.07*
Single-parent status	1	0.09	0.29	Prenatal	0.09*
1+ marital changes 0–5 years	3	0.17	0.38	5 year	0.13*
Marital conflict (DAS)¶	8/0.75	0.10	0.30	Postnatal–5 years	0.09*
Parental arrest	2	0.18	0.39	5 years	0.07*
Parental imprisonment	2	0.05	0.22	5 years	0.08*
Maternal pre/postnatal substance use					
Heavy smoking	2	0.08	0.26	Prenatal	0.07*
Heavy smoking	2	0.11	0.31	Postnatal	0.09*
Binge drinking	2	0.20	0.40	Prenatal	0.06*
Alcohol use (1+ drinks/day)	2	0.01	0.11	Prenatal	0.05*
Alcohol use (1+ drinks/day)	2	0.02	0.13	Prenatal	0.05*
Parenting practices					
Pregnancy planned	4/0.89	2.38	0.79	Prenatal	
Unplanned		0.19	0.40		-0.00
Unsure		0.24	0.43		0.03
Planned		0.57	0.50		-0.03
High affect	6/0.75	0.94	0.23	6 months	-0.04*
Teaches baby	4/0.66	0.85	0.35	6 months	-0.04*
Cuddles baby	1	0.88	0.32	6 months	-0.02
High/low control	5/0.66	0.76	0.43	5 years	-0.02
Allows much freedom	5/0.84	0.08	0.27	5 years	0.05*
Physical punishment	6/0.62	1.94	0.55	5 years	0.07*
Reasons with child	6/0.83	0.05	0.22	5 years	-0.00
Gives consequences	6/0.74	0.05	0.21	5 years	0.02

*p < 0.01 based on Pearson correlation coefficients; †Derived from the delinquency subscale of the Child Behaviour Checklist (CBCL) [36], completed by mothers when children were age 14 years. All independent variables are dichotomous, with the exception of family income and use of physical punishment, which are ordinal variables with a range of 1–3. ‡The Denver Developmental Screening Test (DDST) was administered to children at the five-year assessment [49]. The test has questionable sensitivity (a high false negative rate), but high specificity (a low false positive rate), so that it underestimates the number of children who are truly at risk, but those classified as delayed are truly delayed. The reliability and validity of the test have been demonstrated in numerous studies [59,60]. §The Peabody Picture Vocabulary Test-Revised (PPVT-R) was completed by study children at age 5 [50]. Respondents were asked to listen to a series of vocabulary words and select one of four pictures that corresponded to the word. The test has been shown to have moderately high stability coefficients [61] and good predictive validity [62]. ¶Assessed using the dyadic satisfaction subscale items from the Spanier Dyadic Adjustment Scale (DAS) [63]. The DAS also has demonstrated validity and reliability.

Table 2. Predictors of adolescent antisocial behaviour† (logistic regression)

Predictors	B		EXP (B)
Model 1: child characteristics			
Sex (Male)*	0.59		1.79
Aggression*	1.29		3.62
Attention/restlessness*	0.89		2.44
Accidents	0.53		1.70
Language ability	-0.30		0.74
Low birth weight	0.53		1.70
Model χ^2		150.21*	
R^2		0.09	
n		3513	
Model 2: maternal/family			
Teenager at birth*	0.68		1.97
Income	-0.46		0.63
Single-parent at birth	0.04		1.04
1+ change in marital status*	0.65		1.91
Marital conflict*	0.63		1.88
Parental arrest	0.25		1.28
Parental imprisonment	0.66		1.94
Model χ^2		69.69*	
R^2		0.05	
n		3072	
Model 3: maternal substance use			
Smoking (prenatal)	0.20		1.22
Smoking (postnatal)*	0.61		1.84
Binge drinking (prenatal)	0.29		1.33
Alcohol use (prenatal)	0.60		1.83
Alcohol use (postnatal)	0.40		1.49
Model χ^2		49.70*	
R^2		0.02	
n		5073	
Model 4: parenting practices			
High affect*	-0.61		0.54
Teaches baby	-0.31		0.74
Allows much freedom*	0.58		1.79
Physical punishment*	0.44		1.56
Model χ^2		41.86*	
R^2		0.02	
n		4276	

*$p < 0.01$. †Derived from the delinquency subscale of the Child Behaviour Checklist (CBCL) [36], completed by mothers when children were age 14 years.

Table 3.   Predictors of adolescent antisocial behaviour† (n = 3286; logistic regression)

Predictors	B		EXP (B)
Sex*	0.56		1.75
Aggression*	1.13		3.10
Attention/restlessness*	0.92		2.51
Teenager at birth*	0.53		1.70
1+ marital changes*	0.86		2.37
Marital conflict	0.41		1.50
Smoking (postnatal)	0.32		1.38
High affect	0.01		1.01
Allows much freedom	0.49		1.63
physical punishment*	0.48		1.61
Model χ^2		180.81*	
R^2		0.12	

**$P < 0.01$. †Derived from the delinquency subscale of the Child Behaviour Checklist (CBCL) [36], completed by mothers when children were age 14 years.