

# Antisocial behaviour across neighbourhoods: Individuals and families in context

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## **Executive Summary**

### ***Understanding Antisocial Behaviour***

There is a large body of research that examines the individual, family and neighbourhood level predictors of antisocial and criminal behaviour and a range of individual and familial factors associated with anti-social behaviour including childhood aggression, disruptive family processes and maternal factors (for example maternal age, alcohol/drug consumption/mental health). In the ecology of crime literature, studies suggest the neighbourhood also influences poor outcomes for children and young people. Residential mobility, immigration/racial concentration and neighbourhood disadvantage are frequently associated with high levels of crime and victimisation and low informal social control of children. Despite the acknowledgement of the many and varied predictors of antisocial behaviour, in practice, research rarely models the interdependence of these factors. With few exceptions, existing explanations of antisocial behaviour often centre on individual and familial characteristics to the exclusion of neighbourhood factors. Or conversely, neighbourhood research focuses on the neighbourhood context without including known individual and familial predictors. Thus an understanding of the interdependence of these processes on antisocial behaviour is still at a very early stage of development.

### ***Research Objectives***

This project draws on the Mater University Study of Pregnancy (MUSP) and the Australian Bureau of Statistics (ABS) census data. Utilising data from a prospective longitudinal study, the present research examines the between neighbourhood variation in incidences of antisocial behaviour in adolescence and provides a more meaningful test of the magnitude of neighbourhood effects by controlling for empirically driven individual and familial predictors of antisocial behaviour in infancy, early childhood and adolescence. Three questions guide the present research:

1. What are the key individual and family characteristics that predict individual antisocial behaviour?
2. Are there spatial differences in individual level antisocial behaviour? That is, is antisocial behaviour concentrated in certain types of places?
3. Are there independent neighbourhood effects on antisocial behaviour when controlling for individual characteristics and family processes?

## ***Methodology***

The MUSP is a prospective longitudinal study which has involved a number of phases of data collection with mothers and their children. Data were first collected when the mother entered the study at her first clinical prenatal visit and again at 3–5 days after the birth of the study child. Subsequent follow-ups of the mother and child occurred when the study child was six months, five years old and fourteen years of age. The focus of this study required a measure of antisocial behaviour from the MUSP, which was obtained from the study children when they were fourteen years old. Individual and family level variables were also measured at various phases of the MUSP. The neighbourhood measures used in this study were obtained from the ABS Census data and included residential mobility, immigration concentration and neighbourhood disadvantage.

Addressing the research questions of this study required a number of analytic stages. To explore the spatial distribution of antisocial behaviour in South East Queensland the MUSP addresses were geo-coded to x and y coordinates. Secondary data from the ABS were then included at the level of the statistical local area (SLA) and a number of thematic analyses were undertaken to explore the spatial patterning of antisocial behaviour and disadvantage. We then examined the variation in antisocial behaviour that could be attributed to differences in SLAs. Finally, a number of multiple regression models were estimated to explore the independent neighbourhood effects on antisocial behaviour when controlling for individual characteristics and family level variables.

## ***Results***

Our findings suggest that antisocial behavior was not concentrated in particular types of places in the South East Queensland Region. Overall, the spatial visualisation of antisocial behavior and disadvantage did not show a strong relationship; participants living in highly disadvantaged areas did not always have the highest levels of antisocial behaviour. Further analyses of variation in antisocial behaviour across the different SLAs supported the geo-coded maps and indicated that only one percent of the variation in antisocial behaviour could be explained by living in a given SLA.

We then tested whether SLA level factors had a direct effect on antisocial behaviour after controlling for family processes and individual characteristics. The regression models used data obtained from the various phases of the MUSP to identify which individual and familial indicators/processes are most important in predicting antisocial behaviour at age 14. The final full model that was estimated included

the significant individual and familial variables from the age specific models, together with several neighbourhood SLA level variables including disadvantage measured by the SEIFA index of disadvantage, residential mobility and ethnicity. A range of individual, maternal and family processes remained predictive of antisocial behaviour in the full model. However, the relative disadvantage of an SLA was the only neighbourhood level factor moderately associated with individual antisocial behaviour. This suggests that antisocial behaviour may be best explained by individual, family and maternal factors rather than by the effects of place and neighbourhood.

### ***Implications of Findings for Existing Research and Policy***

The results from this project provide support for existing research that shows that individual and family factors play an important part in shaping the development of antisocial behaviour. For example, the individual factors found to be most important to explaining antisocial behaviour in this research support findings of existing studies which suggest that school performance (McGloin, et al., 2004; Tresniewski, et al., 2006) and childhood aggression (Farrington, 2003; Moffitt, Caspi, Dickson, Silva, & Stanton, 1996; Patterson, DeBaryshe, & Ramsey, 1989) have important independent effects on antisocial behaviour. Familial processes found to be important in explaining antisocial behaviour in this research also support extant research that indicates that dyadic adjustment (Najman, et al., 1997; Shaw, Winslow, Owens & Hood, 1998), length of marital relationships (Henry, et al., 1993; Peris & Emery, 2004) and family communication (Beyers, Loeber, Wikstrom & Stouthamer-Loeber, 2001; Lambert & Cashwell, 2004) are most predictive of antisocial behaviour.

Results from this study also highlight the need for critical reflection on the relative importance of neighbourhood factors in explaining antisocial behaviour. Certainly, a community's level of socio-economic disadvantage is shown to be strongly associated with crime, disorder and victimisation (Krivo & Peterson, 1996; Mason, 1998; Morenoff, et al., 2001 ; Morenoff & Sampson, 1997; Sampson, Morenoff, & Earls, 1999; Vinson & Homel, 1975; Weatherburn & Lind, 1998). However, this research suggests that antisocial behaviour in adolescence is best explained by family processes and individual factors and that variability in levels of antisocial behaviour in particular neighbourhoods is likely to be explained by variation in the individual and family level processes. These results may be due to this research being focused on antisocial behaviour at age 14 (Moffitt, 2006; Odgers et al., 2009) or may be a

consequence of community factors, like disadvantage being indirectly related to antisocial behaviour in adolescence through its impact on family processes (Weatherburn and Lind, 1998; 2001).

Given the findings of this research, future research needs to closely examine the ways in which place and neighbourhood contexts may facilitate or indeed hinder key family processes like parenting at different stages of the life course. The findings of this research also have policy implications for Government programs that centre on the prevention of antisocial behaviour. The findings suggest that programs such as the Pathways to Prevention Project (Homel, 1999) targeting at risk children and families during early childhood and adolescence would be most effective reducing the prevalence of antisocial behaviour.

## Chapter 1 Background

### ***Introduction***

When considering explanations of antisocial and criminal behaviour, researchers have examined individual, family and neighbourhood level variables. Yet, much of the research, particularly in Australia, fails to simultaneously model these factors. The present research examines individual and family factors measured in the MUSP and neighbourhood factors measured by the ABS census. The study explores an under-researched topic and is the first of its kind in Australia in that it simultaneously examines individual, family and neighbourhood predictors of antisocial behaviour. By utilising data from a prospective longitudinal study, this research provides a more detailed analysis of neighbourhood variations in incidences of antisocial behaviour than have previously been possible. This chapter provides an overview of the literature that is central to our research. In particular, it focuses on the key studies that have examined individual, familial and/or neighbourhood factors and their effects on antisocial behaviour.

### ***Contrasting offending with antisocial behaviour***

Offending at its most simple level is behaviour which contravenes codified laws, however there are multiple ways of conceptualising and operationalising the measurement of offending behaviour. Conceptualising offending in the context of codified laws works well when examining adults but not as well for younger people. Developmental and life course criminologists interested in the development of offending behaviour usually explore origins in early childhood. Given that violations and subsequent adjudication of codified laws are almost non-existent for children it does not make conceptual sense to examine the *offending* of children. Therefore, researchers interested in the development of offending examine behaviours in childhood such as aggression, delinquency and antisocial behaviour. Behaviours defined as offending are part of a larger syndrome of antisocial behaviour (Farrington, 1991; Rutter, 1997) and substantial stability can be observed in antisocial behaviour over time (Laub & Sampson 1991; Piquero, Farrington & Blumstein, 2003). It is this larger syndrome of *antisocial behaviour* that is the focus of the current research.

*Antisocial behaviour* is a broad term that has different meanings at different stages of the life course. For example it encompasses “biting and hitting at four, shoplifting and truancy at ten, selling drugs and stealing cars at 16, robbery and rape at 22, and fraud and child abuse at 30” (Moffitt, 1996). The current

project focuses specifically on *adolescent* antisocial behaviour and includes a broad range of behaviours in its measurement such as stealing, lying, school truancy, arguing, wilful damage, disobedience, and physical fights (measurement is discussed in detail later in this report). While some of these behaviours, if detected by police, could be processed as criminal offences, it is clear that antisocial behaviour is much broader than just offending behaviours.

Competing theoretical explanations for the observed peak during adolescence in the age-crime curve appear in the literature (Gottfredson, 2005; Hirschi & Gottfredson, 1995; Sampson & Laub, 1995, 2005) however one point that all researchers agree on is that there is a relationship between age and crime, with crime rates declining as offenders age (Laub & Sampson, 1991; Piquero, Farrington, & Blumstein, 2003, p. 366). There is compelling evidence that a very small proportion of offenders are responsible for the majority of offences, that is the *frequency* at which offences are committed causes the peak in the age-crime curve (Tracy, Wolfgang, & Figlio, 1990, p. 280). However, Farrington (1986) suggests that the aggregate peak age of offending primarily reflects variation in *prevalence* and not frequency. That is, the evidence suggests that the peak is due to more individuals engaging in offending behaviours during adolescence rather than those who were offending previously engaging in higher rates of offending (Elliott, 1994, p. 5; Farrington, 2003, p. 142; Huizinga, Loeber, & Thornberry, 1993; Tracy, et al., 1990, p. 275; Wolfgang, Figlio, & Sellin, 1972, p. 65). The current research focuses on adolescence and during this period of development it is expected that there will be a high *prevalence* of antisocial behaviour within the sample. However, we anticipate that more extreme levels of antisocial behaviour will be associated with key individual and family characteristics. Additionally it is expected that particular neighbourhood factors will predict higher antisocial behaviour during the adolescent period.

### ***Individual and familial explanations for antisocial behaviour***

Previous research concerned with examining behavioural problems during adolescence primarily focuses on a broad range of individual and familial factors. One of the earliest studies looking at the development of antisocial behaviour was carried out by Glueck and Glueck (1950). The Gluecks employed a matched-pair design, studying 500 boys from Massachusetts who were either in the Lyman School for Boys in Westboro, the Industrial School for Boys in Shirley, and an additional seven boys who although they had not been in either of the Schools had court records of continuing offences. The 'delinquent' boys were matched with 500 'non-delinquent' boys, of whom approximately one quarter,

despite their title, had committed a range of delinquent acts but these were described as 'very occasional or accidental'. They are perhaps best described as 'normal youth' rather than 'saints' (Sampson & Laub, 1993). One of the key findings from the Gluecks' research was that poor family management leads to delinquency (Laub & Sampson, 1991; Piquero, Farrington, & Blumstein, 2003, p. 366). While not recognised at the time, this study was foundational in directing focus to the examination of individual and familial factors in studies of antisocial behaviour across the life course.

Since this time a large number of studies examining the development of offending and antisocial behaviour have been carried out. For example, in the United States, the Philadelphia Birth Cohort Studies examined all males born in Philadelphia in 1945 (cohort 1) and both males and females born in 1958 (cohort 2). Those who engaged in antisocial behaviour were characterised by greater residential instability, lower scholastic achievement and fewer school years completed (Tracy, Wolfgang, & Figlio, 1990, p. 275). More recently, the Causes and Correlates research program was begun in 1986 by the Office of Juvenile Justice and Delinquency Program (OJJDP) and incorporates the Pittsburgh Youth Study, Rochester Youth Development Study and Denver Youth Survey (Kelley, Huizinga, Thornberry, & Loeber, 1997). One of the key findings from these studies is that involvement in less serious forms of problem behaviour and delinquency precede more serious forms (Loeber, Wei, Stouthamer-Loeber, Huizinga, & Thornberry, 1999). Given that antisocial behaviour in adolescence is a precursor to later offending, these findings highlight the importance of studying antisocial behaviour.

In the United Kingdom, the Cambridge Study in Delinquent Development is a prospective longitudinal study of 411 South London boys, mostly born in 1953 (Farrington, 2003, p. 137). The males in the study were interviewed nine times from age 8 to 46 (which were the forty years spanning 1961 to 2002). The study allowed for the identification of risk factors that preceded offending and showed that they were more likely to: be troublesome and dishonest in primary school; come from poor, large families in which they were neglected; have convicted parents; receive poor parenting and harsh or erratic discipline; experience parental conflict; and receive poor supervision. They were also more likely to have experienced broken homes; have a father with erratic employment history; have lower intelligence and school achievement; be risk takers; be impulsive and hyperactive; and below average height and weight (Farrington, 2003, p. 149). The importance of these risk factors from across the life course highlights the need for any spatial study of antisocial behaviour to incorporate broad ranging individual and familial risk factors into analyses.

There is also evidence from Australia which points to a range of individual and familial factors that must be considered in the development of antisocial behaviour. The Australian Temperament Project began in 1983 and the original sample of 2443 included children born in urban and rural Victoria between September 1982 and January 1983. (Prior, Sanson, Smart, & Oberklaid, 2000; Smart, Vassallo, Sanson, & Dussuyer, 2004; Vassallo, et al., 2002, p. 6). Since then there have been waves of data collection until the participants were in their twenties. Results from this research indicates that the individual and familial precursors of antisocial behaviour are similar for both males and females; that there are few differences between the different pathways of antisocial behaviour on the basis of socio-demographic characteristics; that peer relationships are similar in quality but the low/non-antisocial individuals interacted with peers in a structured setting while the two antisocial groups interacted with their peers more frequently and were more likely to be in an unstructured setting; and finally that school attachment and adjustment was more important than achievement for explaining antisocial behaviour (Vassallo, et al., 2002, p. 37). Those individuals whose antisocial behaviour decreased during adolescence were in better family environments and were better adjusted and attached to their schools (Smart, et al., 2003).

These key studies provide the foundations for the development of various, and sometimes competing developmental and life course theories that attempt to explain the onset, continuity and desistence of antisocial and offending behaviour across the life course (for a summary see Farrington, 2005; Farrington, 2006). For example, in explaining the aforementioned peak in the age-crime curve, some theories focus on the antisocial potential or propensity of individuals (Farrington, in press; Lahey, Waldman, & Burnett, 1999) and others also identify different 'types' of individuals with specific groups of individuals engaging in antisocial behaviour during adolescence (Lahey, et al., 1999; Le Blanc & Kaspy, 1998; Moffitt, 2006; Thornberry & Krohn, 2005). There are also those that focus on opportunities to offend and/or social controls to prevent offending (Laub & Sampson, 2003; Wikström, 2005).

As Farrington (2005) notes, each of these theories consider the role of neighbourhoods. For example, neighbourhoods can influence the degree to which antisocial potential becomes antisocial behaviour (Lahey, et al., 1999). Neighbourhoods characterised by disorganisation with many delinquent adolescents can have a negative influence (Farrington, 2005), lack the necessary social controls for preventing antisocial behaviour (Laub & Sampson, 2003; Wikström, 2005) and create opportunities for social mimicry of antisocial behaviour (Moffitt, 2006). Despite the acknowledgement of neighbourhood

level explanations in these theories, there is very little empirical research which explicitly incorporates the individual and familial level variables usually examined by developmental psychologists and criminologists, with the broader macro level variables measured at the level of the neighbourhood.

### ***Ecology of crime: Neighbourhood factors***

Individual lives and family relationships are played out in varying geographical and neighbourhood contexts and for nearly a century scholars have explored the ways in which a community's culture and its structure impact upon the life chances of its constituents. In the 1920's, Robert Park and Ernest Burgess, the founding fathers of the Chicago School, departed from the prevailing individualistic theories of crime and deviance in the United States and suggested instead that causation stemmed from the social organisation of the city (Park, Burgess, & McKenzie, 1925). Clifford Shaw and Henry McKay (Shaw & McKay, 1931/1999) were strongly influenced by this ecological approach to understanding the differential distribution of crime and subsequently used the concentric city zones to guide their investigation into the spatial distribution of delinquency across Chicago neighbourhoods. Shaw and McKay's research firmly established the role of the neighbourhood in influencing crime and delinquency. They argued that socio-economic status, the cultural transmission of delinquent behaviour patterns resulting from constant exposure to contradictory standards of behaviour and the breakdown of community norms and conventional values explained crime more comprehensively at the community level.

The 1980's brought about a renewed focus on the importance of neighbourhood effects in criminological research. Studies examining community effects and childhood and adolescent outcomes regained prominence in the social sciences (Bursik, 1988; Sampson, 2002; Sampson & Groves, 1989; Wilson, 1987). A body of research that has emerged, predominantly in the United States, clearly demonstrates the relationship between the structural dimensions of the neighbourhood and poor outcomes for children and young people including infant mortality, child maltreatment, high school drop-out rates and adolescent delinquency (Brooks-Gunn, Duncan, & Aber, 1997a, 1997b). The most significant structural predictors of crime and delinquency are socio-economic status, residential instability and the concentration of immigrant or minority residents. Bursik and Grasmick (1993) argue that high levels of poverty and residential mobility coupled with a population comprising diverse cultural

backgrounds makes it difficult for a neighbourhood to establish common norms and values that facilitate crime prevention.

Research also indicates that negative outcomes such as crime or child maltreatment are spatially clustered, confined to particular types of communities (Krivo & Peterson, 1996; Mason, 1998; Morenoff & Sampson, 1997; Sampson, Morenoff, & Earls, 1999; Weatherburn & Lind, 1998). In Australia, Vinson and Homel (1975) demonstrated the coalescence of medical and social problems (including crime) in disadvantaged Newcastle communities and Braithwaite's (1979) research provided insight into the relationship between social status and crime across Australia. More recently, Weatherburn and Lind (1998, 2001) proposed an epidemic model of growth in the offender population derived from measures of economic and/or social stress, especially in the absence of social supports.

