

**THE EARLY DEVELOPMENT AND FAMILY ENVIRONMENTS OF
CHILDREN BORN TO MOTHERS ENGAGED IN METHADONE
MAINTENANCE TREATMENT DURING PREGNANCY**

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ABSTRACT

Introduction. There is clear evidence that children raised in families affected by parental drug use are at high risk for a wide range of adverse outcomes, including; early cognitive and language delay (van Baar & de Graaff, 1994); poor school attendance and educational under-achievement (Hogan & Higgins, 2001; Steinhausen, Blattmann, & Pfund, 2007); substance abuse and psychological problems (Keller, Catalano, Haggerty, & Fleming, 2002; Kilpatrick, Acierno, Saunders, Resnick, Best, & Schnurr, 2000; Kolar, 1994; Lagasse, Hammond, Liu, Lester, Shankaran, Bada et al., 2006; Merikangas, Dierker, & Szatmari, 1998; Moss, Vanyukov, Majumder, Kirisci, & Tarter, 1995; Nunes, Weissman, Goldstein, McAvay, Beckford, Seracini et al., 2000; Nunes, Weissman, Goldstein, McAvay, Seracini, Verdelli et al., 1998; Stanger, Higgins, Bickel, Elk, Grabowski, Schmitz et al., 1999). Careful examination of the impact of parental drug use on children and the developmental mechanisms associated with risk and resilience is central to the establishment of appropriate intervention. Children born to mothers who are drug dependent and enrolled in methadone maintenance treatment during pregnancy face the “double jeopardy” of prenatal drug exposure and post-natal environmental disadvantage (Zuckerman & Brown, 1993). This research aimed to identify early developmental difficulties or differences in communicative and cognitive development, and in particular the joint attention skills, of young children born to mothers engaged in methadone maintenance treatment. Of particular interest was the way in which pre- and postnatal factors combined to influence developmental outcome at age 2 years. This prospective, longitudinal study

offered the opportunity to identify early indicators of developmental differences in this group and thus, contribute to a better understanding of the long-term mechanisms of risk.

Research Methods. Sixty children born to mothers engaged in methadone maintenance treatment and 60 randomly-selected, non-exposed comparison children were followed prospectively from birth to age 2 years. During the third trimester of pregnancy, mothers completed a comprehensive maternal interview. At 18 months, children were visited at home and evaluations of the social background, family and childrearing context were completed. At age 2 years, all children underwent a developmental assessment that included the Early Social Communication Scales (ESCS) (Mundy, Hogan, & Doehring, 1996). The ESCS consists of a semi-structured series of activities, which assess the joint attention abilities, social skills and interactive behaviour of infants aged 8 to 30 months. The focus of this study was on children's use of two types of communicative behaviour – requesting and affect-sharing communications. Alongside the ESCS, the Mental Development Index (MDI) and language items from the Bayley Scales of Infant Development (BSID-II) (Bayley, 1993) and the Communication and Symbolic Behaviour Scales– Developmental Profile (CSBS-DP) (Wetherby & Prizant, 1998), were used to assess concurrent cognitive and language skills.

Results. The results of this study indicated that children born to mothers engaged in methadone maintenance treatment were typically growing up in single-parent families ($p < .0001$) and in welfare-dependent households ($p < .0001$). Methadone-exposed children were also more likely to be living in out-of-home care

placements at age 18 months than comparison group children ($p < .0001$). Their caregivers were less likely to be accepting of ($p < .01$) and responsive to their needs ($p = .008$) compared to parents of comparison children. At home, methadone-exposed children had fewer learning opportunities ($p < .0001$) and were more likely to live in houses where the television was on for longer, compared to non-exposed children ($p < .001$). Caregivers of methadone-exposed toddlers reported more depression ($p < .0001$), more illicit substance use ($p < .0001$) and more family stress ($p = .004$) than comparison caregivers. They were also more often victims of psychological aggression ($p = .002$) and violence from others ($p < .0001$), but they also reported that they were more likely to use psychological aggression ($p < .001$) and physical punishment ($p < .03$) in managing their children's behaviour than comparison caregivers.

The developmental assessment at age 2 years suggested that methadone-exposed children were significantly more likely to engage in communicative behaviour, which expressed a request, than non-exposed, comparison children ($p = .03$). On the other hand, analysis suggested that whilst methadone-exposed children were less likely than comparison children to engage in communication, which had the goal of affect sharing, this difference did not reach significance ($p = .27$). Previous research links greater use of requesting behaviours with later behaviour problems (Sheinkopf, Mundy, Claussen, & Willoughby, 2004). The MDI, BSID language measure and CSBS results further indicated significant delay in both cognitive ($p < .0001$) and language development ($p < .0001$) in the methadone-exposed group, compared to the comparison group. Between group differences were attenuated by control for

confounding social background and prenatal factors, including maternal education, gestational age, other drug exposures during pregnancy and gender, but significant differences remained. Further analysis suggested that parenting practices and family environment factors were important intervening influences on the relationship between being born to a mother engaged in methadone maintenance treatment and poorer outcomes. More specifically, the association between methadone-exposure and differences in joint attention behaviours, were explained by caregiver use of psychological aggression ($p=.01$), caregiver disruption ($p=.07$) and caregiver stress ($p=.01$). On the other hand, poorer cognitive and language outcomes were explained by family contextual factors, including a less child-centered home environment ($p=.008$), caregiver disruption ($p=.001$), increased use of background TV ($p=.02$) and fewer stimulating activities ($p=.06$)

Discussion. The family circumstances of children born to mothers engaged in methadone maintenance treatment during pregnancy, when compared with a group of randomly-selected comparison children, showed pervasive differences and multiple disadvantage. Findings suggest that these differences in family disruption, family functioning and parenting practices explain the negative outcomes of methadone-exposed children in early cognitive and communication skills at age 2 years. These results raise concerns for the later functioning of methadone-exposed children and emphasise the key importance of early intervention for children and families affected by parental drug use.

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ABBREVIATIONS

| | |
|--------|--|
| BSID | Bayley Scales of Infant Development |
| MDI | Mental Development Index |
| ESCS | Early Social Communication Scales |
| IJA | Initiating Joint Attention |
| IBR | Initiating Behavioural Request |
| CSBS | Communication and Symbolic Behaviour Scales |
| SES | Socio-economic Status |
| CYF | Child, Youth and Family |
| NAS | Neonatal Abstinence Syndrome |
| DSM IV | Diagnostic and Statistical Manual of mental Disorders 4 th Revision.1994. Published by the American Psychiatric Association |
| MLS | Maternal Lifestyle Study |

CHAPTER 1: INTRODUCTION

Illegal drug-use amongst New Zealanders has increased and is of serious concern to both policy makers and service providers. Treatment services for adult drug users are now well-established and widespread. However, the potentially negative impact of parental drug use on children has only recently become a national, as well as an international issue (Advisory Council for the Misuse of Drugs, 2003, 2007). Whilst figures are currently unavailable for the numbers of New Zealand children who live in households affected by parental alcohol misuse or substance dependence, a recent report by the Australian National Council on Drugs (2007) estimates that around 13% of Australian children do so. Systematic and rigorous investigation of the impact of parental drug use on children and the developmental mechanisms associated with risk and resilience is central to the establishment of effective health, education and social services, as well as appropriate government policy.

Opioid Dependency and Methadone Maintenance Treatment in New Zealand

Drug dependency associated with opiates is a universal problem with an annual world-wide prevalence of around 0.4% (United Nations Office on Drugs and Crime, 2006). In New Zealand, an estimated 10,000 adults have an opiate dependency, defined as using opiates daily or almost daily. This represents an incidence of opiate dependence of at least 0.6% of the New Zealand population (Deering, Sellman, Adamson, Campbell, Sheridan, Pooley et al., 2008; Wilkins & Sweetsur, 2008). This suggests that New Zealand has a somewhat higher prevalence of opiate abuse than

many countries. Due to its geographical isolation, heroin is relatively unavailable and street opiates are illegally manufactured from prescription drugs.

For those seeking treatment for their opiate dependence, methadone maintenance treatment is the only treatment available in New Zealand. Eighteen specialised clinics, in association with selected general practitioner and prison clinics, offer opiate substitution with oral methadone and enrolment in a methadone maintenance programme. Currently, around 4000-5000 individuals are receiving methadone maintenance treatment in this country, but there are concerns about lengthy waiting lists and limited places on existing programmes (Deering, et al., 2008).

Methadone is a synthetic opiate agonist. Similarly to other opiates, it acts on both central and peripheral nervous systems. However, unlike heroin, methadone is slowly absorbed by the body and is long acting. It acts to block the effects of other opiates, producing stable blood concentrations and reducing most symptoms of intoxication and withdrawal (Dole & Nyswander, 1965). In this way, methadone maintenance treatment allows those who are opiate-dependent to achieve a more stable lifestyle, in particular lessening the need for involvement in drug-seeking behaviour and its associated criminal activity. In addition, it reduces the need for drug users to share needles, which has further health benefits. In this way, methadone maintenance treatment can minimise some of the harm associated with illegal drug use (Ward, Hall, & Mattick, 1999).