Currently little research exists that considers the effects of place on antisocial behaviour. One exception is a recent study conducted by Candice Odgers and her colleagues (2009) in the United Kingdom. Drawing on the E-Risk Longitudinal Twin study, Odgers et al. (2009) examined the impact of neighbourhood deprivation and neighbourhood affluence on the development and the decline of antisocial behaviour in early and middle childhood. As the E-Risk study includes key individual and familial predictors of antisocial behaviour at various points in time, Odgers and her colleagues provide the first longitudinal, hierarchical examination of the impact of neighbourhood factors on children's levels of antisocial behaviour at school entry and their influence on the rate of decline of such behaviour from age five to age ten. Their findings add to the existing neighbourhood effects literature in two important ways. First, drawing on a developmental perspective they demonstrate the need to consider individual and familial predictors that extend beyond basic socio-demographic measures like household income when examining individual outcomes. For example, parents' antisocial behaviour, child maltreatment and domestic violence were all very strong predictors of a child's antisocial behaviour in this research. Second, by including a fuller complement of individual and familial measures and by examining change over time, Odgers and her colleagues' research provides a more accurate account of neighbourhood influences on antisocial behaviour across key developmental periods. Their study clearly demonstrates that neighbourhood deprivation is associated with a "more compromised developmental course of antisocial behaviour" (Odgers et al., 2009: 954) as children growing up in deprived areas not only had higher levels of antisocial behaviour at ages five and 10 years, but were also less likely to demonstrate a decline in this behaviour across time.

The E-Risk study goes some way in demonstrating the need to consider the interdependence of individual, family and neighbourhood processes across time. However, this research does not examine whether antisocial behaviour, like crime, is spatially concentrated in particular types of places. Moreover, while the inclusion of family processes greatly improves on previous neighbourhood effects research concerned with individual level outcomes, the measures used are limited in scope, concentrating predominantly on parental antisocial behaviour. Thus the hierarchical nature of the complex and dynamic relationship among the individual, their family, their community and antisocial behaviour is still at an early stage of development.

### ***Aims of the proposed research***

In Australia, there is limited criminological research that analyses the dynamic relationship between individual and social factors and their relationship to crime (an exception is Mazerolle et al., in press). To our knowledge, there is no research in Australia that has specifically utilised this approach to understand the prevalence of antisocial behaviour. The present research seeks to address this gap. Specifically it will examine the relative impact of individual, familial, and neighbourhood influences on antisocial behaviour across the South East Queensland Region (SEQR). This study provides a more refined and nuanced approach to understanding the prevalence of antisocial behaviour in an Australian context. Also, incorporating new spatial analytic modelling and visualisation techniques provides insight into the spatial distribution of antisocial behaviour in SEQR.

### ***Research questions***

Corresponding to the above aims, key questions guide the present research:

1. What are the key individual and family characteristics that predict individual antisocial behaviour?
2. Are there spatial differences in individual level antisocial behaviour? That is, is antisocial behaviour concentrated in certain types of places?
3. Are there independent neighbourhood effects on antisocial behaviour when controlling for individual characteristics and family processes?

## **Chapter 2 The Antecedents of Antisocial Behaviour**

### ***Introduction***

An examination of the extant literature on the predictors of antisocial behaviour show great breadth in the factors that are related to this outcome. The purpose of this chapter is to summarise the existing evidence on each of the factors examined in the current study. They are presented in three sections: individual level characteristics; maternal and familial characteristics; and neighbourhood characteristics.

### ***Individual level characteristics***

#### **Problems during pregnancy and at birth**

Problems during pregnancy and at birth increase the likelihood of neuropsychological deficits, due to stress and trauma to the foetus/newborn. Recent research has shown that perinatal and obstetrical complications: in the context of family adversity, are related to higher levels of antisocial behaviour in boys (Beck & Shaw, 2005); increase the risk of violent behaviour (Arseneault, Tremblay, Boulerice, & Saucier, 2002); are related to criminal violence (Harris, Rice, & Lalumiere, 2001); and when coupled with maternal rejection, increase the likelihood of early onset violent criminal behaviour (Raine, Brennan, & Mednick, 1997). Collectively, this research points to a relationship between problems at the time of birth and subsequent antisocial behaviour.

#### **Time away from mother**

There are two main ways that a child can spend time away from their mother: firstly, the child can be removed from the home of the mother and live with someone else for longer periods of time and secondly, the child can go into short term care such as child care. The weight of the empirical evidence suggests that child care is beneficial to a child's development (Bacharach & Baumeister, 2003; Borge, Rutter, Cote, & Tremblay, 2004; Votruba-Drzal, Coley, & Chase-Lansdale, 2004). On the other hand, long term care outside the home (Christoffersen, Francis, & Soothill, 2003) has detrimental effects on child development. Research has found that adolescents and young men exhibiting violent criminal behaviour often come from homes where there has been disruption of the family unit with the child being placed outside the home (Christoffersen, et al., 2003). Other research has found that disordered children are differentiated from non-disordered by many changes in the child's primary caretaker during childhood

(Henry, et al., 1993). Overall, this research demonstrates the negative outcomes that can result from longer term changes in the child's carers.

## **Peer rejection**

Peer rejection is a significant predictor of antisocial behaviour (Dishion, Patterson, Stoolmiller & Skinner, 1991; Ladd, 2006; van Lier, Vitaro, Wanner, Vuijk, & Crijnen, 2005). When coupled with childhood aggression, peer rejection for girls leads to adolescent aggressive behaviour, substance use and risky sexual behaviour (Prinstein & La Greca, 2004). On the other hand, popularity with peers seems to facilitate low level delinquency and drug use, but it also decreases behaviours such as hostility (Allen, Porter, McFarland, Marsh, & McElhaney, 2005). Relational problems with peers are also related to both male and female delinquency (Agnew & Brezina, 1997)

## **School achievement**

An analysis of the National Longitudinal Survey of Youth (NLSY) data shows that IQ does not have a direct relationship with delinquent behaviour, rather its effects operate indirectly through inhibiting school achievement and lowering self control (McGloin, et al., 2004). Recent research indicates that the relationship between antisocial behaviour and reading achievement in boys is due primarily to the same environmental factors, and that reading achievement and antisocial behaviour have a reciprocal influence on each other over time (Trzesniewski, Moffitt, Caspi, Taylor, & Maughan, 2006). Despite these relationships child verbal intelligence has been found to be related to future delinquency and criminality, even when controlling for SES (Stattin & Klackenber-Larsson, 1993), race, social class and test motivation (Lynam, Moffitt, & Stouthamer-Loeber, 1993). Poor school achievement appears to be a necessary component in the path between early disruptive behaviour (in grade one at school) and delinquency at 14 years of age for both boys and girls (Tremblay, et al., 1992) and academic failure is predictive of antisocial behaviour at age 12 (Dishion, et al., 1991).

## ***Maternal and Family Factors***

### **Number of births / Parity**

The evidence regarding the impact of birth order on antisocial behaviour is mixed (Begue & Roche, 2005; Pevalin, Wade, & Brannigan, 2003, p. 129). Recent research shows that first-born children are less likely to participate in delinquent behaviour, which is due in part to differential parental control and

number of siblings (Begue & Roche, 2005; Werner, 1993). The presence of siblings can be beneficial to social development. For disadvantaged inner-city adolescents, older sibling support is associated with positive adolescent development in relation to delinquency, academic performance and mental health (Widmer & Weiss, 2000). Children who grow up with siblings also have better social and interpersonal skills and are better able to negotiate peer relationships (Downey & Condrón, 2004). Siblings are also important in the context of desistance from antisocial behaviour. Overall the evidence indicates that being first born is likely to inhibit antisocial behaviour (Begue & Roche, 2005). The presence of siblings increases social support from siblings (Widmer & Weiss, 2000) but leads to parental resource dilution (Downey, 2001).

### **Maternal age**

It is unclear whether antisocial offspring are a result of the age of the mother or the mother's own behavioural problems. Research shows that those children who have early onset of conduct and psychiatric problems are more likely to end up being teenage parents (Cairns, Cairns, Xie, Leung, & Hearne, 1998; Kessler, et al., 1997; Woodward & Fergusson, 1999). Additionally the children of these teenage parents are also more likely to have childhood and adolescent behavioural problems<sup>1</sup> (Fergusson & Lynskey, 1993; Gray, Indurkha & McCormick, 2004; Spieker, Larson, Lewis, Keller & Gilchrist, 1999), lower scores on tests of cognitive ability (Fergusson & Lynskey 1993), and are at greater risk of delinquency and criminality (Conseur, Rivera, Barnoski & Emanuel, 1997; Jaffee, Caspi, Moffit, Taylor & Dickson, 2001; Nagin, Pogarsky & Farrington, 1997). Externalising behaviours are found to decrease continuously with increasing maternal age at delivery in both boys and girls (Orlebeke, Knol, Boomsma & Verhulst, 1998). Overall the evidence suggests that lower maternal age is related to higher levels of antisocial behaviour in offspring.

### **Maternal depression and anxiety**

Maternal depression impacts on children's lives in both social context and the physiology of the child, particularly around the time of the birth. People who are depressed have interpersonal difficulties that may lead to inappropriate parenting (Hammen & Brennan, 2002). For example, mothers with postnatal depression touch their infants more negatively and their infant directed speech is less well adjusted

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<sup>1</sup> An exception is Cairns and his colleagues (1998) who found that the aggressive behaviour of teenage mothers when they were children themselves was not strongly related to the aggressive behaviour of their offspring.

(Herrera, Reissland & Shepherd, 2004). Children of mothers with postnatal depression have more behaviour problems during their second year of life (Mathiesen, et al., 1999).

Biological research suggests that when focusing specifically on the physiology of the child, *prepartum* depression may be more of a concern. In a recent study (Diego, et al., 2004), those infants whose mothers exhibited both pre- and postpartum maternal depression had elevated cortisol and norepinephrine levels (which are both produced as a response to stress), lower dopamine levels (linked to affective disorders such as depression), and greater relative right frontal EEG asymmetry (which is characteristic of negative affect). When the mother only experienced postpartum maternal depression, infants displayed greater relative right frontal EEG asymmetry and higher norepinephrine levels (Diego, et al., 2004). Similar patterns of relative right frontal EEG asymmetry are found in 3-6 month year old infants of depressed mothers (Field, Fox, Pickens, & Nawrocki, 1995). These early differences in physiology may explain behavioural differences that have been observed in other research on child behaviour and maternal depression.

When considering the impact of depression on child antisocial behaviour, previous analyses of the MUSP data show that contemporaneous episodes of maternal depression are most influential (Brennan, et al., 2000). Maternal depression can also affect the level and type of parenting which, in turn, has been found to lead to child behaviour problems (Herwig, Wirtz & Bengel, 2004). These effects may have long lasting, cumulative outcomes, as postpartum maternal despair and anxiety has been shown to be predictive of lower scores on a high school entrance exam when the child was 11 to 12 years of age (Galler, et al., 2004).

Maternal depression *and* anxiety is also an antecedent to inattentive/impulsive/overactive behaviours in children and maternal anxiety is a precursor to oppositional/defiant behaviour (Elgar, Waschbusch, McGrath, Stewart & Curtis, 2004). Maternal depression predicts both internalising and externalising behaviours in children (Herwig, et al., 2004; Nelson, Hammen, Brennan & Ullman, 2003) and increases the risk of behavioural disorder in boys (Williams, Anderson, McGee & Silva, 1990). In addition it has been shown to slightly increase the odds for non-violent and violent offending in males (Maki, et al., 2003) and non-violent offending in females<sup>2</sup> (2003, p. 276). Despite this, children with a higher IQ, closer

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<sup>2</sup> Statistically significant differences were found for males but not females.

parental monitoring, and better family functioning are resilient to the negative effects of maternal psychopathology (Tiet, et al., 2001). Collectively, these findings highlight the impact that maternal mental health can have on the behaviour of offspring. The main mechanisms that are proposed for this relationship are firstly that mother child interactions are more negative and secondly that the child's brain physiology is altered.

### **Family communication**

Poor family communication is also related to antisocial behaviour outcomes in adolescents. Some research even suggests that child disclosure of their activities to parents rather than surveillance and monitoring by parents is most closely related to reduction in delinquency (Stattin & Kerr, 2000). Perceived effective communication with parents is negatively correlated with school-based aggression (Lambert & Cashwell, 2004). Low parent-adolescent communication is also a risk factor for later repeated violence for those adolescents that live in low-SES neighbourhoods (Beyers, Loeber, Wikström, & Stouthamer-Loeber, 2001). Collectively this research demonstrates that communication is an important element of parenting when considering the development of antisocial behaviour.

### **Family income**

Higher socioeconomic status is demonstrated to be one of the strongest inhibitors of early onset antisocial behaviour (Gibson, Piquero & Tibbets, 2000). Previous research using MUSP data has shown that the longer families experience low income, the higher the rate of child behaviour problems at age five (Bor, et al., 1997). However the relationship between low family income and externalising behaviour appears to be mediated by maternal depression (Bor, et al., 1997) and less positive parenting (Larzelere & Patterson, 1990; Laub & Sampson, 1988); (National Institute of Child Health and Human Development Early Child Care Research Network, 2005). This suggests that it is not economic disadvantage in particular that is producing children with antisocial behaviour. The effect of childhood economic disadvantage on self-reported and official criminal behaviour is instead mediated by adverse family, individual, school and peer factors (Fergusson, Swain-Campbell, & Horwood, 2004). However, persistent poverty has been shown to be related to a higher rate of delinquency than episodic poverty (Jarjoura, et al., 2002) and continuing involvement in street crime (Farnworth, et al., 1994). Another way in which economic disadvantage is related to antisocial behaviour is via a detrimental effect on cognitive development (McLoyd, 1998; National Institute of Child Health and Human Development Early Child

Care Research Network, 2005). The timing of poverty is also important, with some research indicating that later poverty (during childhood) is more detrimental to cognitive development than poverty during infancy (National Institute of Child Health and Human Development Early Child Care Research Network, 2005).

Despite this evidence, there is some research that suggests that higher socioeconomic status has an indirect effect in facilitating antisocial behaviour (Wright, Caspi, Moffitt, Miech, & Silva, 1999). Low socioeconomic status facilitates the development of antisocial behaviour by increasing alienation, financial strain, aggression, and decreasing educational and occupational aspirations (Wright, et al., 1999). At the other end of the spectrum, high socioeconomic status facilitates antisocial behaviour through increased risk taking and social power, and decreasing conventional values (Wright, et al., 1999). In other words the graphical relationship between socioeconomic status and antisocial behaviour is curvilinear and U-shaped. Overall, socioeconomic status has been shown to have both a direct (Wright et al. 1999) and an indirect effect (Bor, et al., 1997; Fergusson, et al., 2004) on antisocial behaviour. Persistent poverty appears to be particularly prognostic of delinquency and offending (Farnworth, et al., 1994); (Jarjoura, et al., 2002).

## **Maternal smoking**

Smoking is important in the current study because it is a form of foetal disruption that is related to poor neuropsychological functioning (Moffitt, 1994). A review of the literature provides support for but does not *prove* that prenatal smoking plays an etiologic role in the onset of antisocial behaviour (Wakschlag & Hans, 2002). However the literature shows a consistent link between antisocial behaviour and prenatal smoking (Wakschlag, Pickett, Cook, Benowitz & Leventhal, 2002). The mechanism linking maternal smoking to antisocial outcomes is still not clear, however there is a substantial body of research that shows that after controlling for a range of social, familial and personal factors, the association remains (Fergusson, 1999). A possible mechanism by which smoking during pregnancy leads to antisocial behaviour in offspring is via a disruption of noradrenergic functioning and enhancement of cholinergic receptors that inhibit cardiac functioning (Raine, 2002b).

Biological differences between babies whose mothers smoke and those who do not, are detectable from birth. Previous research using the MUSP data shows that cigarette exposure during pregnancy adversely affects head circumference and birth weight (O'Callaghan, O'Callaghan, Najman, Williams, & Bor, 2003).

Maternal smoking at the MUSP first clinical visit is also predictive of externalising behaviour at age five, with a dose response of higher levels of smoking resulting in higher levels of externalising behaviour (Williams, et al., 1998). These dose response findings are similar to those of an earlier study by Weitzman, Gortmaker, and Sobol (1992) who found more extreme behaviour problems associated with mothers smoking more cigarettes during pregnancy.

Research on the children of mothers who smoked during pregnancy using the Christchurch Study data shows small but detectable increases in the risk for problem behaviour in childhood when controlling confounding factors (Fergusson, Horwood, & Lynskey, 1993). Smoking during pregnancy was also predictive of offspring externalising disorders in late adolescence (16-18 years) (Fergusson, Woodward, & Horwood, 1998). Girls who were exposed to maternal smoking during pregnancy were at double the risk for later offending in the 1966 North Finland cohort (Kemppainen, Jokelainen, Isohanni, Jarvelin, & Rasanen, 2002).

The effects of maternal smoking during gestation are ongoing for the exposed children. Smoking during pregnancy is predictive of behaviour problems at age four to five (Wasserman, Liu, Pine & Graziano, 2001), hyperactivity at age eight (Kotimaa, et al., 2003), higher rates of behaviour problems and school failure (Weitzman, Byrd, Aligne & Moss, 2002), and behaviour problems at 3, 5 and 8 (Gray, et al., 2004). In addition these children are more prone to respiratory diseases, are shorter, and report poorer school performance at age 14 (Rantakallio, 1983).

A meta-analysis (Linnet, et al., 2003) showed that exposure to tobacco smoke in utero is associated with attention deficient hyperactivity disorder (ADHD) behaviours in children. However, it is argued that the relationship between maternal smoking and boys conduct disorder may be attributable to a latent familial transmission of antisocial behaviour and not the direct effect of smoking (Silberg, et al., 2003). But for ADHD at least the effect has been shown to hold in children aged 5-16 independent of genetic influences (Thapar, et al., 2003)

Maternal smoking during pregnancy is also linked to the onset and duration of antisocial behaviour of offspring. Maternal smoking during pregnancy interacts with low APGAR scores (a measure of the newborn's health) to predict later offending behaviour (Gibson & Tibbetts, 1998). It is also linked to an earlier age of police first contact, with similar patterns for males and females (Gibson, Piquero, & Tibbetts, 2001). Life-course persistent offending is predicted by maternal smoking, when based on

official criminal history and conceptualised in a similar way to Moffitt (Piquero, et al., 2002). Maternal smoking during pregnancy also predicts adult male persistent criminal outcome but not adolescence limited offending behaviour (Brennan, Grekin, & Mednick, 1999; Rasanen, et al., 1999). Maternal smoking during pregnancy is also associated with violent offences among male offspring in adulthood, with sons of smokers having two times the risk of committing a violent crime or persistent offending<sup>3</sup> (Rasanen, et al., 1999). Although the mechanism linking maternal smoking to antisocial behaviour is unclear, an association has been observed in the research discussed above. There is some evidence that suggests the relationship is biological (O'Callaghan, et al., 2003; Raine, 2002a).

### **Maternal alcohol consumption**

Maternal alcohol consumption is related to the antisocial behaviour of children. Similar to heavy cigarette consumption during pregnancy, there appears to be an effect on the foetus when the mother consumes large amounts of alcohol during the pregnancy (Streissguth, Barr, Sampson, Darby, & et al., 1989). Even after controlling for a range of variables related to IQ such as parental education, race, prenatal nutrition, child's sex and birth order, mother-child interaction, and preschool attendance, maternal consumption of three drinks of alcohol per day during pregnancy resulted in a decrease of an average of 5 points in IQ in the child at 4 years of age (Streissguth, et al., 1989).

The effect of alcohol consumption on child behaviour could also be environmental. Adolescents whose parents have a history of alcohol dependence exhibit higher levels of alienation and aggression (Elkins, McGue, Malone, & Iacono, 2004). For example, adolescents and young men exhibiting violent criminal behaviour often come from homes where there is maternal alcohol abuse (Christoffersen, Francis & Soothill 2003). However other research shows that parental alcohol dependency only affects adolescent behaviour when comorbid with parental drug dependence and/or depression (Ohannessian, et al., 2004). Overall the combined evidence of the biological and environmental impact of maternal alcohol consumption makes it an important issue to consider in the examination of antisocial behaviour.

### **Marital discord (Dyadic adjustment)**

Marital maladjustment is associated with child externalising behaviour in children as young as 3.5 years of age (Shaw, et al., 1998) and previous research using the MUSP data shows that mothers who rated

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<sup>3</sup> Not associated with non-violent offences.

their relationship with their partners as poor also reported the highest rate of child behaviour problems<sup>4</sup> when the child was aged 5 (Najman, et al., 1997). Mothers' perceptions of marital problems had a strong relationship to aggression in a study of both boys and girls aged 3 to 8 (Dadds & Powell, 1991).

A number of studies indicate that the relationship between marital conflict and problem behaviour is also evident in older children. Marital conflict was positively associated with children's internalising and externalising problems in children aged 10 years old (Stocker, Richmond, Low, Alexander & Elias, 2003). Exposure to marital conflict also increased the likelihood of aggressive behaviour in children aged 8-16 years (Stockman, 2000). Marital discord can result in emotional and behavioural disturbances in both male and female children aged 10-15 years (Rutter & Quinton, 1984) and is consistently linked to adolescent (15-16 years of age) behaviour problems (Peris & Emery, 2004).

In a study of adolescents aged 14-16, exposure to arguments and fights between parents at home was also positively related to depressed mood and anger. Anger had an indirect effect on delinquency however exposure to arguments also had a direct effect on delinquency (Sigfusdottir, Farkas, & Silver, 2004). Arguments also had a greater impact on the depression and anger of girls but it had a stronger impact on delinquency of boys (Sigfusdottir, et al., 2004). In addition, when children are aware of marital conflict, negative interactions with the opposite sex parent may be particularly harmful (Osborne & Fincham, 1996). Research on marital violence shows that it does not predict the delinquency of girls or boys (Becker & McCloskey, 2002), however paternal abuse has a direct effect on the violent and non-violent offending of girls (Becker & McCloskey, 2002). Overall, it seems that there is a relationship between behaviour problems and marital discord (Dadds & Powell, 1991; Najman, et al., 1997; Shaw, et al., 1998).

## **Marital disruption**

Families become less stable when there are changes in marital status which can affect the behaviour of the children in the family. Children from homes experiencing marital disruption have higher levels of antisocial behaviour (Henry, et al., 1993; Peris & Emery, 2004). Additionally, single parent status and an increased number of parent changes increases risk for criminal conviction (Henry et al. 1996).

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<sup>4</sup> It is important to note that this relationship is not necessarily causal; that is, the child behaviour problems could have predated the marital discord.

Adolescents and young men exhibiting violent criminal behaviour often come from homes where there has been family break-up (Christoffersen, et al., 2003). Previous research using the MUSP data has shown that children of mothers who experienced no partner changes have the lowest rates of child behaviour problems (Najman, et al., 1997). The prevalence of delinquency is higher in 'broken' families, with the relationship being stronger for minor offences rather than serious criminal offending (Wells & Rankin, 1991). Moreover, it appears that those homes broken by desertion result in the highest levels of delinquency among white males (Heck & Walsh 2000). A meta-analysis of research published in the 1990s showed that, when compared to continuously married parents, children of divorced parents score significantly worse on measures of behaviour and academic achievement (Amato, 2001). Subsequent research also finds that adolescent delinquency and poor academic achievement is explained by the number of marriages of the mother (Manning & Lamb, 2003). Collectively this research shows that marital disruption is related to the antisocial behaviour of children in the family (Henry, et al., 1993; Henry, Sager, & Plunkett, 1996; Peris & Emery, 2004).

### **Parenting style - supervision**

The ways in which parents respond to child behaviours affect the future behaviour of the child and lack of parental support and affection is related to violent behaviour (Saner & Ellickson, 1996). Supervision, in particular parental supervision, appears to be a crucial factor in curbing antisocial behaviour in adolescents. This is likely to be because parental supervision controls access to delinquent peers and performance of delinquent behaviours (Snyder, Dishion, & Patterson, 1986). Early meta-analytic research shows one of the strongest predictors of delinquency was lack of parental supervision (Loeber, Stouthamer-Loeber, van Kammen, & Farrington, 1991). More recent research suggests that high levels of supervision are related to fewer delinquent behaviour problems (Pettit, Laird, Dodge, Bates, & Criss, 2001) and lower levels of antisocial behaviour in both boys and girls (Jacobson, Prescott, & Kendler, 2002).

Additionally, where monitoring is low, police contact and self-reported delinquency is higher (Patterson & Stouthamer-Loeber, 1984). Given this, it is likely that ongoing low levels of monitoring may lead to persistent offending (Patterson & Stouthamer-Loeber, 1984). Children who are allowed to stay out late at night and report that their parents have a poor knowledge of their whereabouts have higher antisocial behaviour scores (Martens, 1997). Supervision has also been observed to be lower in single

parent families (Cookston, 1999). Collectively this research demonstrates the importance of supervision of children in preventing antisocial behaviour (Jacobson & Crockett, 2000; Martens, 1997; Patterson & Stouthamer-Loeber, 1984; Pettit, et al., 2001).

### ***Neighbourhood Effects***

While the majority of research in to antisocial behaviour centres on individual family characteristics, some recent research suggests the neighbourhood contexts should also be considered. The results of two major reviews of neighbourhood effects point to several socio-structural dimensions of the neighbourhood that are consistently associated with higher levels of crime, disorder and delinquency (Levanthal and Brooks-Gunn, 2000; Sampson, Morenoff and Gannon-Rowley, 2002). Residential mobility, immigration/racial concentration and neighbourhood disadvantage are consistently associated with crime (Sampson, et al., 2002). For social disorganisation theory in particular, these neighbourhood socio-structural conditions result in an inability for residents to realise common values, enforce internal social controls and develop primary relationships that are necessary in achieving social order (Bursik, 1988). Though explanations of antisocial behaviour have not yet explicitly considered social disorganisation theory, the balance of evidence suggests that certain tenets may be important.

### **Residential Mobility**

Residential mobility has a long history in criminological research as an important predictor of higher crime rates. Berry and Kasarda (1977) suggest that residential mobility or high population turnover makes it difficult for residents to develop the necessary relationships that facilitate informal social control. Schuerman and Korbin (1986) examined the key factors associated with high crime across a 20 year period in Los Angeles. Using a developmental model of place and taking a longitudinal approach to explain neighbourhood change, their findings suggest that the structural features of the environment were the key drivers of higher levels of crime. In particular, changing residential patterns significantly predicted higher crime rates across the 20 year period. Increased residential mobility and a change from owner occupied to rental dwellings were also highly associated with increases in crime rates.

### **Immigration Concentration**

In addition to residential instability, immigration and minority concentration/segregation continues to be central to the explanation of neighbourhood crime. Scholars suggest that ethnically heterogeneous

places or 'diversity' is associated with lower levels of trust which then erodes intra-community networks and reduces the level of prosocial engagement among residents. Putnam (2007) argues that ethnic diversity, at least in the short term, has deleterious effects on a community's social capital. In particular, Putnam (2007) suggests that social cohesion, trust and the development of networks outside one's own reference group are attenuated in ethnically heterogeneous neighbourhoods. He states that ethnic diversity increases the likelihood of social withdrawal that in turn encourages the distrust of others (especially of neighbours regardless of ethnic background) and a reduction in social interaction and participation in civic activities/organisations. For example, drawing on a citizenship survey of 15,093 British residents across 839 neighbourhoods, Letki (2008) found that people living in areas with high levels of ethnic diversity are more likely to report more negative attitudes towards neighbours.

### **Socio-Economic Disadvantage**

Although residential mobility and ethnic concentration are strongly associated with lack of trust in fellow residents, lower community civic participation and higher crime rates, their effects are most strongly felt in disadvantaged communities. The impact of social disadvantage on the development of trust and social cohesion is noted in much of the neighbourhood effects research. In many studies (see Guest, et al, 2008; Hipp, 2007; Hipp & Perrin, 2009; Letki, 2008; Putnam, 2007; Ross et al, 2001; Sampson, et al., 1997; , Stolle, et al., 2008), residents living in disadvantaged communities are significantly more likely to distrust their neighbours than those living in middle class or affluent areas. Ross et al (2001; 568) suggest that the powerlessness experienced by those living in disadvantaged areas "where resources are scarce and threats are common" encourages the development of mistrust and social withdrawal. As Sampson and Morenoff suggest (2006), this is because disadvantage sets in motion a process that undermines key processes associated with community organisation. Thus the vulnerability associated with ethnic diversity is mediated not only by social exchange, but the relative disadvantage of a particular neighbourhood or community. Further, of all the aforementioned neighbourhood determinants of poor behavioural outcomes, concentrated disadvantage is most robustly associated with problems for children and young people. In Leventhal and Brooks-Gunn's review (2000), concentrated disadvantage was associated with low school readiness, lower IQ scores and higher levels of externalising behaviours in children. For adolescents, disadvantage was associated with peer rejection, school drop-out and increases in delinquent behaviours like drinking or smoking

marijuana. In consideration of these findings, assessing the impact of neighbourhood disadvantage is important to the present research.

### ***Summary***

As this chapter demonstrates, the antecedents of antisocial behaviour are many and varied, existing at the level of the individual, the family and the neighbourhood. To date, explanations of antisocial behaviour have centred predominantly on individual and familial characteristics, largely to the exclusion of neighbourhood factors. Although some research exists which considers the effects of place on poor behaviour outcomes, it is limited in two ways. First, such research relies on probability samples across large cities or even nation states. Second, many of the studies that include neighbourhood predictors in their analysis of antisocial behaviour lack rich and nuanced measures of an individual's propensity for antisocial behaviour or key family processes known to be important predictors of antisocial behaviour. The present research is uniquely placed to simultaneously examine these individual predictors of antisocial behaviour within the broader family contexts and neighbourhood locations. Drawing on the longitudinal data from the MUSP, this project will simultaneously examine individual and family processes and key characteristics of the neighbourhood, like residential mobility, ethnic diversity and concentrated disadvantage. In so doing, it will be able to model, for the first time in an Australian context, the spatial clustering of antisocial behaviour and the extent to which neighbourhood factors predict antisocial behaviour when controlling for known individual and familial antecedents.

## Chapter 3 Methodology

The present study employs a secondary data analysis of the MUSP data using information from the first five phases of data collection (pre-natal through to 14 years of age). This chapter provides an overview of MUSP project and details the operationalisation of the key variables used in the present research.

### ***Data sources: The Mater–University Study of Pregnancy***

Data for this study are drawn from the MUSP project. Background information for the study as well as the demographic characteristics of participants are described elsewhere (Keeping, et al., 1989; Najman, et al., 2005). The following description of the study is based on information contained in these publications, the survey instruments, historical records and personal communication with the Principal Investigators.

The MUSP project was conceived in the late 1970s and developed by a multi-disciplinary group of researchers from The University of Queensland in Brisbane, Australia. These researchers saw a need for research that examined the broader social factors and characteristics of mothers that contribute to the outcome of pregnancy (Keeping, et al., 1989, p. 290). The available hospital records did not record the social and psychological variables required for research of this nature. As a result, the MUSP study was commenced in Brisbane in 1981.

Brisbane is the capital city of the State of Queensland, Australia. The estimated population of the Brisbane Statistical division at June 30, 1981 was 1,096,200 (Keeping, et al., 1989, p. 290). The site for the research was the Brisbane Mater Misericordiae Mothers' Hospital (MMH) which is one of the two major obstetric units in Brisbane. In the early 1980s between 6000 and 7000 patients per year had their children delivered at the MMH (Keeping, et al., 1989). During the first phase of the MUSP (1981-1984), MMH public section delivered between 54.6 and 61.3 per cent of all babies born in public hospitals in Brisbane (Keeping, et al., 1989, p. 290).

### **The MUSP Sample**

The target population for the study were those women who attended the hospital clinic as public patients for antenatal care. There is no means testing for use of the free public hospital clinic and full-time and visiting medical staff provide the care for public patients. Private patients attend the hospital

on a fee-paying basis, usually covered by private health insurance. The patients are supervised and their babies delivered by a private obstetrician. The same obstetricians also supervise the care of most of the public patients (Keeping, et al., 1989, p. 290). Public patients seeking obstetric care at the MMH routinely had an initial antenatal clinic visit. The researchers obtained a list of those women given appointments and prepared an enrolment questionnaire for them. Data collection occurred for three years from 1981, however collection occurred every second week for a period of time due to resource constraints (Keeping, et al., 1989, p. 292). During the first phase of data collection 8556 women were approached to participate in the study, of these 98 (one per cent) declined (Keeping, et al., 1989, p. 292).

### **Retention rates**

The prenatal and birth phases of data collection were undertaken prior to discharge from hospital. For those mothers who agreed to participate by completing both phases, 7223 live singleton children were discharged. This is considered to be the full cohort for the MUSP project. The other 1333 (of the total 8556) were excluded from the cohort for the following reasons:

- 98 mothers refused at the initial phase;
- 710 did not deliver a live child at the public hospital (including 169 miscarriages and those who chose to use other facilities);
- 59 mothers had multiple births;
- 312 did not complete the birth questionnaire;
- 99 children died during or post delivery; and
- 55 children were adopted prior to discharge (Najman, et al., 2005).

There was subsequent attrition from the sample at each of the phases of data collection. Those lost to follow-up in the first three phases were predominantly young, single and in the lowest income group (Keeping, et al., 1989, p. 292). About 72 per cent of those mothers who gave birth to a live singleton baby at the study hospital (the entry criteria) remained in the study at the 5-year and 14-year follow-ups, with some 64 per cent being available at both follow-ups. Loss to follow-up was due to both refusal and not being able to contact the participants using previous contact details. Table 3.1 (below) provides a summary of the response rates to each phase of the MUSP project used in the current research.

**Table 3.1: Summary of MUSP phases I–VI and number of participants at each phase**

Phase	Component	N
I. Prenatal – entry to the study	Mother’s questionnaire	8458
II. Three to five days after birth	Mother’s questionnaire	7421
III. 6 months after the birth	Mother’s questionnaire	6837
IV. Obstetric data	Coded data from hospital antenatal/neonatal obstetric data	7775
V. Five–year follow–up	Mother’s questionnaire about the child	5354
	Mother’s questionnaire about herself	5366
	Child assessment interview	4086
VI. 14–year follow–up	Child self-report questionnaire	5265
	Mother’s questionnaire about herself and the child	5278
	Child assessment interview	3867
	Youth supplementary	4040
	Mother supplementary	3797

Given that those lost to follow-up are disproportionately from lower socioeconomic status groups, it is likely that any estimates of effects are conservative (Najman, et al., 2005, p. 994). Data from the Christchurch study have also been used to examine potential effects of sample selection bias (loss to follow-up) and these tests have consistently found that the conclusions to be drawn from the data are the same before and after correction for sample bias (Fergusson & Horwood, 2001, p. 289).

### **Phases and methods of data collection**

This prospective longitudinal study has had a number of phases of data on the mother and child: entry to the study at the first prenatal visit; 3–5 days after the birth of the study child; obstetric data from hospital records on the birth of the child; then the mother and child were assessed again when the study

child was six months, five, fourteen years old. Many of the phases of data collection had a number of components, which are outlined in Appendix 1. The present study uses data from all the aforementioned phases.

## **Sample validity**

The MUSP study focuses on public patients. It is important therefore to examine the characteristics of both the public and private patients to see whether there are any differences in birth outcomes. Data from all deliveries at MMH 1982–4 show that younger and single mothers tended to use the public system. Despite this there are no major differences in terms of gestation, birth weight, APGAR scores and special care nursery admissions (Keeping, et al., 1989, p. 292). Nor are there major differences in perinatal mortality rates (Keeping, et al., 1989, p. 293).

Despite there being little variation in obstetric outcome, there is considerable variation in socio-economic characteristics when the sample is compared to the Brisbane population. The sample is under-representative of professional, administrative and clerical workers and skewed towards blue-collar and manual workers (Keeping, et al., 1989, p. 293). This is reflected in the family incomes of the cohort. At the time of the initial data collection in Brisbane, 19 per cent of households had an income greater than \$26 000. In the MUSP cohort however only 3.4 per cent fall into this category (Keeping, et al., 1989, p. 293).