Methadone Maintenance Treatment in Pregnancy

The benefits of methadone maintenance treatment for opiate-dependent adults are well recognised. In 1977, the U.S. National Institute of Health also recommended methadone maintenance treatment as standard care for opiate-dependent, pregnant women, despite the fact that pregnant women were excluded from all international trials of methadone (Berghella, Lim, Hill, Cherpes, Chennat, & Kaltenbach, 2003). Nevertheless, there has subsequently been a widespread, global implementation of this treatment policy for women in pregnancy. Furthermore, as clinical experience with methadone maintenance treatment has increased, higher doses of substitute opiates have been successfully used to achieve better outcomes for those who are drug dependent (Amato, Davoli, Perucci, Ferri, Faggiano, & Mattick, 2005; D'Aunno, Folz-Murphy, & Lin, 1999; Ward, Mattick, & Hall, 1998). Higher doses have been associated with reduced drug-seeking behaviour, which in turn has been found to lessen the criminal activity necessary to sustain opiate dependency (Ling, Wesson, Charuvastra, & Klett, 1996). As a consequence, the average prescribed methadone dose for adults in maintenance treatment has increased over the last 20 years (Parrino, 1993; U.K. Department of Health, 1999; US Department of Health and Human Services, 1996). This trend towards higher doses has also generalised to the treatment of pregnant women (Berghella, et al., 2003; McCarthy, Leamon, Parr, & Anania, 2005). This is despite the fact that there are no empirically-supported guidelines for practitioners regarding appropriate doses for pregnant women.

In New Zealand, women who are pregnant or who have young children are given priority in accessing methadone maintenance treatment services (N.Z. Ministry

of Health, 2008). In Christchurch, around 25-30 pregnant women each year give birth under the supervision of the Christchurch Methadone Programme, in partnership with the multidisciplinary, antenatal team at Christchurch Women's Hospital. For these women, the monitoring of methadone dose by specialist staff is seen as an important health care priority, given the clear benefits for women of good management of their opiate dependency during pregnancy

The effects of methadone on the developing foetus, however, are not so easily ascertained. Methadone and other opiates readily cross the placenta and therefore have the potential to affect the developing foetus (Blinick, Inturrisi, Jerez, & Wallach, 1975). Methadone transferred during pregnancy is stored primarily in the infant brain (Kandall, Doberczak, Jantunen, & Stein, 1999). Animal studies have suggested that methadone has specific and consistent effects on neuroanatomic and behavioural maturation (Robinson, Guo, Maher, McDowell, & Kunko, 1996; Robinson, Guo, McDowell, Pascua, & Enters, 1991; Zagon & McLaughlin, 1978).

Whether the physiological effects of prenatal methadone exposure affect the developing brain of human infants and thereby influence underlying changes in longer-term development, remains to date unclear. However, whatever the causal influences, research suggests that in adolescence, children of opiate-dependent parents tend to achieve significantly less well than their peers. Reported long-term, negative outcomes for this group of children include increased risk of mental health problems (Nunes, et al., 2000; Nunes, et al., 1998; Stanger, et al., 1999; Wilens, Biederman, Bredin, Haehsy, Abrantes, Neft et al., 2002; Wilens, Biederman, Kiely, Bredin, & et al., 1995) and poor academic achievement (Hogan, 1998; Kolar, 1994).

Whilst these challenging outcomes might be associated with the intrauterine biological effects of methadone exposure, there is clear evidence that significant, post-natal environmental adversity is also associated with parental drug dependence including low incomes, domestic violence, parental absence or mortality, parental mental health problems, family and relationship breakdown and risk of abuse and neglect (N.Z. Ministry of Health, 2007).

This combination of pre- and postnatal risks has been termed, ‘double jeopardy’ (Zuckerman & Brown, 1993). The present study aims to identify some of the important influences on the early development of children born to mothers engaged in methadone maintenance treatment by investigating the emerging cognitive and communicative skills of this group of children. A systematic comparison of the differences in development between methadone-exposed and non-exposed children may assist in identifying the key processes associated with early risk and resilience; thereby providing further clarification of the complex pathways implicated in the negative trajectories of this group of children. Understanding their unfolding developmental profile is crucial to planning effective prevention or intervention strategies. A review of the existing evidence regarding the development of this group of children follows.

Early Developmental Outcomes in Children Born to Mothers Engaged in Methadone Maintenance Treatment.

Whilst the focal point of this thesis is on children’s development at age 2 years, first the effects of methadone on short-term perinatal outcomes will be briefly

considered and then, the evidence regarding toddler development in two domains – early cognitive and communication skills – will be reviewed. This summary will focus on research conducted over the last twenty years. Some aspects of infant development have not been extensively examined in methadone-exposed children, so some evidence will also be drawn from studies that have examined the effects of other illicit drugs on children’s early progress. Whilst the effects of other substances cannot be assumed to have the same biological effect on infants, studies of other drugs, might give an indication of the possible developmental impacts of methadone. In addition, it could be hypothesised that the environments of children growing up with drug-dependent parents might be similar, even if the drug of abuse is different.

Short-Term Perinatal Outcomes

At birth, many children of mothers engaged in methadone maintenance treatment during pregnancy show clear physiological signs of methadone exposure in the form of neonatal abstinence syndrome (NAS). This physiological withdrawal is characterised by a cluster of symptoms including hyperirritability, tremors, jerkiness, gastrointestinal dysfunction, inconsolability, over activity, and increased and altered crying. Studies have found NAS symptoms to occur in 30% to 91% of methadone-exposed infants (Kuschel, 2007). Around half of children with signs of NAS may require pharmacological treatment (Lejeune, Simmat-Durand, Gourarier, & Aubisson, 2006; McCarthy, et al., 2005). Symptoms of withdrawal in infants are treated with morphine and phenobarbitone (Oei & Lui, 2007). Thus, during the first few months, a substantial number of infants born to mothers maintained on

methadone in pregnancy will be affected both by withdrawal symptoms, as well as psychoactive, pharmacological treatment, sometimes for extended periods.

During the neonatal period, many methadone-exposed infants can be dysregulated and hard to soothe. For example, Gewolb, Fishman, Qureshi and Vice (2004) reported that the suck-swallow-respiration co-ordination is impaired in opiate-exposed children in the first weeks of life, though this seems to self-resolve by one month. Analysis of cry characteristics of newborn methadone-exposed infants also showed higher levels of frequency perturbation than infants not exposed to methadone (Quick, Robb, & Woodward, 2009). Furthermore, LaGasse et al (2003) reported that opiate-exposed infants at 4 weeks showed more feeding problems and increased arousal, compared to matched comparison infants. Animal studies also indicate that prenatal exposure to opiates followed by post-natal withdrawal is associated with dysregulation of the HPA (hypothalamic–pituitary–adrenal) axis in response to stressors (Hamilton, Harris, Gewirtz, Sparber, & Schrott, 2005). What is not yet clear is whether this early biological response to methadone exposure is the first evidence of neuro-physiological changes that will have long-term consequences for the infant, or whether it reflects only the short-term, transient effects of withdrawal.

Long-Term Outcomes

Whilst a notable body of research has examined the outcomes of children born to mothers engaged in methadone maintenance treatment at term, relatively few have studied the longer-term progress of methadone-exposed toddlers. As a result,

evidence about the early developmental trajectories of methadone-exposed toddlers is scarce. For this reason, the following review includes studies, which examine the early development of children exposed to opiates, as well as methadone. Whilst these two substances are chemically similar, there are clearly life-style differences for adults involved in either illicit opiate use or prescribed methadone use, which may affect children's development. In the following section, the drug exposure examined by the study will be described as either methadone or opiate, as appropriate. The published work in this field can be divided methodologically into two groups: those studies, which assess outcomes in children at a single time-point, where prenatal exposure is determined retrospectively; and then secondly, those research programmes which examine evidence from prospective, longitudinal research. The following section will review first retrospective and then prospective research. The focus is first on studies of cognitive development and then language and communication studies.

Cognitive development.

Retrospective Studies

Three studies were located that employed a retrospective research design. First, a UK study reported by Burns, O'Driscoll and Wason (1996), investigated the health and development of 23 methadone-exposed children, whose mothers were enrolled in a London methadone maintenance programme and 20 non-exposed children, matched for age and locality of housing. Retrospective maternal reports were used to determine birth history and prenatal drug use. Mothers of all exposed

children reported using opiates during pregnancy. The children were seen at one time point, aged between 3 and 7 years. A number of age-appropriate, standardised measures were used, including the Griffiths Mental Development Scales (Griffiths, 1970) for children of preschool age. The authors report that there were no significant differences in cognitive development between the methadone-exposed children and the comparison group.

Developmental outcomes in five groups of Israeli children were investigated by Ornoy and colleagues (Ornoy, 2002; Ornoy, Michailevskaya, Lukashov, & Bar-Hamburger, 1996; Ornoy, Segal, Bar-Hamburger, & Greenbaum, 2001). Two groups of opiate-exposed children participated: one group had been adopted at birth or in infancy and the other group had remained with their biological mothers. Other comparison groups included non-exposed children born to heroin-dependent fathers, children who had been referred to the authorities for severe neglect and environmental deprivation and lastly a group of children from average socio-economic status (SES) homes. Measures were collected once during the preschool period, when there were five groups of children (n= 50-80) and again during primary school years (n= 30-35). Pre-natal drug exposure was determined by maternal report and maternal clinical record.

Developmental outcome was assessed during the pre-school years using either the Bayley Scales of Infant Development (BSID), (Bayley, 1969) or the McCarthy Scales for Children's Abilities (McCarthy, 1972), depending on the age of the child. The findings suggested that opiate-exposed children living with biological mothers and non-exposed children living with their biological, heroin-dependent

fathers fared significantly worse than opiate-exposed children living in adoptive homes and children from average SES homes. However, children who had experienced neglect did significantly less well than all other groups.

In the primary school phase, four subtests from the Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974), as well as standard tests of reading and mathematics were used (Ornoy, et al., 2001). The results indicated that the groups of opiate-exposed children raised by their biological mothers, the non-exposed but neglected group, and the non-exposed, dependent-father group showed significant intellectual impairment and learning difficulties compared to the groups of average SES and the adopted and opiate-exposed children. Nevertheless, the adopted, opiate-exposed group showed higher rates of ADHD than children raised in average SES environments, suggesting some possible biological effects of opiate exposure.