In summary, although the sampling procedure employed in the MUSP was systemic and rigorous, there are still some slight compositional issues to consider because this sample is drawn from the public section of MMH. The MUSP sample is socially disadvantaged when compared to the wider population. Despite this, the MUSP research design allows for the assessment of change over time, particularly when the repeated measures of key constructs are analysed. Internationally there has been little research which simultaneously examines independent and familial characteristics with neighbourhood characteristics.

## **Sample for the Present Research**

There are 7,223 participants in what is commonly referred to as the MUSP birth cohort (Najman et al 2005). This sample comprises those mothers who gave birth to a live singleton baby at the Mater hospital at the commencement of the MUSP project. This figure includes those women who have

participated in some, but not all phases of the research. Only those participants who completed all phases of the research (from prenatal to 14 years of age) and were successfully geo-coded to an address in the South East Queensland region (SEQR) were considered for this research. The total sample size for all analyses conducted herewith is 3,817 participants. These respondents resided in 259 Statistical Local Areas (SLA) in the South East Queensland region (SEQR) in Australia at the time of the 14 year data collection. In 1996, there were 290 SLAs in SEQR. The average population across the 290 SLAs was 7,135 persons with a range of 126 and 66,135 persons in each SLA. Although the socio-economic status of mothers in the MUSP sample differs from those in the population more broadly, there is no difference in the socio-economic status of the SLAs in which the participants reside when compared to the 290 SLAs that make up the SEQR.

An SLA is a general purpose spatial unit used to collect and disseminate statistics. In some instances the SLA is a geographic representation of one suburb, but can also comprise two or more suburbs (ABS, 2001). We recognise the problems associated with using the SLA as a measure of community in this research and note the definitional limitations of 'neighbourhood' and 'community' in the neighbourhood effects literature. For centuries, scholars have been plagued with the complexities of operationalising the term "community" (e.g. Hillery, 1955). In much of the research, a neighbourhood is defined and operationalised by enumerating space and overlaying geographic boundaries. The underlying assumption is that the imposed territorial boundaries are not solely arbitrary delineations but represent meaningful ecological units where residents have some shared notion of belonging. However some challenge this assumption. For example, Fine and Weiss (1998) suggest that geographic contours are not able to define adequately the boundaries of a community and reject the assumption that "coherence organizes life within while differences defines life between" localities (1998: 266). Additionally, Wellman's (1999) research demonstrates that "community" has moved out of neighbourhoods and thus cannot be measured only in terms of census tracts or suburbs. Certainly, people belong to many communities - including ethnic, religious or sporting communities to name but a few - that cannot be measured only in terms of space.

While caution is required when using purpose built spatial units as proxies for communities, the very nature of community research, as it relates to residential, geographic locales, necessitates a demarcation of place. For the present research, we examine the variation in antisocial behaviour across

SLAs as we considered them to be the most parsimonious unit of analysis which can be matched with important census, police and other government data.

### ***Data Sources: The Australian Bureau of Statistics Census Data***

Drawing on the empirical literature, several indicators of neighborhood composition are consistently associated with poor outcomes for children, young people and adult residents, (see Leventhal & Brooks-Gunn, 2000 and Sampson, Morenoff and Gannon-Rowley, 2002). For example, high levels of concentrated disadvantage, immigration concentration and residential mobility are often associated with higher crime rates and victimisation (Sampson, Morenoff & Earls, 1997). The present research employs census data from the 1996 ABS to examine the relative importance of community level attributes in predicting antisocial behaviour at the age of 14. The 1996 census was collected at the middle of the 14 year follow-up for MUSP, providing a good match to the 14 year data.

### ***Measures***

This section describes the variables, which are used in this research. First, we describe the measure of antisocial behaviour used in this study. This is followed by the independent variables drawn from the MUSP which are grouped on the basis of the phases of data collection: prenatal; birth; 6 months; 5 years and 14 years. Descriptions of the measures are provided and where a published scale has been used, the source of the scale is provided. Further details of all measures are available from the authors and summary statistics for the variables in the final analytic model are detailed in Appendix 3. Finally, the neighbourhood level measures extracted from the ABS Census for use in this study are described.

### **Dependent Variable: Antisocial Behaviour**

The focus of this study required a measure of antisocial behaviour in adolescence. The MUSP measures come from the Achenbach System of Empirically Based Research (ASEBA). To measure adolescent antisocial behaviour, the current study utilises the 30 item externalising scale<sup>5</sup> of the Youth Self Report (YSR) (Achenbach, 1991a). These include behaviours such as setting fires, truancy, stealing, running away from home and hurting others. The YSR is a 112 item self-report version of the Child Behaviour Checklist (CBCL). Being part of the ASEBA, it also has established reliability and validity (Achenbach,

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<sup>5</sup>The externalising scale includes both the aggression and delinquency subscales.

1991a, 1999, 2001) and cross-cultural consistency (Verhulst, et al., 2003). The YSR was completed by the study children when they were 14 years of age. For each of the items, the child nominated whether in the last year they engaged in the behaviour: often; sometimes; or rarely/never. The item response categories were reverse coded and summed so that a higher score represented higher levels of the behavioural syndrome. Those individuals who had 20 or more non-responses on the full YSR were coded as missing data ( $\alpha = 0.87$ ,  $M = 12.77$ ,  $SD = 7.42$ ).

## **MUSP Independent variables**

### *Phase I: Prenatal*

This section includes a description of all of the variables used in this study that were measured at entry to the MUSP study, when the mother attended the hospital for her first antenatal clinical visit. There are a number of measures taken at the prenatal phase that provide important data on the social environment (number of births, dyadic adjustment, family income, and maternal age) and biological environment (maternal depression and anxiety, maternal smoking, maternal alcohol consumption) of the study child. These are each discussed in more detail below.

Number of Births: Maternal number of births was recorded on the obstetric data sheets of the hospital records.

Dyadic adjustment: Quality of the marital relationship was assessed using a version of the Dyadic Adjustment Scale (DAS)<sup>6</sup> (Spanier, 1976). The mother was asked about various aspects of her relationship with her partner, such as how often they fight or think about terminating the relationship. The items are part of the dyadic satisfaction subscale and are taken from the 32 item DAS which was devised to assess quality of life for married or cohabiting couples. The items included in MUSP have good internal consistency (For example;  $\alpha = 0.86$  at Phase I) and were included at each phase of the study. The items were recoded and where appropriate reversed so that a high score indicated good

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<sup>6</sup> A more recent examination of the DAS found that overall the scale was still valid (Spanier & Thompson, 1982), however a discriminant analysis conducted by Sharpley and Cross (1982) found that only six items were necessary to discriminate between high and low adjustment. Hunsley and colleagues (2001) re-assessed a seven item shortened form DAS and reported similar results.

adjustment. The score was calculated taking the arithmetic mean of each individual's responses to the items and multiplying that value by ten<sup>7</sup>. Those with no partner were coded as missing data.

Family income: In MUSP the mother was asked to report on the gross income of the family (including spouse's income, child endowment, etc.) at each phase of the MUSP from a list of the seven brackets/ranges of income. To increase accuracy of reporting both an annual figure and corresponding weekly amount were provided.

Maternal age: The date of birth of the mother was recorded at the first clinical visit (Phase I). The age of the mother at entry to the study was calculated by subtracting the date of the first antenatal visit from the mother's date of birth.

Maternal depression and anxiety: Maternal anxiety and depression was assessed throughout all phases of the MUSP data collection. It was measured using the Delusions–Symptoms–States Inventory (DSSI) scale (Bedford & Foulds, 1978). The scale was constructed to identify persons who are depressed and living in the community. It is intended to identify signs and symptoms of mental illness that limit a person's ability to function and maintain relationships (Bedford, Foulds, & Sheffield, 1976; Heather, 1977). A number of studies have confirmed Bedford and Foulds' model and measurement instrument (Bagshaw, 1977; Bedford & Foulds, 1977; Gilleard, 1983; Morey, 1985; Najman, Andersen, Bor, O'Callaghan, & Williams, 2000; Palmer, Ekisa, & Winbow, 1981). In the current research, for each item of the Delusions–Symptoms–States Inventory the mother reported how frequently she experienced the symptom. A summative score for each of the subscales (depression and anxiety) was calculated by giving a value of one each time the mother indicated 'all the time', 'most of the time', or 'some of the time'. Both of the subscales show good internal consistency, with the Cronbach's alpha for depression ranging from 0.78 to 0.88 across the phases and from 0.76 to 0.84 for anxiety.

Maternal smoking: The MUSP study measured the number of cigarettes that the mother consumed each day by presenting her with a series of ranges in which she could nominate the number of cigarettes consumed. The response categories were recoded by taking the mid point of each of the range options provided on the questionnaire. The new categories were: 50, 40, 25, 15, 5 and 0. This was done to allow

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<sup>7</sup> Responses were multiplied by ten so that the scores were whole numbers rather than decimals.

the magnitude of the number of cigarettes that were smoked each day to be reflected in the standardised score comparisons.

Maternal alcohol consumption: The measure of maternal alcohol consumption used in the current research is an estimation of the volume of consumption in a one week period. The mother was asked how often she drank alcohol and how much she drank at those times. The frequency responses were then recoded to a value that represented a proportion of a week and this value was multiplied by the number of drinks that the mother consumed on each drinking occasion. The resulting figure is an approximation of the amount of alcohol the mother consumed each week.

#### *Phase II: Birth*

The following section discusses the measures used in the current study that were taken at three to five days after the birth of the study child. These were collected on a questionnaire completed by the mother. A number of variables measured at this phase have been described previously and were repeated at Phase 2 including dyadic adjustment; maternal depression; maternal smoking; and maternal alcohol consumption. At Phase II the only additional variable included in the final model is problems during pregnancy.

Problems during pregnancy: Questions included in the MUSP assessed whether the mother experienced the problem and how much of a problem it was. The scale was constructed by summing the values of the responses to each item so that higher scores indicate a higher level of problems (Cronbach's alpha = 0.59).

#### *Phase III: 6 months*

When the study child was six months of age data were collected using a mail out questionnaire. Again, number of variables measured at this phase have been described previously and were repeated at Phase 3 including family income; dyadic adjustment; maternal smoking; and maternal alcohol consumption.

#### *Phase V: Five years*

This section describes the variables that were measured when the study child was five years of age. A face to face physical assessment and questionnaires were used. Importantly, some measures outlined

above where also repeated at this phase including; dyadic adjustment; family income; and maternal smoking. Two additional variables measured at five years include child aggression and parenting style.

Child aggression: The current study utilises the aggression subscale of the Child Behavior Checklist (CBCL)<sup>8</sup> (Achenbach, 1991b), completed by the mother when the study child was five years of age. The ten aggression subscale items are listed in Appendix A and include items such as fighting, temper tantrums, destroying belongings. The CBCL is part of the ASEBA. These measures are used widely in both clinical practice and research<sup>9</sup> and have established reliability and validity (Achenbach, 1991b, 1999, 2001). In this study, mothers reported whether the behaviours listed in the CBCL described their study child 'often = 1', 'sometimes = 2', or 'rarely/never = 3' in the 'last year'. The item response categories were reverse coded (1 = 2, 2 = 1, 3 = 0) and added, so that a higher score represented increased levels of that behavioural syndrome ( $\alpha = 0.83$ ,  $M = 5.98$ ,  $SD = 3.53$ ). Those individuals who had six or more non-responses on the aggression subscale were coded as missing data and not included in the study.

Parenting style: The measure of supervision when the child was five years old is a prospective measure of the level of supervision the mother intends to provide as the child grows up. It was operationalised by asking the mother to indicate the age (in years) at which she would let her child engage in a range of activities without the supervision of a parent. The item responses show a moderate level of internal consistency (Cronbach's alpha = 0.60). The score was calculated taking the arithmetic mean of each individual's responses to the items and multiplying that value by ten. For this scale a lower score indicates a lower level of supervision and an earlier age at which the child will be allowed to engage in activities in the absence of parental supervision.

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8 For the purpose of reducing completion time of the survey, the MUSP study used a subset of 33 items from the full CBCL. These items were chosen on the basis of face validity as those being most relevant to a 5 year old (Brennan, et al., 2000). To test the reliability of the shortened CBCL compared to the full CBCL a sub-sample of 76 parents completed the full and shortened version of the CBCL. For this group the correlations between the full and the shortened version is very high for total behaviour problems ( $r=0.98$ ) and for the aggression subscale ( $r = 0.94$ ) (Bor, Brennan, Williams, Najman, & O'Callaghan, 2003). This indicates that the inclusion of the shortened version did not result in any loss of information.

9 The Achenbach System of Empirically Based Research (ASEBA) web site makes reference to a bibliography of over 5000 publications that utilise their instruments (Achenbach, 2004).

### *Phase VI: 14 years*

The following section describes the variables used in the current study that were measured when the study child was 14 years of age. Items were measured on a maternal report questionnaire and a child report questionnaire.

School performance: Both the mother and child were asked to rate the child's overall school performance. The rating was provided on a five point likert scale from below average to above average, with lower values indicating poorer school performance.

Number of close friends: At the MUSP 14-year follow-up the mother was asked to report the number of close friends that her child had. The mother had a choice of four ranges of number of friends to choose from.

Problems in residential area: The MUSP study mother was presented with a list of nine items to gauge the level of disorder in her neighbourhood. She was asked to indicate to what degree each item was a problem in the area in which she lived, on a four point likert scale. The items have good internal consistency (Cronbach's alpha = 0.93). The items were recoded so that those for which the mother reported were a 'major problem' or 'moderate problem' were assigned a value of one. The responses to the items were then summed with zero indicating a lack of problems and the highest level of problems were assigned a value of nine.

Violence in the home: The level of violence in the family home was measured using a modified version of the Conflict Tactic Scale (CTS) (Straus, 1979). The items showed a good level of internal consistency: Cronbach's alpha = 0.98. The mother indicated the frequency with which each of items of conflict occurred in the home and the responses to each of these items were summed so that a high score indicated higher levels of violence within the home.

Family Communication: Communication in the family was measured using the Parent-Adolescent Communication Scale (Barnes & Olsen, 1982; Olsen, et al., 1982). It is composed of two sub-scales, one that measures the degree of openness in family communication and one that assesses the extent of problems in family communication. Only the first sub-scale is used in the current study. The scale is summative with the mother indicating her level of agreement with each statement on a 5 point likert scale. The openness scale is scored so that higher scores mean higher levels of openness. The openness

subscale has good internal consistency with Cronbach's alpha of 0.85. These are comparative to those reported by Barnes and Olsen (1985). Previous research using this scale has found that those who report better functioning on both the problems and openness subscales also self-report engaging in less serious forms and at lower rates of delinquency (Clark & Sheilds, 1997).

Years mother has been in present relationship: Indicators of the stability of the family environment include the number of times that the marital status of the mother has changed and the years that she has been in her current relationship. In the MUSP, the number of years in the present relationship was measured by asking the mother how long her current relationship had lasted.

Number of times child has lived with someone other than mother: The mother was asked to report the frequency with which the study child lived with someone else other than the mother as the main care giver for over 3 months.

### **Statistical Local Area Measures**

In line with the neighbourhood effects literature, the present study draws on administrative data from the ABS and three SLA level variables were incorporated into the present research. These included the SEIFA Disadvantage Index, the proportion of people from a non-English speaking background and residential mobility.

Neighbourhood Disadvantage: To effectively measure neighbourhood disadvantage, the ABS SEIFA index of relative socio-economic disadvantage was used. The SEIFA Disadvantage is a summary index of socio-economic disadvantage which captures disadvantage using a composite of the number of low income households, the extent of low-rent or public housing in each SLA, low educational attainment, low skilled occupational status and unemployment. This index provides a populated weighted value for each of the SLAs allowing for comparison across SLAs. A lower SEIFA index value is indicative of a high proportion of low-income families, people without training and people in low skilled occupations. High index values indicate an overall lack of disadvantage in the SLA (Australian Bureau of Statistics, 2001). In the final analytic model, the SEIFA Disadvantage Index was standardised to allow for easier interpretation.

Immigration Concentration: To capture immigration concentration across the SLAs we used one item which measured the proportion of people per SLA from a non-English speaking background.

Residential Mobility: Residential mobility was measured by proportion of people who lived at a different address 5 years ago.

## Chapter 4 Analysis and Results

Our research examines the interdependent effects of individual, family and neighbourhood characteristics on antisocial behaviour across SLAs in the South East Queensland region. We progressed our analysis in four stages. First, we geo-coded the MUSP data to x and y coordinates. Using MUSP data from the participants successfully geo-coded to the SEQR, we then examined the key individual and familial factors associated with antisocial behaviour. Next we examined the spatial distribution of antisocial behaviour across the SLAs in the MUSP sample and estimated the effects of place on levels of antisocial behaviour. This chapter provides a detailed explication of the findings for each analytic stage.

### *Stage 1: Geo-coding the MUSP Data*

At the initial phase of the MUSP data collection, archives of participant contact details were created. These have been updated at each subsequent phase of data collection. Up until this point, these archives were not considered 'data', rather they were kept as administration records of the Study. One of the key aims of the present research is to examine the spatial patterning of antisocial behaviour in adolescence. Thus the archived address data were central to addressing this aim.

Address records for each MUSP participant who had participated in all phases of data collection were entered into an electronic database (n=4841). These addresses were used to determine x and y coordinates for all valid participants. The geo-coding was completed using the Google geo-coding engine. The threshold precision beyond which cases were not included in the mapped sample was the suburb. Any case that mapped to the suburb and below (address, street and intersection) was included in the final sample. This geo-coding process resulted in a 97.4% hit rate with 4,717 participants geo-coded to an Australia address. As this research was interested in the spatial patterning of antisocial behaviour in the SEQR, only those participants with a valid address geo-coded to this region were retained for subsequent analyses. The total number of valid participants geo-coded to the SEQR was 3,817.

## ***Stage 2: Identifying the Key Individual and Familial Predictors of Antisocial Behaviour at age 14***

The MUSP data are a rich data source and contain many variables of theoretical and empirical importance to the present study. To understand the relative contribution of these variables in a multivariate context, we progressed a series of ordinary least squares multivariate regression models to determine the most salient individual and familial predictors of antisocial behaviour at age 14. These analyses were grouped on the phases of data collection and included only those participants who were successfully geo-coded to the SEQR (N=3,817). There was limited missing data for the variables employed in all models, however, pairwise deletion was chosen over list-wise deletion to deal with the missing responses on the dyadic adjustment scale. The dyadic adjustment scale measures the quality of a partnered relationship, however not all the MUSP participants were married or partnered at various points of the data collection. Using pairwise instead of listwise deletion ensured that single parents who would have a missing score on the dyadic adjustment variable were not dropped from the analysis. Instead their responses were only discounted for the dyadic adjustment measure.