The developmental progress of children of clients from a drug treatment programme has also been investigated by Steinhausen et al (2007). Developmental outcomes were measured in a group of 61 Swiss children (age range “<3 to 14 years”), who were predominantly prenatally exposed to heroin and/or methadone. Age-appropriate tests of intellectual ability were administered at one time point. Retrospective accounts of pregnancy drug use were used in conjunction with clinical records. Maternal intelligence was assessed and psychosocial and peri-natal risk factors were recorded. The authors found that developmental outcomes across the age range from infancy to pre-adolescence did not match population norms. There was no comparison group in this study. When compared to population-normed IQ scores, the majority of study children had IQ test scores at least one standard

deviation below the mean. This trend was particularly marked in some groups, especially amongst younger children and boys. No significant correlations between biological or environmental risk factors and developmental outcomes were found.

Taken together, these three aforementioned studies (Burns et al, Ornoy et al and Steinhausen et al.) suggest that children exposed to methadone and/or opiates during pregnancy show poorer cognitive outcomes, than population norms would suggest. Furthermore they indicate that opiate- or methadone-exposed children may not be significantly more impaired than other children growing-up in socially-disadvantaged environments, with the possible exception of attentional skills, as suggested by the Israeli study (Ornoy et al; 1996, 2001, 2002).

Prospective Studies

Three other studies employed a prospective, longitudinal research design to investigate the developmental outcomes of prenatally, opiate-exposed children. This research design has the advantage of being able to collect data with regard to pregnancy substance use contemporaneously, rather than relying on retrospective report, which becomes less accurate with the increase in the distance in time from the occurrence of the event. First, a study conducted by van Baar and de Graaff (1994), followed 35 methadone-exposed children and 35 randomly-selected, comparison children from birth until age 5½ years in the Netherlands. A number of standardised intelligence and language tests were administered. Two measures of social risk: maternal education and changes in family circumstances were also collected. They found that methadone-exposed children had lower scores on all measures of intelligence. When comparing those methadone-exposed children in foster care, with

those who remained with their natural parents, fostered children fared as well as comparison children at 5½ years on measures of intelligence and significantly better than those living with biological, drug-dependent parents. Nevertheless, in this study, the group numbers were small and sample attrition was high, with almost a third of the methadone-exposed group lost to follow-up by 5½ years. In addition, more than half of the 22 methadone-exposed children remaining in the study were in foster care.

Second, Hans and Jeremy (2001) compared the development of 33 methadone-exposed and 45 non-exposed infants at age 2 years. All mothers were African American women from low-income families in inner-city Chicago. Children were seen five times for assessment by age 2 years. The BSID (Bayley, 1969) was the primary measure of outcome. Socio-environmental risk was calculated by summing an extensive range of measures, including mother-child observation and maternal mental health. The authors found that the methadone-exposed infants had lower scores on the BSID Mental Development Index (MDI), though differences between the two groups were not large and mean scores for both groups were within the normal range. Both groups evidenced a steady decline in cognitive and motor performance during the second year of life. Analyses of covariance revealed that methadone exposure was no longer significantly associated with MDI scores once socio-environmental risk was taken into account. Sample attrition from birth to 2 years was 30% in the methadone group and 8.5% in the comparison group.

As part of the large U.S. Maternal Lifestyles Study, a group of 50 opiate-exposed children was recruited, as well as a larger group of children exposed to

cocaine ($n=474$). These two groups were compared separately to two matched comparison groups (Messinger, Bauer, Das, Seifer, Lester, LaGasse et al., 2004). The non-opiate-exposed comparison group included children who were exposed to cocaine. Study children were assessed using the BSID-version II (Bayley, 1993) at ages 1, 2, and 3 years. Opiate-exposed children scored as well as non-opiate-exposed children on the MDI of the BSID-II. Eighty eight percent of participants were seen at least once for follow-up.

From 1979 to 1984, Hunt, Tzioumi, Collins and Jeffery (2008) studied 133 women enrolled in methadone maintenance treatment and their infants, and a comparison group consisting of 103 infants. Children were born in New South Wales and comparison group mothers were matched for age, height, ethnicity and previous obstetric history. Developmental outcome was measured at 18 months and 3 years using the BSID and the Stanford Binet Intelligence Scale (Thorndike, Hagen, & Sattler, 1986). The methadone-exposed children showed significantly poorer cognitive ability at 18 months and 3 years compared with the comparison group. Further, 25% of methadone-exposed children were in permanent foster care at 3 years. At this 3-year follow-up, the authors saw 50% of the original methadone-exposed group and 43% of the comparison group children. This high sample attrition, together with minimal control for confounders, raises serious questions about the generalisability of these results.

An examination of existing retrospective and prospective research assessing the early cognitive development of methadone- or opiate-exposed children suggests this group performs significantly less well than children raised in less adverse

environments, but in comparison to similarly-disadvantaged children there are fewer differences. There is some evidence from the research by Ornoy et al, that attentional differences might have some effect on cognitive skills. However, methodological issues including particular problems with participant retention, make drawing firm conclusions difficult.

Language and Communication Outcomes.

Studies of children exposed to methadone

A number of studies have reported the difficulties that young, methadone-exposed children may have with language and communication. Three of the studies mentioned above, noted language and communication difficulties in their cohorts. Steinhausen et al (2007) reported a lower mean verbal IQ score amongst older opiate-exposed children. Similarly, Van Baar and de Graaff (1994) report that their study group had language and communication problems, which became apparent at 18-24 months of age. Hunt et al (2008) also found lower scores on measures of language amongst the methadone-exposed children. There is a paucity of studies however, that employ a fine-grain analysis of the development of communication skills in methadone-exposed children. In contrast however, there are a greater number of studies that have investigated language outcomes in cocaine-exposed infants, which may be relevant to this discussion.

Studies of children exposed to cocaine

Three prospective, longitudinal studies have examined language development in cocaine-exposed children. A study of 189 cocaine-exposed children and 185 non-exposed, comparison children examined language outcomes at ages 12 months (Singer, Siegel, Lewis, Hawkins, Yamashita, & Baley, 2001), 4 years (Lewis, Singer, Short, Minnes, Arendt, Weishampel et al., 2004) and 6 years (Lewis, Kirchner, Short, Minnes, Weishampel, Satayathum et al., 2007). Participant retention was good. The mothers of both groups of children were primarily African American, urban, single and on low incomes. Pregnancy and infant clinical data was gathered at term from hospital records. A number of measures were used to assess family socio-demographic background and maternal ability including: assessment at 12 months using the Pre-school Language Scale-3 (Zimmerman, Steiner, & Pond, 1992). Results indicated that children who were heavily exposed to cocaine showed poorer auditory comprehension than non-cocaine-exposed children and lower total language scores than infants with lighter or no exposure.

Differences on measures of language development between cocaine-exposed children and comparison children were maintained at follow-up after controlling for confounding factors. Environmental effects were also observed as children in the cocaine-exposed group who had moved to foster or adoptive families showed significantly improved scores, relative to those who stayed with their biological parents.

Similarly, reports from the Miami Prenatal Cocaine Study (Bandstra, Morrow, Vogel, Fifer, Ofir, Dausa et al., 2002; Bandstra, Vogel, Morrow, Xue, & Anthony, 2004; Morrow, Bandstra, Anthony, Ofir, Xue, & Reyes, 2003) and another from Boston (Beeghly, Martin, Rose-Jacobs, Cabral, Heeren, Augustyn et al., 2006) examined language outcomes in cocaine-exposed children. Both studies reported some effects of prenatal cocaine exposure on language development. However, Beeghly et al. (2006) noted that the findings were 'complex'. Significant results emerged in relation to cocaine-exposed children having lower receptive language scores at age 6, but not at age 9½ years, as well as having poorer expressive language, if they had lower birth weight, and having poorer expressive and total language, if they were female. This suggests that the effects of prenatal cocaine exposure interact with other factors to protect some children and place others at greater risk of delayed language.

In summary, existing research seems to indicate some subtle effects of prenatal cocaine exposure on language development. Lester, LaGasse and Seifer (1998) suggest that language might be a developmental domain worthy of closer examination. With regard to the effects of methadone exposure, detailed, recent research on this area of development is lacking. However, children's language performance is variable during toddlerhood. At age 2 years, children typically understand a mean of 312 words with a standard deviation of 175 words, so measures of language used at age 2 have a high degree of imprecision and lack predictive validity (Crais, 2007). As a consequence, achieving a meaningful measure of language for toddlers is not straightforward.

The Role of Joint Attention

Studies of early language and cognitive development in methadone-exposed infants have yet to identify key developmental difficulties, which may contribute long-term negative educational, behavioural and social outcomes. The important role of joint attention in infant development has been highlighted by a number of authors (Bruner, 1981; Carpendale & Lewis, 2006; Carpenter, Nagell, & Tomasello, 1998; Newson & Newson, 1975), but has not been examined in children born to mothers engaged in methadone maintenance treatment. Joint attention refers to children's ability to co-ordinate interest in an object with attention to another individual. By around age 12 months, children typically develop joint attention skills, which herald a new level of sophistication in their ability to express interests and requests in a social context. Joint attention requires of infants, an integration of early executive function, social motivation and socio-cognitive processes. Joint attention skills are implicated in developing social competence, language and cognition, and conversely, failure to develop appropriate joint attention skills may play a part in increased risk of early psychopathology (Mundy & Sigman, 2006). Thus, joint attention, because of its central role in linking social, cognitive and language processes, has been selected as a particular focus for this thesis.

Studies in the field have employed a wide range of definitions of joint attention. This thesis will use the description developed by Mundy et al (1996), who described two categories of child-initiated, joint attention communications. The first of these is when the child communicates with an adult to share interest in an object. The second category is when the child communicates with an adult to request an object.

They propose that the first of these behaviours is largely affective in quality, as the child shares his or her feelings about something with another, whilst secondly, requesting behaviours are seen as more instrumental and goal-directed (Mundy, Block, Delgado, Pomares, Vaughan Van Hecke, & Parlade, 2007; Mundy & Newell, 2007; Vaughan Van Hecke, Mundy, Acra, Delgado, Parlade, Neal et al., 2007). This model of early social communication parallels the description proposed earlier by Bruner (1981) and also Bates (1976) who used the nomenclature, 'protodeclarative' (affect-sharing) and 'protoimperative' (requesting) acts. Mundy et al (1996) have developed an assessment tool, The Early Social Communication Scales (ESCS), to assess joint attention behaviours in young children. In this measure communications, which initiate the sharing of interest in an object, are termed 'Initiating joint attention' behaviours and communications, which initiate a request, are termed 'Initiating behavioural request' behaviours. These two behaviours are outcome variables of interest in the current study.

Currently there is no published research which measures the relationship between joint attention skills and being born to a mother engaged in methadone maintenance treatment. However, Sheinkopf, Mundy, Claussen and Willoughby (2004) measured joint attention skills in 30 children, prenatally exposed to cocaine at ages 12, 15, and 18 months using the ESCS. They found that initiating joint attention behaviours and requesting behaviours made independent contributions to the prediction of disruptive behaviour when assessed at 36 months. Children, who used more early initiating joint attention behaviours, were later less frequently rated as disruptive by teachers at 36 months, but children who used more requesting behaviours

were more frequently rated by teachers as disruptive. Good initiating joint attention skills, or affect-sharing skills were associated with behaviours that teachers deemed prosocial, whereas requesting behaviours seemed to be associated with behaviour that teachers saw as demanding and disruptive. Cognition and language skills did not mediate the relationship with behavioural outcomes in this study. Similarly, a study by Flanagan, Coppola Riggs and Alario (1994) of 13 teenage mothers and their infants age 9-11 months found that nearly 70% of child-initiated, mother-directed communicative acts involved requesting or demanding objects, or protesting. Again, there was no comparison group. However, this finding adds some weight to the suggestion that children in more at-risk, care-giving environments may have a different profile of joint attention behaviours to other children. Mundy and Acra (2006) suggest that an attenuation in initiating joint attention scores may be indicative of developmental risk and furthermore that initiating joint attention behaviours may be most closely associated with social-motivational and affective development in infancy (Kasari, Sigman, Mundy, & Yirmiya, 1990; Mundy, Kasari, & Sigman, 1992; Vaughan, Mundy, Block, Burnette, Delgado, Gomez et al., 2003; Venezia, Messinger, Thorp, & Mundy, 2004).

From the research investigating children with learning difficulties, it has been demonstrated that certain individual child factors are associated with the development of joint attention skills. Sigman and Ruskin (1999) showed that children with autistic spectrum disorder had clear deficits in their use of affect-sharing joint attention behaviours. They also used fewer requesting behaviours, but the difference was less marked. Furthermore, Paul and Shiffer (1991) examined the communicative bids of 22

children at age 24-34 months and found that children, who were late to talk, also initiated fewer affect-sharing communicative bids. They hypothesised that children with delayed language used communication more frequently for instrumental, i.e. requesting purposes, rather than affect-sharing purposes. Moore and d' Entremont (2001) found that whilst there was an association between measures of general cognitive development and joint attention skills, cognitive development alone did not explain all the variance. Therefore, increasing cognitive ability does not seem to be the only explanation for advancing joint attention skills (Mundy, Block, Delgado, Pomares, Vaughan Van Hecke, & Parlade, 2007).

Summary

On the basis of the study findings above, it would appear that the joint attention skills in children born to mothers engaged in methadone maintenance treatment may further illuminate the relationship between social and cognitive domains of development, and between biological and environmental influences. Research studies which have investigated differences in the profiles of joint attention behaviours of at risk and typically-developing children, suggest that the propensity of methadone-exposed children may be to use less frequent initiating joint attention or affect-sharing behaviours. On the other hand, the use of more requesting behaviours by methadone-exposed children may be observed. When measured alongside cognitive and language skills, this data may clarify the extent to which these processes covary in this at risk group.

Research Challenges and Limitations

Thus far, drawing firm conclusions about the important pathways of influence in the development of children born to mothers engaged in methadone maintenance treatment continues to be problematic. No clear trend has emerged from the last 20 years of research. The inclusion in this study of a measure of joint attention will begin to address one aspect of these limitations, by broadening the focus of research beyond cognitive and language development as separate processes. Investigating joint attention may assist in determining the way in which children use social communication to share affect and achieve their goals – skills which in turn contribute to extending their linguistic and cognitive competence. Joint attention can be seen as both the end point of an initial phase in social development, which is largely dyadic and intimate, occurring between the infant and its parent; but also the beginning point of a more complex stage, when children begin to integrate their existing close relationships with other aspects of the outside world (Carpenter, et al., 1998).

Standardised tests

However, there are other aspects of research to date, which have limited the conclusions that can be drawn about the effects of methadone-exposure on infant development. First, some have suggested that a reliance on standardised tests in this field, for example the BSID (Bayley;1969, 1993) has not been altogether helpful. Jacobson and Jacobson (1996) and Morrison, Cerles, Montaini-Klov Dahl and Skowron (2000) pointed out that, whilst standardised tests may have good psychometric properties allowing for robust comparisons between groups, results also lack clarity in

pointing to the nature of any early difficulties. Outcomes, which suggest a delayed level of general ability, may in fact reflect a problem in one or more domains of development, which is not apparent based on measures of global ability. Furthermore others, including Alessandri, Bendersky and Lewis (1998) and Metosky and Vondra (1995) have hypothesised that the difficulties experienced by children prenatally exposed to drugs may lie in a lack of self-regulatory ability, which is masked by the structured nature of standardised tests, suggesting that children may manage better in a formal assessment situation than they might in the real world.

Poly-drug Use

Second, reliance on maternal, retrospective accounts of pregnancy substance use (Burns, et al., 1996; Ornoy, et al., 2001; Steinhausen, et al., 2007) has introduced potential for significant inaccuracy in an area, which is central to the validity of studies in this field. Prospective, longitudinal studies are methodologically superior, particularly with regard to maternal recall of additional and illicit drug use. Whilst clinical records of methadone dose may be available post-natally, poly-drug use is common and many methadone-exposed infants may be exposed to combinations of alcohol, nicotine and cannabis, if not other illicit drugs (Frank, Augustyn, Knight, Pell, & Zuckerman, 2001). The accuracy of records based on recollections of substances used, may be additionally compromised in either retrospective or prospective studies, because of the women's reluctance to be open about other drugs used, in light of the perceived social stigma. Researchers in the field need to be as clear as possible, about the other drugs to which infants may be exposed. Lester, ElSohly, Wright, Smeriglio, Verter, Bauer et al., (2001) note that maternal self-report of other drug use is notably

inaccurate and urine toxicology is a more reliable method of determining use. Improved testing for biological markers using infant meconium has more recently allowed researchers to estimate other substance exposure more accurately (Araujo, McCune, & Feibus, 2008; Williamson, Jackson, Skeoch, Azzim, & Anderson, 2006).

Furthermore, whilst some inferences may be extrapolated from research which has examined the effects of drugs other than methadone, it cannot be assumed that different, or even chemically similar, drugs will have the same effect on infants. Bunikowski, Grimmer, Heiser, Metze, Schafer and Obladen (1998) and Ziegler, Poustka, von Loewenich and Englert (2000), for example, noted that there were differences between infants exposed to uncontrolled opiates and those exposed to methadone, even though both drugs are opioid. Such is the complexity of this field that these differences may or may not be attributable to the drug itself or indeed, other environmental factors – a question, which is further examined below.

Methadone Dose

Contemporary prescribing practice has changed so that early studies generally were reporting on lower levels of methadone exposure. This makes it difficult to compare recent research with earlier research. Some studies report mean doses for participating pregnant, methadone-maintained women (Bier, Ferguson, Grenon, Mullane, Oliver, & Coyle, 1999; Hans & Jeremy, 2001), but some do not (Bunikowski, et al., 1998; Hunt, et al., 2008). Clearly, the reporting of dose information is critical to the interpretation of results. Teratogenic consequences for

infants may be imperceptible at low levels of exposure, but not at increased doses (Jacobson & Jacobson, 2005).

Environmental risk

One of the most significant challenges to research in this field is the ability of studies to attribute causal effects to the teratogen itself, rather than the multiplicity of potential health and socio-environmental confounders. It is important that the measurement of possible confounders is both reliable and valid. As Jacobson and Jacobson (2005) have pointed out, unreliable measurement of exposure will increase the risk of failure to detect an effect (Type II error) and inadequate measurement of a potential confounder will increase the risk of erroneously attributing an observed effect to the exposure (Type I error). The measurement of potential confounders in the studies reviewed above varies widely from the comprehensive and complex (Hans & Jeremy, 2001; Messinger, et al., 2004), to the more rudimentary (Hunt, et al., 2008; Steinhausen, et al., 2007; van Baar & de Graaff, 1994). Van Baar and de Graaff use, for example, only three measures of socio-environmental context – family composition, family stability and maternal education; compared to Hans and Jeremy, for example, who used nine measures of socio-environmental risk, including observed mother-child communication. The numbers of participants in foster or adoptive care is an example of a covariate which occurs perhaps unusually frequently in this population of children. Some studies (Bunikowski, et al., 1998; Hunt, et al., 2008; van Baar & de Graaff, 1994) have reported high numbers of methadone-exposed children living with alternative caregivers and this may well have a significant effect on the caregiving

environment and as a consequence, outcome. Thus, covariates need to be appropriately measured.