Five separate models predicting antisocial behaviour at the age of 14 were estimated, commencing with an analysis of theoretically and empirically relevant variables extracted from the pre-natal phase of data, followed by those collected at the birth of the child, at six months, five years and when the child reached 14 years of age. A correlation matrix of the relevant individual, maternal and family factors used in the models is located in Appendix 2 with a full description of the variables and the results of each model are located in Appendix 4 through 8.

Using the significant variables from each phase of MUSP (our cut off for inclusion was .10) we then ran a final analytic model that examined the relative significance of all individual and familial predictors of antisocial behaviour at age 14. When key variables from all phases of data collection were included in the model, those representing adolescent factors were the most important, which is to be expected. However, there were enduring effects from earlier periods of the child's life that remained significant as evidenced in Table 4.1.

As found in other research, maternal factors can have lasting effects on child outcomes later in life. For example, in the present research, we find a strong relationship between the number of maternal births and higher antisocial behaviour in adolescence ( $t=2.596, p<.01$ ). The age of the mother at the birth of

her first child was negatively and significantly associated with antisocial behaviour at age 14 ( $t=-2.851$ ,  $p<.01$ ). Maternal alcohol consumption when the child was six months of age was nearly significant ( $t=1.624$ ,  $p<.10$ ). Children from mothers who drank more during infancy were more likely to report higher levels of antisocial behaviour at 14 years of age. Key familial processes in infancy and childhood were also important in understanding antisocial behaviour in adolescence. For example, reported dyadic adjustment when the child was 6 months of age was strongly related to antisocial behaviour later in the child's life. That is, lower quality partnered/marital relationships, as judged by the mother, are associated with higher levels of antisocial behaviour at age 14 ( $t=-2.086$ ,  $p<.05$ ). Additionally, when parental supervision is low at the age of 5, antisocial behaviour is higher at age 14 ( $t=-1.753$ ,  $p<.10$ ). Finally, the child's propensity to engage in aggressive behaviour in early childhood was also strongly associated with reports of aggression during adolescence. In line with the literature, those children displaying extreme aggression at age 5, had significantly higher antisocial behaviour at age 14 ( $t=5.419$ ,  $p<.001$ ).

**Table 4.1 Results of OLS for FULL model using significant predictors from all phases (n=3112)**

Variables	B	S.E.	$\beta$
Number of births	.048	.018	.053***
Dyadic adjustment: pre-natal	-.001	.005	-.006
Life events	.006	.014	.008
Family income at birth	-.013	.013	-.019
Maternal age at entry to study	-.012	.004	-.060***
Maternal smoking: pre-natal	-.003	.004	-.025
Maternal alcohol consumption: pre-natal	.007	.010	.013
Problems during pregnancy	.002	.005	.006
Dyadic adjustment: post-natal	-.002	.006	-.008
Maternal depression: post-natal	.020	.017	.022
Maternal smoking: post-natal	.007	.004	.059
Maternal alcohol consumption: post-natal	.001	.010	.003
Dyadic adjustment at 6 months	-.009	.005	-.049**
Family income at 6 months	.018	.019	.019
Maternal smoking at 6 months	.001	.003	.008
Maternal alcohol consumption at 6 months	.009	.005	.034*
Dyadic adjustment at 5 years	.001	.004	.007
Family income at 5 years	-.006	.012	-.009
Parenting style – supervision	-.008	.004	-.030*
Maternal smoking at 5 years	-.001	.003	-.014

Child aggression (age 5)	.028	.005	.097***
School performance: Child report	-.216	.020	-.189***
Maternal Smoking at 14 years	.005	.002	.061***
Maternal Depression at 14 years	.016	.013	.023
Problems in Residential Area	.008	.007	.022
Dyadic Adjustment at 14 years	-.016	.006	-.089*
Years mother has been in present relationship	-.004	.002	-.034*
Number of times child has lived with someone else other than mother	.088	.053	.028*
Openness in family communication	-.028	.003	-.150***
$R^2$	.157		

\* p<.10, \*\* p<.05, \*\*\*p<.01

Several variables from the 14 year data collection phase were also highly significant predictors of antisocial behaviour. In line with the literature (Tremblay, et al., 1992, Trzesniewski, Moffitt, Caspi, Taylor, & Maughan, 2006), adolescents who performed poorly in school reported higher levels of antisocial behaviour ( $t=-10.939$ ,  $p<.001$ ). Additionally, maternal smoking during adolescence was strongly and positively associated with antisocial behaviour at age 14 ( $t=2.580$ ,  $p<.01$ ). Familial processes at 14 years were also important predictors of higher reports of antisocial behaviour. Poor family functioning (measured by the dyadic adjustment scale) and lack of openness in family communication predicted higher levels of antisocial behaviour ( $t=-1.64$ ,  $p<.10$ ;  $t=-8.544$ ,  $p<.001$ ). Finally, the length of the mother's present relationship and the number of times the child lived with someone other than the mother also impacted on antisocial behaviour at 14 years. For children where the mother's relationship with a partner was short-lived and when the child lived with someone other than the mother for more than 3 months, antisocial behaviour was higher ( $t=-1.809$ ,  $p<.10$ ;  $t=1.653$ ,  $p<.10$ )

### ***Stage 3: Examining the spatial distribution of Antisocial Behaviour in South-East Queensland***

One of the key aims of the present study is to examine the spatial patterning of antisocial behaviour in adolescence. To achieve this, MUSP data for the 3,817 participants successfully geo-coded to the SEQR were combined with 1996 ABS census data. This allowed for the construction of thematic maps and an analysis of the variation in antisocial behaviour attributable to SLA level differences.

First, we examined the spatial distribution of the 3,817 participants across the SEQR. Not surprisingly, those SLAs closest to the Mater Hospital had the highest number of MUSP participants (see Figure 1). We then created thematic maps to visually assess the spatial distribution of antisocial behaviour and disadvantage across the SEQR. For the latter, the SEIFA Disadvantage Index was chosen over other SLA level variables that may be associated with antisocial behaviour (like immigration concentration and residential mobility) as disadvantage is the strongest predictor of crime and victimisation in the neighbourhood effects literature (see Sampson et al., 2002). Figure 2 shows the relative disadvantage across the SEQR. We then overlaid the average antisocial behaviour score for each SLA, including only those SLAs with 10 or more respondents (N for SLA=95), leaving us with a MUSP sample size of 3,225. Figures 3 and 4 provide maps which overlay the average score of adolescent antisocial behaviour (MUSP) over the SEIFA disadvantage score in SEQR. Here larger dots indicate higher antisocial behaviour and disadvantage is indicated by darker shading. As evidenced in these maps, there is no clear visual spatial relationship between SLA disadvantage and mean levels of antisocial behaviour as the largest dots are not always in the most disadvantaged (darkly shaded) areas.

Figure 1: Density of MUSP sample across SE Queensland SLA

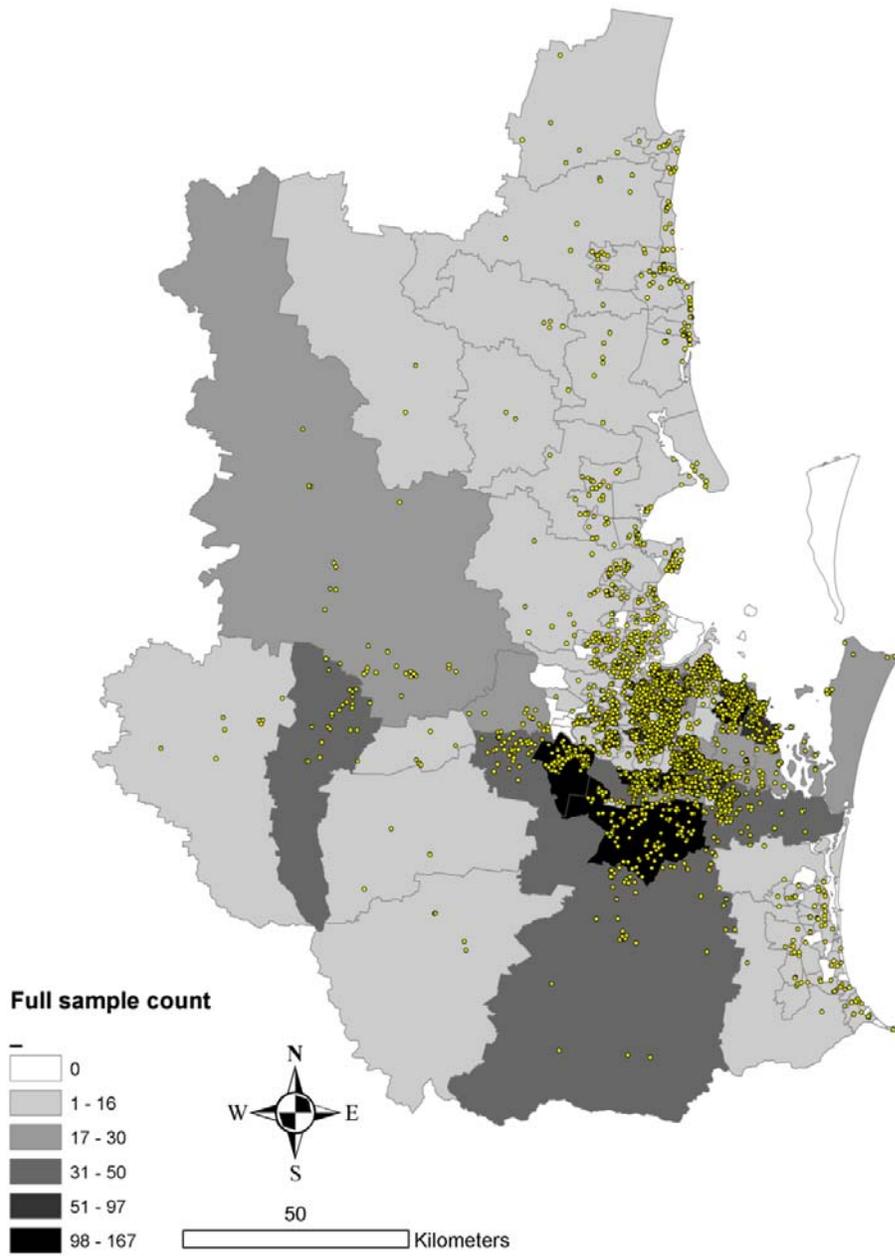
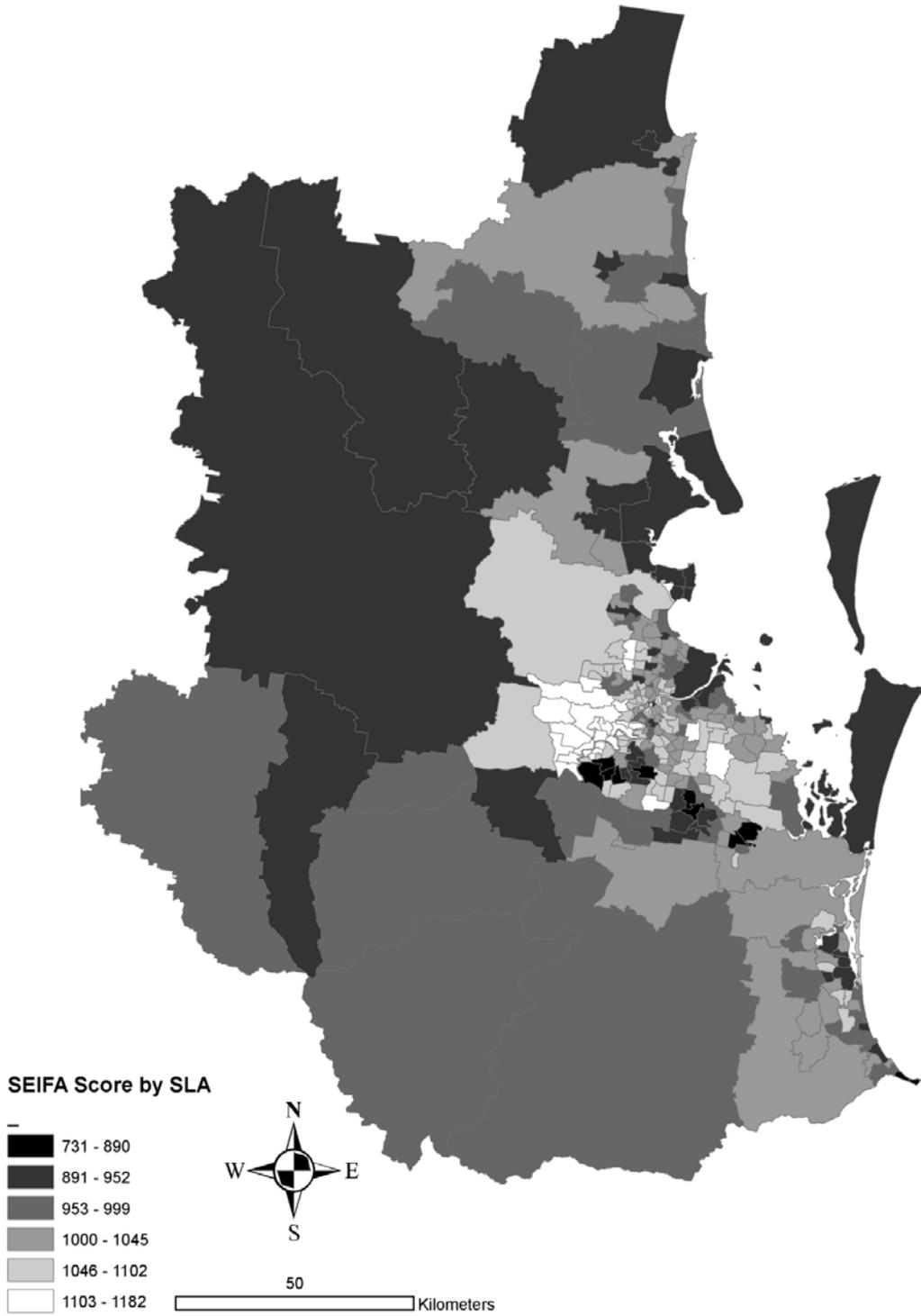
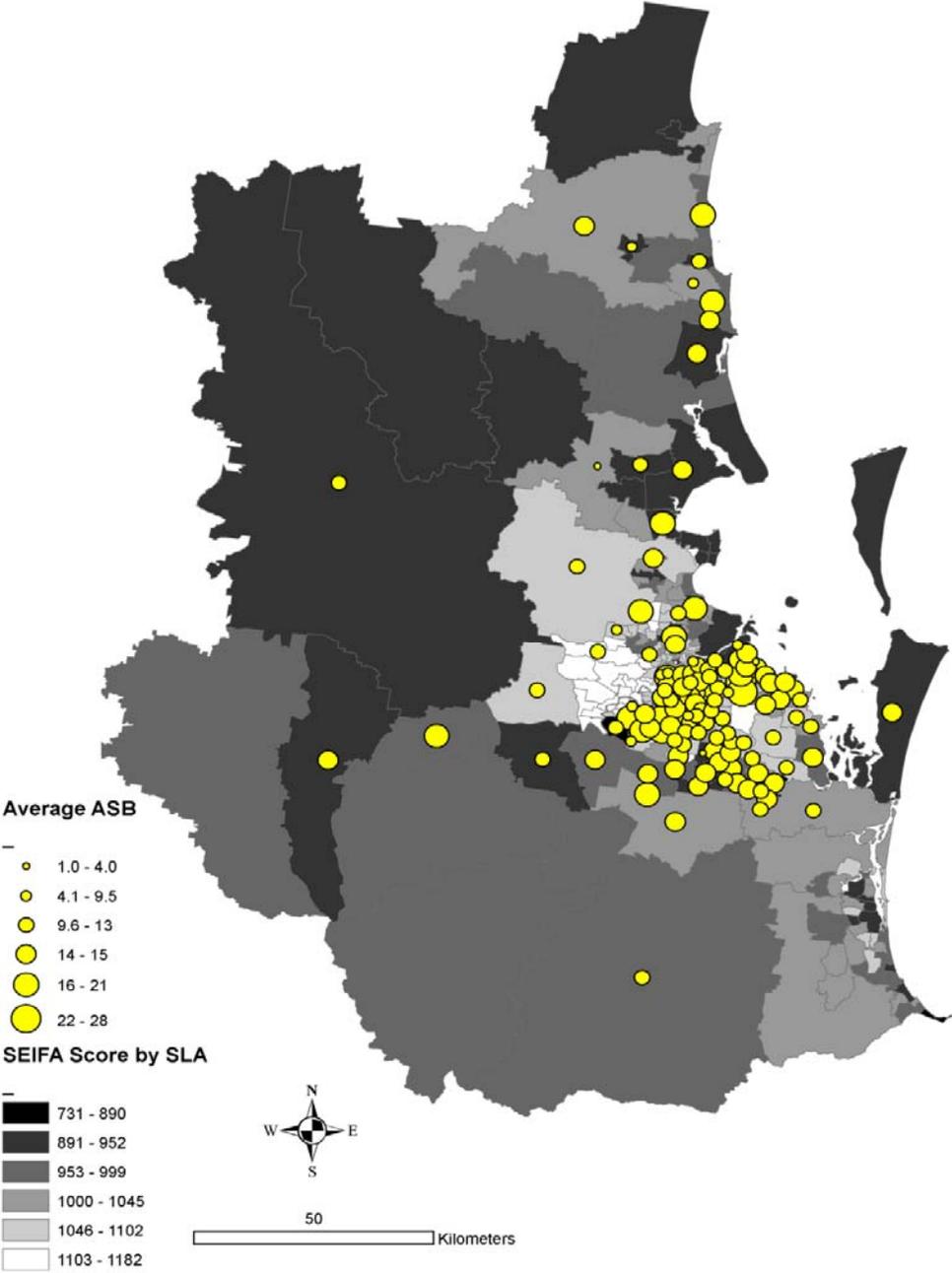


Figure 2: Relative disadvantage (SEIFA Disadvantage Index) across SE Queensland SLAs