Glantz and Chambers (2006) have noted however, that there are some methodological issues in this field of study for which there are no, “absolute solutions”. These revolve around the choice of an appropriate analysis of confounders. Some research studies have controlled for confounding variables, which have included birth weight and some environmental risks, when these may alternatively be seen as mechanisms through which the prenatal exposure has an indirect effect. The process of statistically controlling for these variables then obscures the identification of possibly significant contributory factors, as Glantz and Chambers noted, “even the most sophisticated and carefully conducted research...is limited by pragmatic and analytic restrictions” (pg 911).

Furthermore, Haggerty et al (2008) and Kaltenbach (1996) have described another common problem for research in this area, that of high attrition rates in the longitudinal follow up of this population. Of the studies noted above, significant losses in participants over the course of the study have sometimes occurred (Bunikowski, et al., 1998; Hans & Jeremy, 2001; van Baar & de Graaff, 1994). It is probable that the most dysfunctional families would be more likely to be lost to follow-up, and therefore results which do not include the most challenged families may underestimate the severity of the difficulties. A further problem of some studies in this field is the absence altogether of a comparison group (Hunt, et al., 2008; Sheinkopf, et al., 2004; Steinhausen, et al., 2007).

Use of 'masked' assessors

The use of 'blind' or masked assessors is also an important issue. Some studies have not reported the extent to which assessors are blind to group status (Hunt, et al., 2008; van Baar & de Graaff, 1994). Examiner bias may distort assessment of developmental outcome in children known to be drug-exposed. Woods, Eyler, Conlon, Behnke and Wobie (1998) showed that assessors who observed babies labeled as exposed to cocaine rated them more negatively than infants who had not been similarly labeled.

Conclusions

Thus for a number of reasons, existing research, which examines the early development of children born to mothers maintained on methadone in pregnancy, remains inconclusive. Marked developmental delay in comparison to other disadvantaged toddlers does not seem to be evident. However, it may be that early subtle differences exist, which might have on-going negative consequences for continuing development in this group of children. The aim of this study is to extend current knowledge of early cognitive and social communicative development in toddlers born to mothers engaged in methadone maintenance treatment and identify the key pathways of influence on children's progress.

CHAPTER 2: DEVELOPMENTAL PROCESSES

Chapter 1 has described the evidence regarding the cognitive and social communicative development of toddlers born to mothers engaged in methadone maintenance treatment. It would appear that this group of toddlers show some signs of developmental delay, but this is perhaps not as marked as might have been supposed. As noted earlier, a body of evidence nevertheless suggests that by the time children of methadone-maintained or opiate-dependent parents reach adolescence, significant problems in a number of developmental domains are apparent. However, a clear understanding as to the influences, which shape the long-term outcome for this group, is lacking. The challenge for this field of study is not *whether* children are affected by maternal drug use, but *how* and *why* (Goodman & Gotlib, 1999).

Vulnerability to risk may be the result of either individual and clinical factors associated with being born to a mother engaged in methadone maintenance treatment, or the result of the family background and caregiving context in which children are raised. Indeed, often these children are exposed to multiple risks, both individual and contextual – the ‘double jeopardy’ referred to in Chapter 1. An understanding of the interplay of these risks is crucial in devising evidence-based strategies to address the negative outlook for this vulnerable group. This chapter examines the processes through which risk may be conferred to children born to mothers engaged in methadone maintenance treatment, examining first the individual and clinical factors affecting infants and then secondly, assessing the impact of social background and family environment factors for children growing up in families affected by drug dependence.

Clinical and Individual Factors

Intrauterine Effects of Methadone Exposure

It is clear that maternal consumption of some substances in pregnancy can have negative effects on foetal development. As described above (page 1-6), methadone has an immediate biological effect on infant physiology at term, which results in neonatal abstinence syndrome. However, despite the research which has examined developmental outcome in children born to mothers engaged in methadone maintenance treatment, a lasting, direct teratogenic effect of methadone on the foetal brain, has not yet been identified. Nevertheless, in order to investigate the direct effects of methadone on infant development, research in this field must also examine other pathways of influence. These may occur – in addition to, or instead of – any direct biological effect of methadone.

First, it is possible that methadone has an *indirect*, biological effect, by increasing risk for low birth weight and/or prematurity. Some evidence has supported this hypothesis. For example, a study by McCarthy, Leamon, Stenson and Biles (2008) of 57 infants of mothers engaged in methadone maintenance treatment reported that 39% of children were born premature (<37 weeks' gestation) and there was a 35% incidence of low birth weight (<2500g). Similarly, in a study of 450 births to Scottish women engaged in methadone maintenance treatment, Dryden, Young, Hepburn and Mactier (2009) reported that the median gestational age was 38 weeks, with 20% of infants born <37 weeks gestational age. Twenty three percent of infants weighed less than the ninth centile and 7% weighed less than the second

centile. Wouldes & Woodward (2010) also reported that 32 Auckland children, born to mothers engaged in methadone maintenance treatment, were significantly lighter, shorter and had smaller head circumferences than 42 randomly-selected comparison infants. Nevertheless, exposure to methadone would appear to have benefits for infants in comparison to heroin exposure. A meta-analysis of 18 studies found that the mean reduction in birth weight for infants born to mothers engaged in methadone maintenance treatment was 279g, compared to 489g for infants born to mothers using illicit heroin (Hulse, Milne, English, & Holman, 1997).

The Impact of Other Biological Risks

The early development of methadone-exposed children may be compromised by other biological factors associated with, but not caused by, methadone use. As will be seen, substance-dependent women are more likely than non-substance-dependent women, to engage in behaviours which may also be potential risk factors for the health of the infant and to take less care of themselves in pregnancy (Bauer, Shankaran, Bada, Lester, Wright, Krause-Steinrauf et al., 2002).

Other Drug Use During Pregnancy

Polydrug use and cigarette smoking in pregnancy have been found to be very common in women engaged in methadone maintenance treatment programmes (Berghella, Lim, Hill, Cherpes, Chennat, & Kaltenbach, 2003; Brown, Britton, Mahaffey, Brizendine, Hiatt, & Turnquest, 1998; Crandall, Crosby, & Carlson, 2004; Jones, Martin, Heil, Kaltenbach, Selby, Coyle et al., 2008; McCarthy, Leamon, Parr, & Anania, 2005; Svikis, Golden, Huggins, Pickens, McCaul, Velez et al., 1997).

Other substances consumed in pregnancy have also been independently associated with negative outcomes for infants, including low birth weight (Kashiwagi, Arlettaz, Lauper, Zimmermann, & Hebisch, 2005; Kennare, Heard, & Chan, 2005; Laken, McComish, & Ager, 1997; Winklbaaur, Baewert, Jagsch, Rohrmeister, Metz, Aeschbach Jachmann et al., 2009); more severe NAS symptoms (Bakstad, Sarfi, Welle-Strand, & Ravndal, 2009; Berghella, et al., 2003; Choo, Huestis, Schroeder, Shin, & Jones, 2004) and later cognitive and behavioural problems (Fried, Watkinson, & Gray, 1998; Huizink, 2009). Thus, though debate continues, these other substances – rather than, or as well as – methadone might play a causal role in the relationship between being born to a mother engaged in methadone maintenance treatment and less favourable infant outcome.

Maternal Antenatal Health and Nutrition

Furthermore, poor maternal health in pregnancy, may also contribute to negative outcomes for methadone-exposed infants. Indeed, 43% of New Zealand's frequent drug users believe that opiate use poses an "extreme health risk" (Wilkins, Girling, Sweetsur, & Butler, 2005). Kashiwagi et al (2005) noted that in their study of 89 methadone-maintained mothers in Zurich, 73% of women had health complications during pregnancy. Hepatitis, for example, is a common problem for drug-dependent women (Beeghly, et al., 2006; Carter, Robinson, Hanion, Hailwood, & Massarotto, 2001; Lejeune, et al., 2006). In addition, McCombie, Elliott, Farrow, Gruer, Morrison and Cameron (1995) found that the diet of drug-dependent women was poor. Furthermore, Oei, Abdel-Latif, Craig, Kee, Austin and Lui (2009) showed that drug-dependent women were much less likely to be engaged in ante-natal care during

pregnancy than women who were not drug users. However, pregnant women enrolled in methadone maintenance treatment programmes have been shown to be better engaged in antenatal care, than drug-dependent, pregnant women not receiving methadone (Arlettaz, Kashiwagi, Das-Kundu, Fauchere, Lang, & Bucher, 2005; Burns, Mattick, Lim, & Wallace, 2007; Jones, et al., 2008).

Genetic Pathways

Finally, it is possible that increased risk of poor outcomes for children born to mothers maintained on methadone, is conferred to children via genetic influences on development. Characteristics in the parents, which put the parents at risk of becoming drug dependent, may be inherited by their children. Hicks, Krueger, Iacono, McGue and Patrick (2004) reported that a general vulnerability to externalizing disorders, including substance dependency, was found to be highly heritable in their twin-family study. They suggested that environment may be the filter, which governs the expression of genotype, as phenotype. Lester and Padbury (2009) more recently proposed that prenatal drug exposure might act as an intrauterine stressor, altering genetic programming and contributing to risk of longer-term negative outcomes. In this way, prenatal drug exposure may also have a biological, but non-teratogenic effect on infants, changing the set-points of physiological systems.

Conclusion

Conclusive research findings are limited, but existing studies suggest that there is evidence of early biological effects of methadone exposure in the perinatal period, which result in neonatal abstinence syndrome and there are further risks

associated with the indirect effects of methadone exposure including, prematurity, low birth weight and smaller head circumference. However, there are also other possible pathways, through which biological risks may be conferred to children. Further research is required before long-term risks associated with being born to a mother maintained on methadone treatment can be attributed to the effects of methadone exposure per se.

Social Background and Family Factors

Thus, whilst the biological odds may be stacked against children born to mothers engaged in methadone maintenance treatment, few would argue that in addition, the post-natal family environments of this group of children are also disadvantaged. The next section of this thesis will examine the environmental context in which children born to mothers engaged in methadone maintenance treatment are raised. Again, some aspects of parenting have not been widely studied in women engaged in methadone maintenance treatment, so where appropriate, inferences may be drawn from research, which has involved mothers dependent on other drugs.

Social Background

The social circumstances of families affected by drug dependence are often characterised by acute socio-economic disadvantage. For example, interviews with 108 U.S. mothers engaged in methadone maintenance treatment revealed that 48% of women were single, 68% were chronically unemployed, 52% had more than 3 children, 36% had not completed high school education, 55% had a history of abuse

and 40% had at some point been in prison (Suchman, McMahon, Zhang, Mayes, & Luthar, 2006). Socio-economic disadvantage, in itself, has long been associated with negative developmental outcomes for children, including increased risk of poor academic achievement (Davie, Butler, & Goldstein, 1972), poorer preschool cognitive skills and behaviour problems (Kiernan & Huerta, 2008), language delay (Ginsborg, 2006), and motor and neurodevelopmental delay (McPhillips & Jordan-Black, 2007).

Family Factors

Furthermore, drug-dependent women appear more likely to have grown up with adversity in their families of origin. In an Australian sample of women in treatment for substance dependency, high rates of physical and sexual violence were reported. Seventy two percent of women reported violence at some point in their lives, with 37% reporting childhood sexual abuse, and 21% reporting childhood physical abuse (Swift, Copeland, & Hall, 1996). Similarly, Minnes, Singer, Humphrey-Wall and Satayathum (2008) found that around 50% of cocaine users retrospectively reported childhood abuse, with almost 60% reporting emotional neglect. Drug-abusing adults have been shown to view their own parents as less caring and more intrusive, than non-drug abusing adults (Torresani, Favaretto, & Zimmermann, 2000). Sokolowski, Hans, Bernstein and Cox (2007) showed that mothers who experienced conflict with their own mothers were more likely to maintain emotional distance from their infants and be less sensitive and more passive.

Whilst many drug-dependent women are single, for those involved in relationships, these are more frequently characterised by violence and disruption. Minnes et al (2008) reported high rates of partner violence among cocaine-abusing women, with only 40% of women reporting no or minimal violence in their current relationship. Other research suggests families of drug users are particularly socially isolated (Hogan, 1998; Johnson, Nusbaum, Bejarano, & Rosen, 1999), especially when associated with partner violence (Panchanadeswaran, El-Bassel, Gilbert, Wu, & Chang, 2008). Social isolation has been shown to have an adverse effect on parenting amongst non-addicted mothers (Webster-Stratton, 1990). Women, exposed to partner violence, are in turn more likely to report aggressive and neglectful parenting behaviour (Kelleher, Hazen, Coben, Wang, McGeehan, Kohl et al., 2008). Partners of drug-using women are often also involved in drugs themselves (Tuten, Jones, Tran, & Svikis, 2004). Furthermore, children have been shown to be at greater risk of psychiatric disorders, if they also have a substance-abusing father (Kelley & Fals-Stewart, 2004; Whitaker, Orzol, & Kahn, 2006).

Mental Health

Substance dependence is conceptualised by some, as an attempt to manage distressing emotional states through self-medication with psychoactive substances e.g. Khantzian (1997). Dependent individuals are hypothesised to be experiencing or have experienced distressing affect, which they then have difficulty regulating adaptively. In the view of Flores (2004), drug-users' problems with affect-regulation are often accompanied by difficulties with interpersonal relationships, which may stem from adverse early attachment experiences. This model would suggest that

drug-dependant adults would be at risk of difficulties in building and maintaining relationships, which as a result, would have serious, deleterious consequences for families and parenting.

Further affecting the lives of drug-dependent mothers and their families are other co-occurring mental health problems. A recent Australian study suggested that as many as 45% of drug-dependent, pregnant women may have another DSM IV diagnosis (see Abbreviations page xvi) (Oei, et al., 2009). Depression was the most commonly co-occurring diagnosis (79%), followed by anxiety disorders (20%). In this Australian study, co-morbid DSM IV diagnoses were made by a review of clinic records. However, Adamson, Todd, Sellman, Huriwai and Porter (2006) interviewed a New Zealand sample of 105 men and women in out-patient treatment for drug and alcohol dependency and found that 74% had another current affective disorder diagnosis, suggesting, more accurately perhaps, an even higher prevalence of coexisting disorders. Substance-using women have been found to be more prone to other mental health problems than men (Marsden, Gossop, Stewart, Rolfe, & Farrell, 2000; Peles, Schreiber, Naumovsky, & Adelson, 2007). Post-traumatic stress disorder was diagnosed by interview amongst 61% of 208 Australian opiate-dependent women with 93% of women reporting exposure to some form of trauma (Mills, Lynskey, Teeson, Ross, & Darke, 2005). High rates of severe psychological distress were also noted by Swift et al (1996), who found in their sample of 267 substance-dependent women, 26% had experience of self-mutilation, 44% had attempted suicide and 56% had had experienced eating disorders.

Oei et al (2009) noted that drug-dependent women with a co-morbid diagnosis of depression were at greater risk of domestic violence, serving a prison sentence, and of being homeless following discharge from maternity services, than other drug-dependent women. Maternal depression has, in itself, been associated with lower maternal sensitivity (NICHD Early Child Care Research Network, 1999). Children of depressed mothers have been found to be at greater risk of low social competence and low adaptive functioning (Luoma, Tamminen, Kaukonen, Laippala, Puura, Salmelin et al., 2001); being less cooperative and having poorer language skills (NICHD Early Child Care Research Network, 1999) and delayed cognitive development (Kiernan & Huerta, 2008).

Personality disorders have also been commonly linked with drug dependency. Ross, Teeson, Darke, Lynskey, Ali, Ritter et al (2005) reported that 62% of women entering treatment for heroin dependency met diagnostic criteria for anti-social personality disorder and 44% for borderline personality disorder. A prospective research study by Hans, Bernstein and Henson (1999) interviewed 32 methadone- or other-opiate-using mothers and 37 demographically-matched comparison women. They found no differences in prevalence of affective disorders, but large group differences in the prevalence of personality disorders. Fifty two percent of drug-dependent women met the criteria for personality disorders, compared to 8% of the comparison women. Research has suggested that adults with personality disorders have more difficulty with parenting, particularly with regard to attachment relationships (Meyer & Pilkonis, 2005) and a lack of sensitivity (Newman, Stevenson, Bergman, & Boyce, 2007). Children of parents with personality disorders are at risk of

more emotional and behavioural problems (Barnow, Spitzer, Grabe, Kessler, & Freyberger, 2006; Johnson, Cohen, Kasen, Ehrensaft, & Crawford, 2006) and being less attentive and interacting less (Newman, et al., 2007).

Conclusion

The complex and inter-related psychological morbidity of this population is clear. Taken together, socio-economic disadvantage, histories of family abuse, partner conflict, social isolation, as well as high rates of maternal mental health problems, create significant barriers to optimal child-rearing environments for the children of women engaged in methadone maintenance treatment. However, this further raises the question as to how these negative influences combine to affect the capacity of these mothers for parenting and the provision of adequate childcare.

Parenting of Mothers Engaged in Methadone Maintenance Treatment.

A considerable body of research has described the parenting of mothers who are drug-dependent, in an attempt to identify variables, which might be associated with developmental outcome in their children. An examination of factors associated with risk and resilience in these families is essential to the establishment of appropriate screening and intervention services. Considerable heterogeneity has been found in the parenting of drug-using women and thus a consideration of how the factors described above combine to increase risk for children raised in these environments is important (Suchman & Luthar, 2001). It may be that different dimensions of parenting are differentially influenced by addiction, socio-economic hardship, family violence and so on. Thus, simple conclusions about pathways of influence are hard to reach.

Research has examined the relationship between the parenting of mothers engaged in methadone maintenance treatment and child development, by specifically assessing the parenting style of this group of women. Using a self-report measure, Suchman and Luthar (2000) found mothers enrolled in methadone maintenance treatment described themselves as less involved and less interested in their children, than comparison mothers not enrolled in methadone maintenance treatment. Single, methadone-maintained women were particularly likely to report under-involvement, whereas methadone-maintained women with partners and fewer children were more likely to regard themselves over-protective and over-involved. Similarly, in a small PhD study sample, Copeland (2006) interviewed 25 mothers enrolled in methadone maintenance treatment. She found that the parenting style of mothers enrolled in methadone maintenance treatment could be more frequently characterised as under-involved, rather than authoritarian, authoritative or indulgent.

Suchman and Luthar (2001) reported a further study of parenting in 74 mothers engaged in a methadone maintenance programme. In this paper, they suggested that socio-demographic risk and psychological maladjustment act as distal stressors, increasing risk of aggression and neglect, so as mothers experience greater stress, their tolerance for everyday hassles decreases and their parenting style becomes more aggressive. Using observational methodology, Tronick, Messinger, Weinberg, Lester, LaGasse, Seifer et al (2005) examined mother-infant interaction, using the face-to-face still-face paradigm. Forty-nine opiate-exposed, 236 cocaine-exposed, and two groups of non-exposed comparison mother-infant dyads were assessed when the infants were 4 months old. In the cocaine-exposed group, mother-

infant interactions were characterised by more frequent mismatched engagement, especially amongst more heavily-exposed infants. No opiate-exposure effects were found, however.