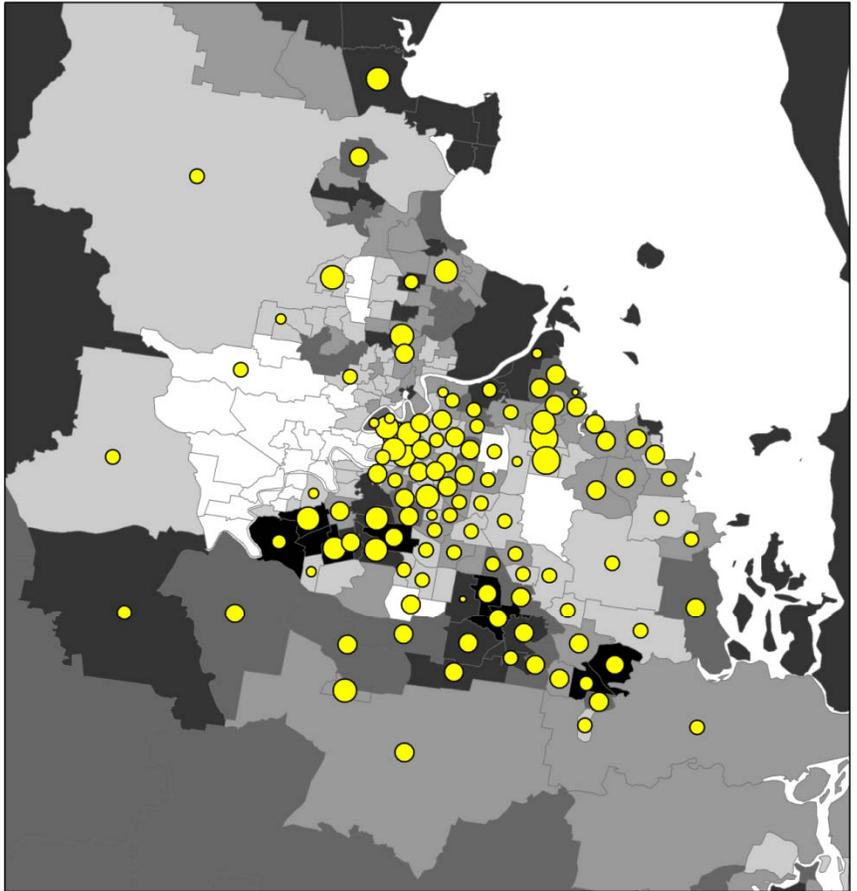


**Figure 3: The average level of MUSP participants' self-reported antisocial behaviour overlaid on the distribution of relative disadvantage (SEIFA Disadvantage Index)**

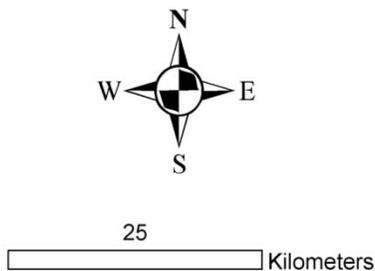
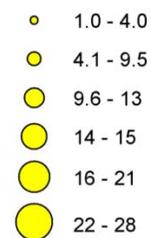
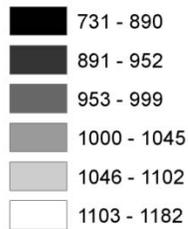


Note: Average antisocial behaviour scores were only calculated for those SLAs where 10 or more MUSP participants reside.

**Figure 4: The average level of MUSP participants' self-reported antisocial behaviour overlaid on the distribution of relative disadvantage (SEIFA Disadvantage Index) (Greater Brisbane SLAs)**



**SEIFA Score by SLA      Average ASB**



Note: Average antisocial behaviour scores were only calculated for those SLAs where 10 or more MUSP participants reside.

To further examine the spatial distribution of antisocial behaviour across the SEQR, we examined the intra-class correlation (ICC) to ascertain if antisocial behaviour is dependent upon place. Using Stata 10, the unconditional ICC was assessed using a mixed effects maximum likelihood model. Results indicated that the variation in antisocial behaviour attributable to SLA was very low, less than 1 percent. Thus 99 percent of the variation in antisocial behaviour was due to within SLA (or person level) differences. Put simply, for the MUSP sample, high levels of antisocial behaviour were not concentrated in particular SLAs, rather they were randomly distributed across the SEQR. We come back to this point in the following chapter.

#### ***Stage 4: Examining the interdependent effects of individual, familial and neighbourhood predictors of antisocial behaviour in SEQR***

As the ICC did not indicate within group dependence, we progressed our analysis with the assumption that the MUSP data were not hierarchical. While the MUSP participants reside in SLAs, antisocial behaviour does not cluster within SLAs nor is it explained by the variation between SLAs. Thus hierarchical linear modelling was deemed unnecessary to examine the interdependent impact of individual, familial and neighbourhood predictors of antisocial behaviour in SEQR. The final model therefore commenced with an ordinary least squares multiple regression, treating the SLA as a fixed effect. As with the earlier models, pairwise deletion was again employed to deal with the missing data in the dyadic adjustment variable. Only those significant variables from the full model of individual and family effects were retained to which three SLA level variables were added, these included percent of non-English speaking residents, percent of people who lived at a different address five years prior and the standardised SEIFA Disadvantage Index. Variable descriptive statistics for the final model are detailed in Appendix 3. To assess model fit, collinearity statistics such as the tolerance and variance inflation factors were examined and all fell within an acceptable range. Further, residuals were normally distributed with a straight line relationship with the predicted antisocial behaviour scores. The final analytic model accounted for 15 percent of the variance in antisocial behaviour ( $R^2 = .153$ ). Results for the final analytic model are found in Table 4.2.

Similar to the previous model (see Table 4.1), several early childhood variables significantly predicted antisocial behaviour. The number of maternal births significantly predicted higher antisocial behaviour

( $t=2.854$ ,  $p<.01$ ) and this may be due to parental resource dilution (Downey, 2001). Higher maternal alcohol consumption in infancy contributed to higher levels of antisocial behaviour in adolescence ( $t=2.579$ ,  $p<.01$ ) which is in line with previous research examining parents' history of alcohol dependence and adolescent behaviour (Elkins, McGue, Malone, & Iacono, 2004). Family processes during infancy and early childhood were also important. Consistent with previous research on the impact of marital conflict on child behaviour (Peris & Emery, 2004, Rutter & Quinton, 1984, Stocker, et al., 2003, Stockman, 2000), poor dyadic adjustment at 6 months predicted higher antisocial behaviour ( $t=-3.506$ ,  $p<.001$ ). Low levels of supervision when the child was 5 years of age, although not significant at .05, was also a contributing factor ( $t=-1.697$ ,  $p<.10$ ). This is not surprising given that parental supervision provides control over access to antisocial peers and antisocial behaviours (Jacobson, Prescott, & Kendler, 2002; Pettit, Laird, Dodge, Bates, & Criss, 2001; Snyder, Dishion, & Patterson, 1986). Childhood aggression at age 5 was again strongly predictive of antisocial behaviour at 14 ( $t=5.975$ ,  $p<.001$ ) demonstrating the continuity of antisocial behaviour over time.

At age 14, poor school performance (as rated by the child) was strongly associated with higher antisocial behaviour ( $t=-11.249$ ,  $p<.001$ ). Indeed, it was the strongest predictor of antisocial behaviour, though we note that school performance may be a result of a cumulative difficulties associated with early childhood aggression. As per Moffitt's theory, subtle neuropsychological deficits at birth and in early childhood are exacerbated through poor language acquisition skills and cumulative failed interactions with peers and at school (Moffitt, 1994). Dysfunctional family functioning at 14 years strongly influenced the level of antisocial behaviour reported. Low quality relationship between the mother and her partner was significantly and negatively associated with antisocial behaviour at 14 ( $t=-2.427$ ,  $p<.05$ ). Additionally, for young people residing in families with effective communication reported antisocial behaviour was lower ( $t=-8.771$ ,  $p<.001$ ). This is again related to parental supervision; when there is disclosure of activities by children to their parents, parents can more effectively monitor behaviour (Stattin & Kerr, 2000). This has been shown to be particularly important for those living in low socio-economic status (SES) neighbourhoods (Beyers, Loeber, Wikström, & Stouthamer-Loeber, 2001). Finally, maternal factors during adolescence were associated with antisocial behaviour. In particular shorter relationship periods between the mother and her partner and maternal smoking during adolescence were factors significantly predicting higher antisocial behaviour ( $t=-2.029$ ,  $p<.05$ ;  $t=4.917$ ,  $p<.001$ ). Disruptions in parenting have been observed in previous research to be associated with antisocial

behaviour (Amato, 2001; Henry, et al., 1993; Peris & Emery, 2004). The number of times the child lived with someone other than the mother was also positively related to antisocial behaviour ( $t=1.726$ ,  $p<.10$ ). This is consistent with previous research (Christoffersen, Francis, & Soothill, 2003; Henry, et al., 1993) and adds further evidence that the disruption of parenting is an important component in the development of antisocial behaviour.

When examining the effects of the neighbourhood on antisocial behaviour, only the level of disadvantage at the level of the SLA came close to significance. Higher proportions of non-English speaking residents did not impact significantly on antisocial behaviour nor did the residential mobility of the SLA. Though not significant at the .05 conventional cut-off, young people living in disadvantage communities reported higher levels of antisocial behaviour ( $t=-1.911$ ,  $p<.10$ ). This finding is in line with previous research which suggests that neighbourhood disadvantage is associated with both the severity and frequency of antisocial behaviour problems (see Leventhal and Brooks-Gunn, 2000). However, of note from the present research is the magnitude of neighbourhood disadvantage when compared to individual propensities or familial processes. When examining the significant predictors of antisocial behaviour in the MUSP sample, individual propensity (measuring by early childhood aggression and school performance), maternal factors and family processes were by far more important than neighbourhood characteristics (see Table 4.3). While we recognise that small area effects can have pronounced impacts on outcomes (Odgers et al., 2009), the present research suggests that disadvantage may exacerbate antisocial behaviour, but its effects are secondary to other factors.

**Table 4.2 Neighbourhood Model: Multiple Regression (n= 3162)**

Variables	B	S.E.	$\beta$
Number of births	.052	.018	.058**
Maternal age at entry to study	-.012	.004	-.057**
Dyadic adjustment at 6 months	-.012	.004	-.064***
Maternal alcohol consumption at 6 months	.011	.004	.043**
Parental supervision at 5 years	-.007	.004	-.028
Child aggression at 5 years	.030	.005	.104***
School performance: Child report at 14 years	-.218	.019	-.191***
Maternal smoking at 14 years	.007	.002	.084***
Dyadic adjustment at 14 years	-.008	.003	-.043*
Years mother in present relationship	-.004	.002	-.036*
Number of times child has lived with someone else other than mother	.091	.052	.029
Openness in family communication	-.028	.003	-.152***
Percent non-English speaking people in SLA	-.003	.003	-.016
Percent of people living at a different address 5 years prior	.001	.003	.004
Neighbourhood disadvantage (z-score)	-.035	.018	-.034
Constant	6.416	.279	
$R^2$	.153		

\*p< .05 \*\*p< .01 \*\*\*p<.001

**Table 4.3 Rank order of antisocial behaviour predictors using standardised beta coefficients (n= 3162)**

Variables	B	S.E.	$\beta$
School performance: Child report at 14 years	-.218	.019	-.191***
Openness In family communication	-.028	.003	-.152***
Child Aggression at 5 Years	.030	.005	.104***
Maternal smoking at 14 years	.007	.002	.084***
Dyadic Adjustment at 6 months	-.010	.004	.064***
Number of births	.052	.018	.058**
Maternal age at entry to study	-.012	.004	-.057**
Maternal alcohol consumption at 6 months	.011	.004	.043**
Dyadic adjustment at 14 years	-.008	.003	-.043*
Years mother in present relationship	-.004	.002	-.036*
Constant	6.416	.279	
$R^2$	.153		

\*p< .05 \*\*p< .01 \*\*\*p<.001

## Chapter 5 Summary and Conclusion

The aims of the present research were two-fold:

- To assess if antisocial behaviour is concentrated in certain types of places; and
- To explore the interdependent effects of individual characteristics, family processes and neighbourhood contexts on antisocial behaviour

In line with these aims, our research sought to address two specific questions. The first was concerned with whether antisocial behavior was spatially distributed in a population sample from Brisbane, Queensland. To address this question we firstly geo-coded the addresses of the MUSP participants and matched the participants' SLA with 1996 ABS Census data. This allowed us to create thematic maps to visually investigate the distribution of antisocial behaviour across the SEQ and to overlay this distribution with the SEIFA Disadvantage Index. These maps did not demonstrate a strong relationship between antisocial behaviour and disadvantage. Those participants living in highly disadvantaged suburbs were not always those with higher levels of antisocial behaviour. To further examine the spatial patterning of antisocial behaviour, we assessed the variation in this behaviour that could be attributable to between SLA differences. The findings from this analysis supported the visual maps, indicating that only 1 percent of the variation in antisocial behaviour could be explained by living in a given SLA.

The next question that informed this research asked if there are independent neighbourhood effects on antisocial behaviour when controlling for individual characteristics and family processes. Although the prevalence of antisocial behaviour in the MUSP sample did not cluster in particular types of communities, neighbourhood characteristics traditionally associated with crime and disorder, like immigration concentration, concentrated disadvantage and residential mobility could still have a direct impact on antisocial behaviour. To examine the relative contribution of individual, familial and neighbourhood factors, we estimated a series of multivariate regression models. First, we progressed a series of OLS models to identify the most salient individual and familial indicators/processes that impacted upon a person's reported antisocial behaviour. During the model building phase, we found a consistent relationship between antisocial behaviour at the age of 14 and individual propensities (e.g. early childhood aggression, time spent living with someone other than the mother, school performance), maternal factors (e.g. age at first birth, number of births, maternal depression and length

of mother's relationship at age 14) and family processes (dyadic adjustment, parental supervision and communication styles). In the final analytic model we included several SLA level variables including residential mobility, ethnicity and disadvantage as measured by the SEIFA Index for relative disadvantage. However, only the relative disadvantage of an SLA was moderately associated with individual antisocial behaviour. Thus, our findings suggest that antisocial behaviour in adolescence is better understood by examining individual propensities, maternal risk factors and family processes associated with communication and relationship quality.

When considering these results within the broader international context, we know that like the United States and the United Kingdom (where the majority of spatial research is conducted) Australia is a typical western nation with established political and economic infrastructure. It is closely linked with the United States, Canada, Germany, the United Kingdom and other OECD countries in its trade linkages, legal structures, technological advances and economic cycles (Otto, Voss & Willard, 2001). However, there are important differences in Australia that might reduce the variation of social problems across place. For example, the ecology of crime research in United States is largely conducted in large cities where the level of concentrated disadvantage is profound and rates of violence are high. In contrast, Australia certainly has its share of disadvantaged communities characterised by higher crime (Vinson, 2004; 2007), but as Hope (1995) suggests "with the exception of the severe distress of Aborigines, there is little evidence of an underclass in Australia" (p.22). Indeed, in Brisbane (the location of the current research project), the rate of reported violent crime is nearly three times lower than in Chicago where much of the ecological research is conducted (see Mazerolle et al., in press). Thus it is possible that the absence of extreme disadvantage acts as a protective factor for people living in Australian urban communities. However, presently there is no research that directly compares Australian SLAs with similar places in the United States to empirically substantiate this claim.

### ***Significance of the Present Research***

This research contributes to the literature in two important ways. First, it provides support for the distinct individual and familial pathways to extreme antisocial behaviour. Our final model included a range of individual, familial and neighbourhood level variables. Despite this, those factors which were found to be most salient were those that were related to maladaptive functioning of the child (for example: school performance and childhood aggression) or factors that lead to disruption of the

parenting process (for example: dyadic adjustment, length of marital relationships, family communication). This is to be expected given that, as Farrington (2006) has identified, all of the extant developmental and life course theories point to parent training as the key preventative strategy in the onset of antisocial behaviour. The evidence from this study points more strongly to this than broader neighbourhood level changes for being important in reducing antisocial behaviour.

Second, this research suggests a need to carefully reflect on the relative importance of neighbourhood effects for particular types of problems. Certainly some neighbourhoods are more criminogenic than others and a community's level of socio-economic disadvantage is strongly associated with crime, disorder and victimisation. As Morenoff and his colleagues (2001) demonstrate, there is a strong spatial concentration of violence (measured by homicide) in disadvantaged neighbourhoods with high levels of mobility and immigration concentration, which has spill over effects into surrounding neighbourhoods. Moreover, the work of Sampson and others shows that neighbourhood processes, like collective efficacy, vary across place and play a key role in preventing or facilitating violence or property crime (see Morenoff et al., 2001; Sampson et al., 1997; Sampson, et al., 1999). However, the ecology of crime literature predominantly focuses on law violating behaviour. Although the measure of antisocial behaviour used in the present research asks respondents to report on law violating behaviour, it also focuses on norm violations like lying or cheating. Viewed in this way, antisocial behaviour might overlap with criminality, but it is a broader concept. Our research suggests that antisocial behaviour in adolescence is best predicted by deficits in family processes and structure, poor school performance and early childhood aggression, thus the variability in levels of antisocial behaviour is likely due to the variability in family rather than neighbourhood processes.

There are two alternative reasons why we did not find significant, direct effects of community characteristics on antisocial behaviour. First, this research focused on antisocial behaviour at age 14. As Moffitt (2006) argues, antisocial behaviour during adolescence is quite normative and ubiquitous. It may be that the relationship between antisocial behaviour and neighbourhood factors is stronger at other time points in the life course, for example, in early childhood (Odgers et al., 2009) and adulthood.

The second likely explanation is that community factors, like disadvantage, are indirectly related to antisocial behaviour in adolescence through its impact on family processes. This view is supported by previous research in Australia. Weatherburn and Lind (1998; 2001) argue that a community's level of

economic or social stress disrupts the parenting process and their findings suggest that “most of the effects of poverty, geographic mobility and ethnic heterogeneity on crime are mediated by parenting processes” (2001:393). In this regard, we suggest that future research needs to closely examine the ways in which neighbourhood contexts may facilitate or indeed hinder key family processes like parenting at different stages of the life course. This would go some way in disentangling the interdependent impacts on antisocial behaviour. Specifically, it would elucidate the way in which other processes, like parenting, are influenced by the neighbourhood context and how this might then impact upon the development and persistence of antisocial behaviour in early childhood, adolescence and early adulthood.