A larger number of studies have described the parenting styles of mothers dependent on cocaine or other drugs, rather than methadone. Johnson et al (2002) examined 186 mothers and their pre-school age, cocaine-exposed children, as well as a non-exposed, infant-mother comparison group at play. They reported that mothers of cocaine-exposed children were characterised by greater intrusiveness and hostility, poorer quality instruction and lower confidence. Other research examining the parenting of mothers of cocaine- and/or other drug-exposed infants has reported low maternal responsiveness, mood and enthusiasm, (Burns, Chethik, Burns, & Clark, 1997), lower maternal attentiveness and responsiveness (Mayes, Feldman, Granger, Haynes, Bornstein, & Schottenfeld, 1997) and increased frequency of “at risk” scores on the Nursing Child Assessment Feeding Scale (Butz, Pulsifer, O'Brien, Belcher, Lears, Miller et al., 2002) amongst drug-using mothers compared to controls. On the other hand, Uhlhorn, Messinger and Bauer (2005) found no differences in maternal interaction behaviour in cocaine-using and non-cocaine-using mothers with their infants at age 18 months.

Influences on the Parenting Capacity of Mothers Enrolled in Methadone Maintenance

As noted above, considerable heterogeneity has been reported in the parenting of mothers affected by drug dependence. Two factors, which may contribute to greater risk of less optimal parenting, have been a particular focus of study – these are first, the extent to which illicit drug use continues as children grow-

up and second, the extent to which drug dependence is accompanied by other maternal mental health problems. Mothers of methadone-exposed children often continue to be engaged in methadone treatment as they raise their children. Some women will use other illicit drugs in addition to methadone. This on-going use of psychoactive substances has potential implications for parenting. From a neurological perspective, Pajulo, Suchman, Kalland and Mayes (2006) suggested that drug effects may “out-compete” the infant in the endogenous reward system, thus brain pathways that normally regulate healthy responses to the infant are ‘hijacked’ by psychotropic substances. Furthermore, Dawe, Harnett, Staiger and Dadds (2000) have noted that for those parents still using illicit substances, as well as methadone, there will continue to be times when parents are engaged in the process of procuring, withdrawing or becoming intoxicated with drugs; at which times, it will be very difficult, if not impossible, to also meet the needs of infants or small children.

The high prevalence of co-occurring mental health problems in mothers who are drug-dependent also raises questions about the effects of this combination of risk factors for women’s ability to parent adequately. Research has examined the way in which personality disorders and depression combine with drug dependence to affect parenting. Hans, Bernstein and Henson (1999) concluded that maternal psychopathology, particularly maternal personality disorder, mediated the association between parenting behaviour and maternal substance abuse in methadone-maintained women, suggesting that psychopathology was a more salient factor, than drug dependency in the link to parenting difficulties. From observations of mother-child

interactions, Hans, Bernstein and Henson noted that maternal psychopathology was related to an insensitive and unresponsive parenting style.

Child Maltreatment

Maternal drug use has also been associated with child abuse and neglect. For example, in a prospective study of over 7000 parents, Chaffin Kelleher and Hollenberg (1996) found that the onset of physical abuse or neglect reported by parents was strongly associated with substance-abuse disorders. Similarly, Ammerman, Kolko, Kirisci, Blackson and Dawes, (1999) showed that that 41% of mothers with a substance disorder scored in the clinical range on the Child Abuse Potential Inventory (Milner, 1986). Furthermore, Walsh, MacMillan and Jamieson (2003) proposed that the children of substance-dependent parents may be at twice the risk of experiencing physical or sexual abuse than other children. However, Suchman et al (2006) suggested that not all women engaged in methadone maintenance treatment were equally at risk of being found to be unable to parent adequately. Methadone-maintained mothers, who also had a history of childhood abuse and exposure to violence, were more likely to have children living in an out-of-home placement. Nair, Schuler, Black, Kettinger and Harrington (2003) suggested that an increased number of family risk factors is accompanied by a linear increase in the risk of parental abuse.

A simple relationship between drug use and child abuse is not clear. Early research by Hien and Honeyman (2000) and Hien and Miele (2003) concluded that drug-dependent mothers tended to be authoritarian and use more physical discipline. However, more recently Hien, Cohen, Caldeira, Flom, & Wasserman (2010) have

challenged the notion that substance dependence itself explains maternal abusive behaviour. Similarly to Khantzian (1997), they conceptualise drug dependence as a problem of self-regulation. Hien et al have suggested that mothers who are drug dependent have difficulty managing arousal and regulating anger. They hypothesised that these self-regulation difficulties were more predictive of child abuse potential than substance dependence itself.

However the risk of abuse and neglect to these children is understood, evidence shows that children living in families affected by drug dependence are at greater risk of disruptions in their care, partly as a result of child protection procedures, but also from increased parental morbidity, hospitalisation and more frequent incarceration of their parents (Advisory Council for the Misuse of Drugs, 2003; Whitty & O'Connor, 2007). Keller et al (2002) reported an association between the number of transitions to a new parent figure and delinquency in the children of parents enrolled in methadone maintenance treatment. In their study, 70% of children experienced at least one parent figure transition and nearly one quarter of children had no single consistent parent figure over a 2-year follow-up.

Thus, it would appear that the parenting of mothers engaged in methadone maintenance treatment may be compromised by drug dependence, as well as by other concurrent drug use and mental health problems, combining to increase parenting behaviour, which is less sensitive, poorly regulated, and which in some families exposes children to greater risk of abuse and neglect.

Transactional Processes

Whilst both biological, intrauterine risks and post-natal, contextual risks can be considered to influence child development, a third mechanism through which risks may be conferred would suggest that these factors continuously affect and are affected by each other, as part of an ongoing family system (Bronfenbrenner, 1979). An ecological model of development would suggest that children's progress is influenced via bi-directional processes, where parents and infants continuously shape the behaviour of each other. A transactional analysis of the difficulties of mother-infant dyads affected by drug dependency has been proposed by Beeghly and Tronick (1994), and Mayes (1995) and more generally by Belsky (1994), Sameroff (1975), Shonkoff and Phillips (2000). Johnson et al (1999), for example, have argued for a largely ecological understanding of drug-exposure effects on children, noting that methadone-exposed infants may well have early medical issues, which leave them difficult to care for, especially by mothers whose parenting ability is compromised in multiple domains. Goodman, Hans and Bernstein (2005) also suggested that a bi-directional model was supported by their prospective, longitudinal study of methadone-exposed infants at ages 12 and 24 months. They reported that mothers engaged in methadone maintenance treatment were less attentive to their infants, leading to avoidant behaviour in the infant, which led to the mother feeling rejected by the infant and which, by age 24 months, adversely affected maternal communication. Nevertheless, some evidence suggests that in the second year of life the prevailing influence on interactional behaviour is from parent to child (Aureli & Presaghi, 2010; Eiden, Leonard, Hoyle, & Chavez, 2004).

In conclusion, research suggests that children born to mothers engaged in methadone maintenance treatment in pregnancy are likely to be born with increased biological reactivity, as a result of prenatal methadone exposure, and then be further dysregulated by the treatment for NAS. They may also be stressed by other prenatal adversity due to poor maternal health in pregnancy. Furthermore, children born to mothers engaged in methadone maintenance treatment are also frequently exposed to postnatal risk factors, which include poverty, poor parental physical and mental health, disrupted and violent family relationships, exposure to crime, intergenerational abuse and familial dysfunction. This combination of disadvantaged circumstances may significantly undermine the ability of mother-infant dyads to form optimal relationships and maximise developmental progress.

The study, described in this PhD thesis, was conceived to answer some of the questions raised by previous research about the developmental pathways of children born to mothers maintained on methadone in pregnancy. The aim of the research design was to address some of the methodological limitations of existing studies. The specific focus of this PhD was to evaluate the effects on children's joint attention skills, cognitive and language development of being born to a mother engaged in methadone maintenance treatment at age 2 years. Further, the study's goal was to examine the relative contributions of prenatal biological effects of drug exposure and post-natal environmental factors on children's progress. The study was prospective and longitudinal. Maternal drug use information was collected contemporaneously and validated prescription records were used for the calculation of pregnancy methadone dose. A wide range of measures of socio-environmental risk were used

and key assessments and data coding were completed by assessors, who were as far as possible 'blind' to group status. A local, randomly-selected comparison group was used and participant attrition was minimised.

CHAPTER 3: AIMS AND HYPOTHESES

This Ph.D. study forms part of a larger project; the aims of which are;

1. To examine the association between being born to a mother enrolled in methadone maintenance treatment during pregnancy and measures of developmental outcome at 2 years. Specific developmental outcomes of interest include: growth, behaviours and brain development.
2. To describe the psychosocial environments in which children born to mothers enrolled in methadone maintenance treatment during pregnancy are reared.
3. To examine the way in which the effects of being born to a mother enrolled in methadone maintenance treatment during pregnancy, and post-natal psychosocial risk combine to influence child outcomes.

The specific foci for this PhD study are, as follows:

Specific Aim 1: To examine the extent to which children born to mothers enrolled in methadone maintenance treatment during pregnancy differ from a comparison group whose mothers were not enrolled in methadone maintenance treatment during pregnancy, on measures of early communication and cognitive skills. These measures included: the Mental Development Index (MDI) of the Bayley Scales of Infant Development–Version II (BSID-II) (Bayley, 1993); the Early Social Communication Scales, (ESCS) (Mundy, et al., 1996); a measure of the language items taken from the BSID II and the Communication and Symbolic Behaviour Scales-Development Profile (CSBS) (Wetherby & Prizant, 1998).

Hypothesis 1: Children born to mothers enrolled in methadone maintenance treatment will perform less well than comparison children on the MDI of the BSID-II.