### ***Limitations and Future Directions***

This research is one of the first projects to comprehensively examine the interdependent effects of individual, family and neighbourhood effects in adolescence. However, while it considers child propensities and familial processes across infancy and early childhood, it only examines the effects of the neighbourhood at one point in time. In order to assess the magnitude of neighbourhood effects, the impact of disadvantage, immigration concentration and residential mobility on antisocial behaviour must be examined across the life course. In particular, a focus is needed on the influence of the neighbourhood in early childhood and early adulthood. As Odgers and her colleagues (2009) note, neighbourhood disadvantage was significantly related to poor school readiness at the age of 5 years which then had future consequences for antisocial behaviour at age 10. Future studies must therefore consider the effects of chronic or transient neighbourhood disadvantage on the onset and progression of antisocial behaviour. Recent research by Sampson and Sharkey (2009) suggests that people who are most disadvantaged tend to move into disadvantaged communities when they relocate. As it relates to antisocial behaviour, it is possible that living in a disadvantaged community for a short period of time may have less of an impact on levels of antisocial behaviour when compared to those continually exposed to disadvantaged neighbourhood contexts across the early phases of the life course.

A second limitation of this research is the reduced number of SLAs used to examine the variation of antisocial behaviour across place. It is possible that the lack of variation found in the current study is due to the omission of those SLAs with less than 10 respondents. The mean for the SEIFA index of relative disadvantage for all the SLAs comprising the SEQR did not differ from the mean for those SLAs

comprising the full MUSP sample. Yet, as noted in Chapter 3, the MUSP participants generally reported lower average household incomes when compared to the general population. Perhaps, therefore, the respondents omitted from the analysis of variation in antisocial behaviour across the 95 SLAs came from more affluent families and communities. While we note that this is a possible limitation for this research, the lack of direct effects of disadvantage on antisocial behaviour in the final analytic model does seem to support that antisocial behaviour, at least in adolescence, may not vary across place in any systematic way.

However, it is possible that those people with high levels of antisocial behaviour who are living in disadvantaged communities may be more likely to engage in more serious offences in early adulthood. Further studies using the MUSP data would go some way in teasing out the longitudinal effects of place on outcomes later in life, however, such research would need to also consider the criminogenic nature of the SLA. Modelling the effects of previous crime rates at the SLA on both antisocial behaviour and their combined impact on later offending would make a substantial contribution to the literature on antisocial behaviour and neighbourhood effects.

### ***Policy Implications***

Our study points to the need to distinguish between and respond differently to antisocial behaviour and crime. Neighbourhoods may differ from one another in levels of crime as suggested by a growing body of international ecological research. However, as often the case in this literature, crime is measured by reported incidents of violence, homicide and burglary. These types of crimes may have a particular spatial character, but that may not be the case for antisocial behaviour. As discussed in the introduction, incidences of antisocial behaviour might not come to the attention of the police and therefore official administrative data may not provide an adequate representation of the level of adolescent problems in a given area. This is important for practitioners as generic programs geared towards reducing crime in a given place, may have little or no effect in reducing antisocial behaviour in adolescence.

As our research indicates, one of the strongest predictors of adolescent antisocial behaviour is childhood aggression. This is a robust finding in the literature with convincing evidence of the cumulative development of an early onset of antisocial behaviour over time (Moffitt, Caspi, Dickson, Silva, & Stanton, 1996; Patterson, DeBaryshe, & Ramsey, 1989; Piquero, Farrington, & Blumstein, 2003, p. 366). While the current research has focused on adolescent antisocial behaviour, the findings still point to the

importance of the prevention of the onset of antisocial behaviour. Therefore, like other initiatives in Australia (for example Pathways to Prevention (Homel, 1999) and further afield (Olds, 2006; Olds, Sadler, & Kitzman, 2007) our research supports the need for prevention programs targeting at risk children and families during early childhood and adolescence. Programs that enhance parenting practices which include improving communication, supervision and monitoring of children are important.

### ***Conclusion***

The present research is the first of its kind in Australia to simultaneously examine individual, family and neighbourhood predictors of antisocial behaviour. While there have been some explorations elsewhere (predominantly in the USA), we can find no evidence of data as rich in nature as MUSP collected in Australia. By utilising data from a prospective longitudinal study, we have provided a more meaningful analysis of between neighbourhood variations in incidences of antisocial behaviour that takes into consideration a complement of factors, both biological and social. In so doing, we have attempted to disentangle and explain the dynamic interdependence of these influences and contexts, allowing for an examination of the interrelations between as well as the separate contributions of individual, family and community factors in explaining incidences of antisocial behaviour. Findings generated by this research will assist in the development of policies that deal with young people and crime prevention, allowing for a more coordinated approach in dealing with antisocial behaviour by targeting a more comprehensive range of indicators associated with its prevalence.

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## Appendices

### *Appendix 1: Phases of data collection of the MUSP project*

Year	Data collection and instruments
Phase	
1980	Preparation, piloting, and validation of questionnaires; logistic details of study design
1981-1984 Phase I Prenatal	Data collection commenced on the 5 <sup>th</sup> January 1981. At their first antenatal visit at the MMH, prospective mothers were asked to participate in the MUSP project. Those who agreed to participate completed a 113 item questionnaire. It was at this phase that the majority of the demographic data were collected. It also included a range of physical and mental health measures.
1981-1984 Phase II Birth	The second questionnaire was given to the mothers at three to five days after the delivery of the study child. It contained 103 items and had repeated health measures from Phase I. In addition the mother was asked a range of questions about the pregnancy.
1981-1984 Phase III Six months after birth	When the study child was six months old the mother was mailed another 103 item questionnaire. The focus of this survey was on mother's postpartum health; baby health and development; and child rearing practices of the mother. It also included repeated health measures. When necessary, follow-up phone reminders and home visits were used to maximise the response rate (Keeping, et al., 1989, p. 291).
1981-1984 Phase IV Obstetric data	With the aid of a 97 item coding sheet, the research team retrospectively coded hospital antenatal and neonatal data from the birth of the study child. This code sheet included the obstetric history of the mother; height and weight of the mother and father of the study child; delivery data such as foetal distress, birth weight, and APGAR; pregnancy complications; and neonatal problems.

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<p>1986–8</p> <p>Phase V</p> <p>Five–year follow–up</p>	<p>The fifth phase of MUSP data collection included three components, an assessment of the child via face–to–face interview and two written questionnaires (one about the child and the other about the mother) to be completed by the mother.</p> <p>The child assessment measured 10 items including the height, weight, pulse, eyesight and hearing of the study child. The interviewer also administered the Peabody Picture Vocabulary Test (Dunn &amp; Dunn, 1981) to assess IQ. The child focussed questionnaire, completed by the mother, contained 101 items assessing the child’s health and behaviour. It included Achenbach’s Child Behavior Checklist (CBCL) (Achenbach, 1991b) as well as measures of mild childhood illnesses and serious physical illnesses.</p> <p>The maternal focussed questionnaire included 126 items and included repeated health measures and also included a measure of parenting control/autonomy; time spent in childcare or at preschool; and questions about the arrest and imprisonment of the mother and her partner.</p>
<hr/> <p>1995-7</p> <p>Phase VI</p> <p>14–year follow–up</p>	<p>The sixth phase of data collection contained three components, much the same as the five–year follow–up. The face–to–face interview included repeated measures of height, weight, pulse, and eyesight of the study child, as well as a measure of the onset of puberty using the Tanner pictorial diagrams for self-report (Tanner, 1962). The interview also included two proxy measures of IQ: a test of non-verbal reasoning using Raven’s Standard Progressive Matrices (de Lemos, 1989a, 1989b; Raven, 1989) and a measure of reading and word decoding using the Wide Range Achievement Test (WRAT) (Wilkinson, 1993).</p> <p>The first questionnaire, rather than being a report from the mother about the child, is a 141 item child self report questionnaire. It includes the Youth Self Report (YSR) version of the CBCL (Achenbach, 1991a); physical health; television viewing; smoking and alcohol use; physical activity; school performance; and career aspirations. The second questionnaire includes 284 items about the mother and the study child.</p> <p>In addition to the two main questionnaires, there were two supplementary questionnaires, one for the mother and the other for the study child. The 108 item child supplementary questionnaire included measures which examine parenting practices; alienation (Travis, 1993); and peer delinquency (Furlong, Morrison, &amp; Clontz, 1996). The mother’s supplementary questionnaire asked the mother 141 questions about her parenting and monitoring of the child. It also included measures of her alienation; attitude to authority; neighbourhood disorder and arrest of both her and her partner.</p> <hr/>

## Appendix 2: Correlation matrix of individual and familial variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1. Number of births	1	-.070**	-.018	.545**	.016	.030	.062**	-.098**	-.007	.029	.031	-.047**	.131**	.002	.015	-.028	.022	.083**	-.007	-.059**	-.108**	-.004	.096**	-.065**	.171**	-.002	-.010
2. Dyadic adjustment: pre-natal	-.070**	1	.104**	.032*	-.160**	-.038*	-.171**	.685**	-.236**	-.139**	-.019	.576**	.133**	-.133**	-.030	.411**	.120**	.072**	-.132**	-.186**	.072**	-.102**	-.113**	.287**	.197**	-.044**	.152**
3. Family income at pre-natal	-.018	.104**	1	.132**	-.094**	.011	-.080**	.058**	-.102**	-.102**	.008	.075**	.447**	-.100**	.017	.032	.303**	-.019	-.116**	-.064**	.096**	-.116**	-.110**	.006	.123**	-.004	.008
4. Maternal age at entry	.545**	.032*	.132**	1	-.070**	.079**	-.026	-.018	-.058**	-.078**	.053**	.058**	.241**	-.102**	.037*	-.004	.126**	.139**	-.140**	-.079**	.022	-.146**	-.034*	-.028	.284**	-.045**	.034*
5. Maternal smoking: pre-natal	.016	-.160**	-.094**	-.070**	1	.130**	.062**	-.088**	.103**	.835**	.057**	-.142**	-.092**	.766**	.089**	-.092**	-.108**	-.018	.651**	.129**	-.089**	.561**	.143**	-.039*	-.086**	.031	-.043**
6. Maternal alcohol consumption: pre-natal	.030	-.038*	.011	.079	.130**	1	.009	-.016	.017	.101**	.552**	-.0220	.019	.086**	.480**	-.013	.010	-.028	.055**	-.002	-.018	.052**	.010	.000	-.036*	.050**	-.007
7. Problems during pregnancy	.062**	-.171**	-.080**	-.026	.062**	.009	1	-.166**	.312**	.072**	.003	-.142**	-.087**	.070**	-.013	-.129**	-.061**	.009	.069**	.136**	-.040*	.065**	.107**	-.111**	-.046**	.023	-.039*
8. Dyadic adjustment: post-natal	-.098**	.685**	.058**	-.018	-.088**	-.016	-.166**	1	-.281**	-.078**	-.014	.634**	.129**	-.072**	-.019	.428**	.108**	.076**	-.070	-.179**	-.034*	-.093**	.333**	.164**	-.037*	.161**	
9. Maternal depression: post-natal	-.007	-.236**	-.102**	-.058**	.103**	.017	.312**	-.281**	1	.095**	.012	-.255**	-.111**	.088**	-.004	-.152**	-.088**	-.002	.056**	.133**	-.042*	.071**	.099**	-.126**	-.072**	.042*	-.026
10. Maternal smoking: post-natal	.029	-.139**	-.102**	-.078**	.835**	.101**	.072**	-.078**	.095**	1	.050**	-.127**	-.085**	.829**	.074**	-.083**	-.098**	-.039*	.700**	.116**	-.098**	.616**	.158**	-.054**	-.072**	.041*	-.036*
11. Maternal alcohol consumption: post-natal	.031	-.019	.008	.053**	.057**	.552**	.003	-.014	.012	.050**	1	-.004	.005	.050**	.548**	-.002	.053**	-.051**	.038*	-.010	-.014	.032*	.008	-.009	-.043**	.041*	.010
12. Dyadic adjustment: 6 mos	-.047**	.576**	.075**	.058**	-.142**	-.020	-.142**	.634**	-.255**	-.127**	-.004	1	.146**	-.143**	-.060**	.456**	.148**	.083**	-.129**	-.205**	.045**	-.103**	-.105**	.332**	.212**	-.040*	.169**
13. Family income: 6 mos	.131**	.133**	.447**	.241**	-.092**	.019	-.087**	.129**	-.111**	-.085**	.005	.146**	1	-.084**	.016	.077	.417**	.023	-.094**	-.094**	.121**	-.091**	-.118**	.025	.200**	-.045**	.026
14. Maternal smoking: 6 mos	.002	-.133**	-.100**	-.102**	.766**	.086**	.070**	-.072**	.088**	.829**	.050**	-.143**	-.084**	1	.135**	-.090**	-.093**	-.041*	.728**	.132**	-.085**	.613**	.133**	-.063**	-.096**	.040*	-.028
15. Maternal alcohol consumption: 6 mos	.015	-.030	.017	.037*	.089**	.480**	-.013	-.019	-.004	.074**	.548**	-.060**	.016	.135**	1	.007	.033*	-.019	.057**	-.001	-.013	.049**	.020	-.020	-.048**	.038*	-.004
16. Dyadic adjustment: 5 yrs	-.028	.411**	.032	-.004	-.092**	-.013	-.129**	.428**	-.152**	-.083**	-.002	.456**	.077**	-.090**	.007	1	.058**	.091**	-.114**	-.220**	.053**	-.097**	-.110**	.468**	.190**	-.031	.176**
17. Family income: 5 yrs	.022	.120**	.303**	.126**	-.108**	.010	-.061**	.108**	-.088**	-.098**	.053**	.148**	.417**	-.093**	.033*	.058**	1	-.005	-.124**	-.095**	.122**	-.106**	-.164**	.054**	.252**	-.052**	.056**
18. Supervisory parenting style: 5 yrs	.083**	.072**	-.019	.139**	-.018	-.028	.009	.076**	-.002	-.039*	-.051**	.083**	.023	-.041*	-.019	.091**	-.005	1	-.089**	-.076**	-.014	-.064**	-.024	.026	.086**	-.030	.057**
19. Maternal smoking: 5 yrs	-.007	-.132**	-.116**	-.140**	.651**	.055**	.069**	-.070**	.056**	.700**	.038	-.129**	-.094**	.728**	.057**	-.114**	-.124**	-.089**	1	.143**	-.088**	.675**	.132**	-.063**	-.146**	.053**	-.027
20. Child aggression: 5 yrs	-.059**	-.186**	-.064**	-.079**	.129**	-.002	.136**	-.179**	.133**	.116**	-.010	-.205**	-.094**	.132**	-.001	-.220**	-.095**	-.076**	.143**	1	-.119**	.103**	.142**	-.172**	-.084**	.075**	-.223**
21. School performance: 14 yrs	-.108**	.072**	.096**	.022	-.089**	-.018	-.040*	.079**	-.042*	-.098**	-.014	.045**	.121**	-.085**	-.013	.053**	.122**	-.014	-.088**	-.119**	1	-.118**	-.062**	.021	.040*	-.025	.174**
22. Maternal smoking: 14 yrs	-.004	-.102**	-.116**	-.146**	.561**	.052**	.065**	-.034*	.071**	.616**	.032*	-.103**	-.091**	.613**	.049**	-.097**	-.106**	-.064**	.675**	.103**	-.118**	1	.132**	-.060**	-.129**	.036*	-.031
23. Problems in residential area: 14 yrs	.096**	-.113**	-.110**	-.034*	.143**	.010	.107**	-.093**	.099**	.158**	.008	-.105**	-.118**	.133**	.020	-.110**	-.164**	-.024	.132**	.142**	-.062**	.132**	1	-.095**	-.101**	.016	-.086**
24. Dyadic adjustment: 14 yrs	-.065**	.287**	.006	-.028	-.039*	.000	-.111**	.333**	-.126**	-.054**	-.009	.332**	.025	-.063**	-.020	.468**	.054**	.026	-.063**	-.172**	.021	-.060**	-.095**	1	.073**	-.046**	.168**
25. Years mother w present partner: 14 yrs	.171**	.197**	.123**	.284**	-.086**	-.036*	-.046**	.164**	-.072**	-.072**	-.043**	.212**	.200**	-.096**	-.048**	.190**	.252**	.086**	-.146**	-.084**	.040*	-.129**	-.101**	.073**	1	-.150**	.077**
26. No times child not lived w/mother: 14 yrs	-.002	-.044**	-.004	-.045**	.031	.050**	.023	-.037*	.042**	.041*	.041*	-.040*	-.045**	.040*	.038*	-.031	-.052**	-.030	.053**	.075**	-.025	.036*	.016	-.046**	-.150**	1	-.035*
27. Family communication: 14 yrs	-.010	.152**	.008	.034*	-.043**	-.007	-.039*	.161**	-.026	-.036*	.010	.169*	.026	-.028	-.004	.176**	.056**	.057**	-.027	-.223**	.174**	-.031	-.086**	.168**	.077**	-.035*	1

\* Correlation is significant at the 0.05 level \*\* Correlation is significant at the 0.01 level

### ***Appendix 3: Descriptive statistics***

**Table A2.1 Descriptive statistics for variables included in the final OLS model predicting antisocial behaviour at age 14**

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Number of births	3817	0.00	8.00	1.06	1.16
Maternal age at entry to the study	3817	13.00	46.00	25.13	5.03
Dyadic Adjustment at 6 months	3620	10.00	50.00	42.27	5.32
Maternal alcohol consumption at 6 months	3797	0.00	70.00	1.01	3.95
Parental supervision (age 5)	3728	13.33	40.00	27.58	4.11
Child Aggression (age 5)	3801	0.00	20.00	6.01	3.54
School performance: Child report	3793	1.00	5.00	3.53	0.91
Maternal smoking at 14 years	3809	0.00	50.00	6.14	11.63
Dyadic Adjustment at 14 years	3298	11.67	50.00	41.35	5.84
Years in present relationship	3757	0.00	42.00	14.80	8.50
Number of times the child has lived with someone else	3745	0.00	10.00	0.05	0.33
Openness in family communication	3808	18.00	50.00	39.77	5.53
Percent Non-English speaking people in SLA	3817	1.44	50.46	9.49	6.65
Percent of people living at a different address 5 years prior	3817	21.87	81.27	45.62	6.60
Neighbourhood Disadvantage (z-score)	3817	-3.48	2.50	0.00	1.00
Square root of the antisocial behaviour measure	3816	0.00	7.14	3.42	1.04

## Appendix 4: Pre-natal model

Variable	Measurement
Number of Births	Maternal number of births was recorded on the obstetric data sheets of the hospital records.
Dyadic adjustment	Quality of the marital relationship was assessed using a version of the Dyadic Adjustment Scale (DAS) (Spanier, 1976). The mother was asked about various aspects of her relationship with her partner, such as how often they fight or think about terminating the relationship. The items are part of the dyadic satisfaction subscale and are taken from the 32 item DAS which was devised to assess quality of life for married or cohabiting couples. The items included in MUSP have good internal consistency (For example: $\alpha=0.86$ at Phase I) and were included at each phase of the study. The items were recoded and where appropriate reversed so that a high score indicated good adjustment. The score was calculated taking the arithmetic mean of each individual's responses to the items and multiplying that value by ten. Those with no partner were coded as missing data.
Life events (6 months prior to FCV)	The MUSP included a number of items adapted from The Social Readjustment Rating Scale (Holmes & Rahe, 1967). The scale is a list of serious life events that were believed to evoke or be associated with some adaptive or coping behaviour (p. 217). MUSP included items such as: change in job situation, serious financial problems, housing problems, trouble with police. For each item the mother was asked to indicate whether or not the event had happened to her in the last six months. She was asked about the period 6 months prior to joining the study in the phase I questionnaire and 6 months prior to birth in the phase II questionnaire. The score was created by summing the number of life events the mother reported.
Family income	In MUSP the mother was asked to report on the gross income of the family (including spouse's income, child endowment, etc.) at each phase of the MUSP from a list of the seven brackets/ranges of income. To increase accuracy of reporting both an annual figure and corresponding weekly amount were provided.
Maternal education	The maternal education of the mother was measured by asking the mother whether her education was an incomplete high school education, a complete high school education or a post high school education.
Maternal age	The date of birth of the mother was recorded at the first clinical visit (Phase I). The age of the mother at entry to the study was calculated by subtracting the date of the first antenatal visit from the mother's date of birth.
Maternal age at first pregnancy	In the current study, the age of the mother at the birth of her first child was calculated in the following way: the date of delivery of study child was subtracted from the year of birth of first child. Those whose study child was their first child were coded as zero. All other values were less than zero. These values were then added to the age of the mother at the first clinical visit. The resulting figure is the age of the mother at the birth of her first child.
Maternal depression and anxiety	Maternal anxiety and depression was assessed throughout all phases of the MUSP data collection. It was measured using the Delusions–Symptoms–States Inventory (DSSI) scale (Bedford & Foulds, 1978). The scale was constructed to identify persons who are depressed and living in the community. It is intended to identify signs and symptoms of mental illness that limit a person's ability to function and maintain relationships (Bedford, et al., 1976; Heather, 1977). A number of studies have confirmed Bedford and Foulds' model and measurement instrument (Bagshaw, 1977; Bedford & Foulds, 1977; Gilleard, 1983; Morey, 1985; Najman, et al., 2000; Palmer, et al., 1981). In the current research, for each item of the Delusions–Symptoms–States Inventory the mother reported how frequently she experienced the symptom. A summative score for each of the subscales (depression and anxiety) was calculated by giving a value of one each time the mother indicated 'all the time', 'most of the time', or 'some of the time'. Both of the subscales show good internal consistency, with the Cronbach's alpha for depression ranging from 0.78 to 0.88 across the phases and from 0.76 to 0.84 for anxiety.
Maternal smoking	The MUSP study measured the number of cigarettes that the mother consumed each day by presenting her with a series of ranges in which she could nominate the number of cigarettes consumed. The response categories were recoded by taking the mid point of each of the range options provided on the questionnaire. The new categories were: 50, 40, 25, 15, 5 and 0. This was done to allow the magnitude of the number of cigarettes that were smoked each day to be reflected in the standardised score comparisons.
Maternal alcohol consumption	The measure of maternal alcohol consumption used in the current research is an estimation of the volume of consumption in a one week period. The mother was asked how often she drank alcohol and how much she drank at those times. The frequency responses were then recoded to a value that represented a proportion of a week and this value was multiplied by the number of drinks that the mother consumed on each drinking occasion. The resulting figure is an approximation of the amount of alcohol the mother consumed each week.
Interaction Term	An interaction term was included for the interaction between age and maternal depression.



**Table A4.1 Phase I First Clinical Visit Predictors of Antisocial Behaviour at 14 years: Multiple Regression Model (n=3610)**

Variables	B	S.E.	$\beta$
Number of Births	.440	.169	.070***
Dyadic adjustment	-.163	.027	-.110***
Life events (6 months prior to FCV)	.161	.098	.030
Family income	-.195	.111	-.039*
Maternal education	-.180	.208	-.015
Maternal age	-.111	.049	-.076**
Maternal age at first pregnancy	-.056	.049	-.031
Maternal depression	-.108	.486	-.018
Maternal anxiety	.154	.105	.031
Maternal smoking	.082	.016	.089***
Maternal alcohol consumption	.110	.058	.032*
Depression x Age (interaction term)	-.005	.019	-.022
Constant	23.849	1.593	
$R^2$	.049		

\*p< .10 \*\*p< .05 \*\*\*p< .01

## Appendix 5: Birth model

Variable	Measurement
Problems during pregnancy	Mothers were asked about a range of problems (n=7) that can occur during the pregnancy. Questions included in the MUSP assessed whether the mother experienced the problem and how much of a problem it was. The scale was constructed by summing the values of the responses to each item so that higher scores indicate a higher level of problems (Cronbach's alpha = 0.59).
Pregnancy easy/hard	Three statements were presented to the mother regarding complications; physical health and whether the pregnancy was straightforward. Levels of agreement with each item were rated on a likert scale. Responses were summed and as a scale the items show good internal consistency (Cronbach's alpha = 0.72).
APGAR 5 minutes	The APGAR test is used to quickly evaluate a newborn's condition after delivery (Apgar, 1953). Newborns are rated at one minute and five minutes after delivery on five qualities: <u>A</u> ppearance (colour); <u>P</u> ulse (heartbeat); <u>G</u> rimace (reflex); <u>A</u> ctivity (muscle tone); and <u>R</u> espiration (breathing). The APGAR is scored by giving zero, one or two points in each category. The higher the score, the better the baby's condition, and scores of seven and over indicate the baby is in good condition. The APGAR scores for the children in this study were taken from the hospital obstetrical records. APGAR scores measure the general health of a new born therefore the APGAR measure is included here as a rough proxy for health of the child at the time of birth.
Time to establish respiration	The first breath of the infant is necessary to remove fluid from the lungs, inflate the bronchial tree and pull blood into the pulmonary circulation (Martini, 1998, p. 834). If respiration is delayed it can cause neurological damage. The time to establish respiration is a measure of the time that it took to get the baby breathing if was born not breathing. If the baby was born breathing the time to establish respiration value is zero. For those babies that were not breathing, the time that it took to establish respiration was coded into ranges of time.
Number of days in intensive care	The hospital records recorded the number of days that the child was in intensive care. Those children that did not go into intensive care were coded as zero. For all others the number of days was recorded in whole numbers. The length of stay in intensive care is an indicator of the health of the child at the time of the birth.
Attitude towards newborn	In MUSP, the mother was asked a series of questions designed to measure the way the mother feels about interacting with her newborn child. A series of five statements describing feelings about contact with the child were presented to the mother with a five point likert scale on which she could indicate her level of agreement with each item. Some items were reverse coded before scores were calculated so that a high score indicates a positive attitude towards the baby. The score was calculated taking the arithmetic mean of each individual's responses to the items and multiplying that value by ten. Each of the items have good internal consistency (Cronbach's alpha = 0.74).

**Table A5.1 Phase II Birth Predictors of Antisocial Behaviour at 14 years: Multiple Regression Model (n=3588)**

Variables	B	S.E.	$\beta$
Problems during pregnancy	.067	.040	.031*
Pregnancy easy/hard	.026	.051	.009
APGAR 5 minutes	.200	.303	.052
Time to establish respiration	-.190	.234	-.016
Number of days in intensive care	-.016	.023	-.011
Dyadic adjustment	-.191	.030	-.116***
Life events (prior 6 months)	.153	.107	.026
Attitude towards newborn	.020	.018	.018
Maternal depression	.308	.145	.048**
Maternal anxiety	-.099	.105	-.021
Maternal smoking	.101	.013	.125***
Maternal alcohol consumption	.090	.053	.028*
Constant	17.177	2.972	
$R^2$	.046		

\*p< .10 \*\*p< .05 \*\*\*p< .01

## Appendix 6: Six months model

Variable	Measurement
Infant general medical	Medical problems have been shown to account for the most variation in outcomes on the Child Behavior Checklist scores (Thomas, Byrne, Offord, & Boyle, 1991). In MUSP, a list of nine medical problems were presented to the mother and she was asked to indicate on a five point likert scale the frequency at which these problems occur. The items were summed based on whether or not the symptom had occurred, so that a higher score indicated more problems. The items have moderate internal consistency (Cronbach's alpha = 0.64).
Medical attention and Hospital admissions	Mothers were also asked to indicate the number of times that she had sought medical attention for the child since birth and the number of times that the child was admitted to hospital since the birth (i.e. the first six months of life). For each of these variables, the score is a count of the number of times the event occurred.
Number of weeks breastfeeding	In MUSP the mother was asked to indicate the length of time that she had breastfed the child by selecting from categories containing ranges of time. These were recoded so that each category was given a value that reflects the mid point of each of the ranges. Those mothers who had never breastfed their child were coded as zero and those who were still breastfeeding at the time of the survey (when the child was six months of age) were coded as 26.
Spend time teaching baby	In MUSP four statements were presented to the mother in order to gauge whether or not she spent time teaching the baby. She was asked to rate her agreement with each statement on a five point likert scale. Each item was reversed coded so that a higher score indicated a higher level of involvement in teaching the baby. The score was calculated taking the arithmetic mean of each individuals responses to the items and multiplying that value by ten. The items showed a moderate level of internal consistency (Cronbach's alpha = 0.66).
Hours in child care	Time spent in child care has a positive impact on child cognitive development (Torr, 2004) and behaviour (Borge, et al., 2004). In MUSP the mother was asked how many hours per week the study child was looked after by someone else. She was given five range options for the number of hours from never to more than 20 hours. These were recoded so that each category was given a value that reflects the mid point of each of the ranges.

**Table A6.1 Phase III Child 6-Months Predictors of Antisocial Behaviour at 14 years: Multiple Regression Model (n=3431)**

Variables	B	S.E.	$\beta$
Infant general medical	.027	.086	.006
Medical attention	-.044	.043	-.019
Hospital admissions	.301	.270	.020
Number of weeks breastfeeding	-.005	.012	-.007
Positive about caring for baby	-.005	.023	-.004
Spend time teaching baby	-.009	.027	-.006
Dyadic adjustment	-.185	.026	-.135***
Family income	-.292	.116	-.043**
Hours in childcare	-.007	.029	-.004
Maternal depression	.166	.151	.027
Maternal anxiety	-.078	.116	-.016
Maternal smoking	.074	.012	.106***
Maternal alcohol consumption	.065	.031	.035**
Constant	21.997	1.713	
$R^2$	.045		

\*p< .10 \*\*p< .05 \*\*\*p< .01

## Appendix 7: Five year model

Variable	Measurement
Behaviour problems 2-4 years	When the child was five years of age, the mother was asked to retrospectively report on the child's behaviour when s/he was aged 2–4 years. For each of the six behaviours, the mother reported the frequency at which they occurred on a four point likert scale. The items show good internal consistency (Cronbach's alpha = 0.74). All item responses were reverse coded and summed so that a higher score indicates a higher rate of behaviour problems.
ADHD	The Clinical Attention Problem Scale (CAPS) (Edelbrock, 1986) is a 12 item screening instrument for measuring attention and impulse control symptoms related to Attention Deficit Hyperactivity Disorder (ADHD). The mother was asked to indicate how true each statement of problem behaviour was for the child in the last week. The items show good internal consistency (Cronbach's alpha = 0.89). The score for the CAPS scale was calculated by summing together the responses provided for each item.
Discipline	At the five-year follow-up the mother was provided with a list of five scenarios of child misbehaviour. For each situation she was asked to indicate the frequency with which she would use <u>physical punishment</u> ; <u>reasoning</u> ; and <u>take something away</u> , on a three point likert scale. Each of the subscales showed moderate to strong internal consistency: physical punishment (Cronbach's alpha = 0.62); reasoning (Cronbach's alpha = 0.82); and take something away (Cronbach's alpha = 0.74). The score for each subscale was calculated by summing the values assigned to each of the responses. For each of these subscales a <i>lower</i> score indicates a <i>higher</i> use of that type of discipline.
Parenting Style	Parenting style at age five was measured across three dimensions: <u>control</u> ; <u>autonomy</u> ; and <u>supervision</u> . The degree of autonomy and control is measured using a two dimensional scale consisting of eight items describing different aspects of parenting. For each item the mother was asked to indicate the frequency with which each parenting activity was carried out. The five control items show a moderate level of internal consistency (Cronbach's alpha = 0.64) and the subscale was scored by taking an average of the mothers' responses to the items in the scale and multiplying by ten. A higher score indicates a higher level of control. The 3 autonomy items show relatively low internal consistency (Cronbach's alpha = 0.48) and the items were first reverse coded before an average score was calculated and multiplied by ten, so that a higher score indicates a higher level of autonomy. The measure of <u>supervision</u> when the child was five years old is a prospective measure of the level of supervision the mother intends to provide as the child grows up. It was operationalised by asking the mother to indicate the age (in years) at which she would let her child engage in a range of activities without the supervision of a parent. The item responses show a moderate level of internal consistency (Cronbach's alpha = 0.60). The score was calculated taking the arithmetic mean of each individual's responses to the items and multiplying that value by ten. For this scale a lower score indicates a lower level of supervision and an earlier age at which the child will be allowed to engage in activities in the absence of parental supervision.

**Table A7.1 Phase V Child 5 Year Predictors of Antisocial Behaviour at 14 years: Multiple Regression Model (n=3100)**

Variables	B	S.E.	$\beta$
Behaviour problems 2-4 years	-.002	.044	-.001
ADHD	.102	.077	.029
Dyadic adjustment	-.085	.028	-.059***
Family income	-.258	.079	-.058***
Hours in preschool or childcare	-.039	.062	-.011
Discipline – Physical punishment	-.036	.032	-.021
Discipline – Reasoning	-.030	.026	-.020
Discipline – Take something away	-.001	.030	.000
Parenting style – control	-.016	.026	-.011
Parenting style – autonomy	.006	.021	.005
Parenting style – supervision	-.071	.032	-.040**
Maternal depression	.205	.134	.038
Maternal anxiety	-.044	.101	-.011
Maternal smoking	.056	.012	.084***
Maternal alcohol consumption	.031	.037	.015
Child Aggression	.292	.049	.141***
Constant	18.688	2.180	
$R^2$	.064		

\*p< .10 \*\*p< .05 \*\*\*p< .01

## **Appendix 8: Fourteen year model**

<b>Variable</b>	<b>Measurement</b>
School performance	Poor school performance is a necessary component in the pathway between early antisocial behaviour and adolescent delinquency (Tremblay, Masse, et al., 1992). Both the mother and child were asked to rate the child's overall school performance. The rating was provided on a five point likert scale from below average to above average, with lower values indicating poorer school performance.
Number of close friends	At the MUSP 14-year follow-up the mother was asked to report the number of close friends that her child had. The mother had a choice of four ranges of number of friends to choose from.
Problems in residential area	The MUSP study mother was presented with a list of nine items to gauge her level of neighbourhood disorder. She was asked to indicate to what degree each item was a problem in the area that she lived in, on a four point likert scale. The items have good internal consistency (Cronbach's alpha = 0.93). The items were recoded so that those for which the mother reported were a 'major problem' or 'moderate problem' were assigned a value of one. The responses to the items were then summed with zero indicating a lack of problems and the highest level of problems were assigned a value of nine.
Violence in the home	The level of violence in the family home was measured using a modified version of the Conflict Tactic Scale (CTS) (Straus, 1979). The items showed a good level of internal consistency: Cronbach's alpha = 0.98. The mother indicated the frequency with which each of items of conflict occurred in the home and the responses to each of these items were summed so that a high score indicated higher levels of violence within the home.
Years mother has been in present relationship	Indicators of the stability of the family environment include the number of times that the marital status of the mother has changed and the years that she has been in her current relationship. In the MUSP, the number of years in the present relationship was measured by asking the mother how long her current relationship had lasted.
Number of times child has lived with someone other than mother and Years child has lived with mother	In MUSP two items measure time spent away from the mother. Firstly the frequency with which the study child lived with someone else other than the mother as the main care giver for over 3 months was recorded by the mother. Secondly, the mother was asked to report the total number of years that the study child has lived with her.

**Table A8.1 Phase 14 Child 14 Year Individual Predictors of Antisocial Behaviour at 14 years: Multiple Regression Model (n=3237)**

Variables	B	S.E.	$\beta$
School performance: Child Report	-1.733	.135	-.216***
Maternal depression	.257	.117	.053**
Maternal anxiety	-.051	.092	-.013
Maternal smoking	.061	.011	.097***
Maternal alcohol consumption	.008	.021	.007
Child's Number of Close Friends	.137	.188	.012
Problems in Residential Area	.144	.045	.054***
Dyadic adjustment	-.071	.022	-.057***
Years mother has been in present relationship	-.062	.015	-.072***
Number of times child has lived with someone other than mother	.894	.366	.040**
Family income	.071	.076	.017
Openness in family communication	-.224	.023	-.170***
Constant	29.959	1.429	
$R^2$	.141		

\*p< .10 \*\*p< .05 \*\*\*p< .01