Hypothesis 2: Children born to mothers enrolled in methadone maintenance treatment will be characterised by poorer social and communication skills compared to a comparison group. Specifically, it is anticipated that methadone-exposed children will show fewer “Initiating Joint Attention” behaviours and more “Initiating Behavioural Request” behaviours as measured by the ESCS; and less mature language and communication skills as measured by language items from the BSID II and parental responses to the CSBS checklist.

Specific Aim 2: To examine the extent to which any observed differences between children born to mothers enrolled in methadone maintenance treatment during pregnancy and comparison children reflected a) the direct effects of methadone-exposure and/or b) the effects of confounding factors correlated with methadone-exposure.

Hypothesis 1: Whilst the relationship between methadone-exposure and developmental outcome will be attenuated by confounding factors, methadone-exposure will nevertheless have a significant independent effect on outcome.

Specific Aim 3: To describe the care-giving context in which children born to mothers enrolled in methadone maintenance treatment and comparison children were being raised. Of particular interest were: socio-economic risk; maternal mental health and maternal report of continuing substance use; family functioning, including measures of family stress, partner deviance and family violence; child care practices,

learning opportunities and behaviour management strategies and an observation of the family environment using the HOME scale (Caldwell & Bradley, 1984).

Hypothesis 1: Children born to mothers enrolled in methadone maintenance treatment will be exposed to greater socio-economic risk, and be living in families experiencing more mental health, stress and family violence problems than comparison children.

Hypothesis 2: Children born to mothers enrolled in methadone maintenance treatment will have fewer learning opportunities and experience higher levels of physical punishment than their non-exposed peers.

Hypothesis 3: Children born to mothers enrolled in methadone maintenance treatment will be living in environments which are less child-centered and score less well on the HOME scale than comparison children.

Specific Aim 4: To examine the ways in which any effects of prenatal methadone exposure and caregiving context combine to influence children's cognitive and communication abilities.

Hypothesis 1: Children who are born to mothers enrolled in methadone maintenance treatment and are raised in adverse family environments will perform less well on measures of cognitive and language ability, i.e. the BSID and the CSBS, and show a different profile of communicative responses on the ESCS than comparison children

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

Research Design

As part of a prospective, longitudinal study examining the neurodevelopmental effects of being born to a mother maintained on methadone during pregnancy, two groups of women were recruited to the study according to criteria described below. The three data collection phases relevant to this thesis are described; term, 18 and 24 months. An overview of the complete study database for the three phases is shown in Figure 4-1. This PhD particularly focused on cognitive and communication outcomes at 24 months and its association with the caregiving environment, as measured at 18 months. In addition, the clinical and social background characteristics of the sample are also described briefly in Chapter 5. The specific contribution to data collection by the author will be described at the relevant points.

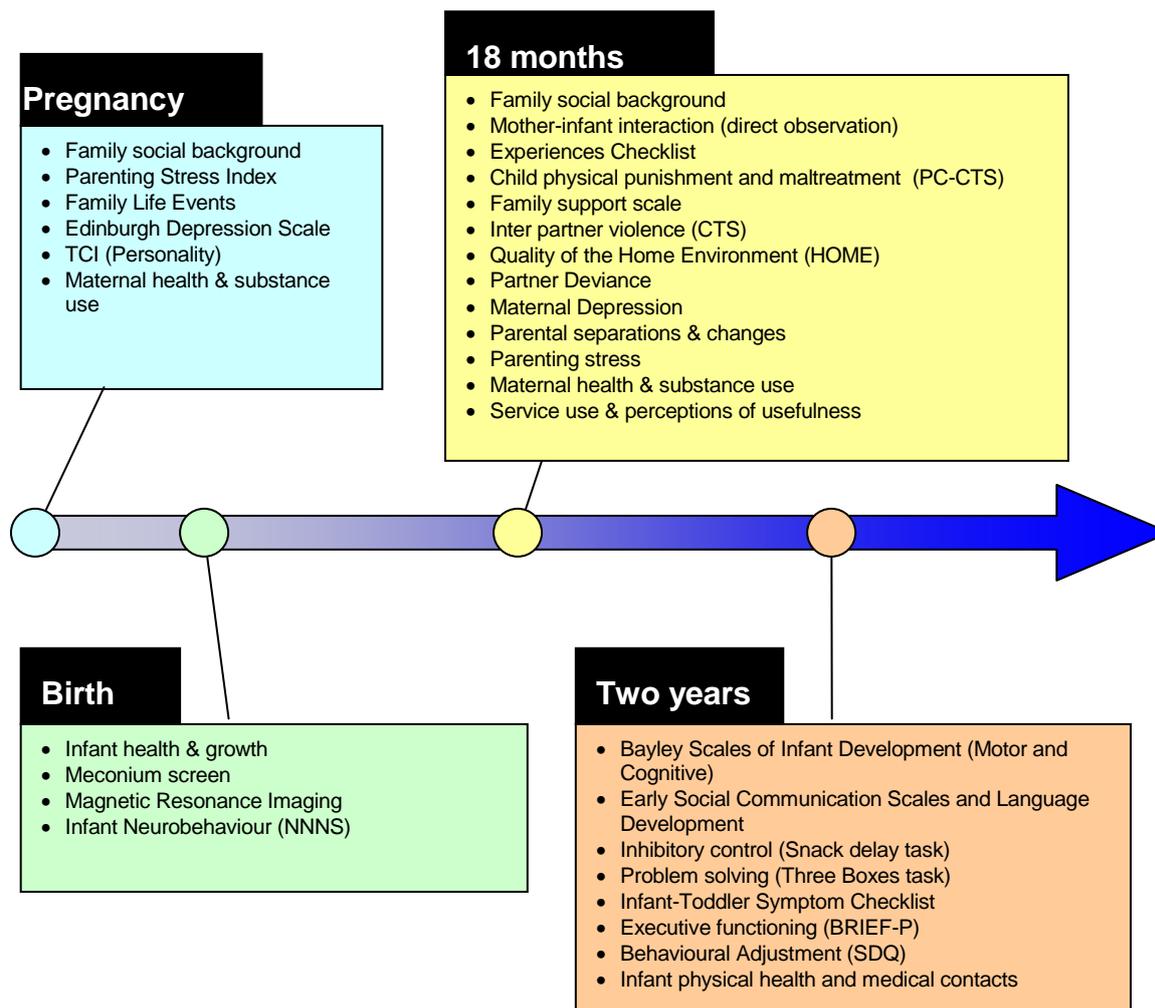


Figure 4-1: Overview of Study Database

Sample

Methadone-Maintained Women

The first group consisted of 60 pregnant women who were enrolled in methadone maintenance treatment and who were receiving methadone at the time of delivery under the supervision of the Christchurch Methadone Programme. Mothers were excluded, if they were unable to give informed consent, did not speak sufficient English to complete the interview; or lived outside the Canterbury region. Infants and their mothers were excluded from the study after delivery, if the child was born with congenital abnormalities; Foetal Alcohol Syndrome; was HIV positive, or if the child was born very preterm i.e. ≤ 32 weeks gestation.

As part of their clinical treatment, all pregnant, methadone-maintained women were required to attend a specialist ante-natal clinic at Christchurch Women's Hospital. Recruitment of women enrolled in methadone maintenance treatment to the research study was undertaken during these antenatal clinic visits. Women were recruited during their second or third trimester of pregnancy. Between December 2002 and June 2006, 87 women attended the specialist clinic; of those, 70 (80%) women met the above eligibility criteria. Of those women, 60 (84%) consented. One woman had twins, so 61 infants formed the methadone-exposed group at term age. Maternal data for the mother of the twins are included twice in the subsequent analyses. The group of infants born to mothers enrolled in methadone maintenance treatment was composed of 33 boys and 28 girls

Just over half the women (53%) were already enrolled in treatment when becoming pregnant. By the end of the first trimester, 75% of women were enrolled in the programme. Most of the remainder joined in the second trimester, with only two women enrolling in the third trimester. The mean daily methadone dose for those being treated with methadone was as follows: trimester 1, 70.5 (\pm 28.8 mg, range 29-195mg); trimester 2, 59.8 (\pm 29.8 mg, range 11.2-195mg); trimester 3, 61.5 (\pm 30.4 mg, range 12.5-195 mg).

Comparison Women

The second group consisting of 60 comparison, pregnant women, who were neither receiving methadone treatment nor using opiates from any other source, was also recruited over the same period. This group was identified at random from the hospital database of all women who were registered to give birth in Christchurch. A random number generator was used to select the women identified (see www.randomizer.org). Six to eight weeks before their estimated delivery date, all women identified as potential comparison participants were contacted first by letter and then by telephone. The same exclusion criteria were applied as for the methadone group described on page 4-51. One hundred and eighteen women were invited to participate in the project and of those, 105 were eligible. Of those eligible, 60 (57%) consented. (Issues of low recruitment rates were addressed after this by the larger study and recruitment procedures were changed. As a result, recruitment rates improved to 65% of those eligible in the total comparison group). When women agreed to participate in the study, an arrangement was made to visit and complete the first

interview. No pregnancies in this group resulted in multiple births. There were 29 boys and 31 girls in the comparison group.

To assess the extent to which this comparison group of mothers and infants was representative of the Canterbury region from which they were recruited, socio-economic status (SES) data for the group were compared with regional census data for Canterbury (Statistics New Zealand, 2006). SES categories were derived from the Elley-Irving SES Index (Elley & Irving, 2003). Scores were coded 1 (professional) to 6 (manual/unskilled). In two-parent families, the highest-rated occupation of either partner was used for analysis. The codes were then grouped for further analysis, into three bands 1-2 (professionals and managers), 3-4 (semi-skilled and trades workers), 5-6 (unskilled workers and labourers). Beneficiaries and unemployed parents were included in band 5-6. As can be seen from Figure 4-2, comparison with 2006 census data confirmed that, in terms of SES, the comparison group of women was similar to the region from which it was drawn.

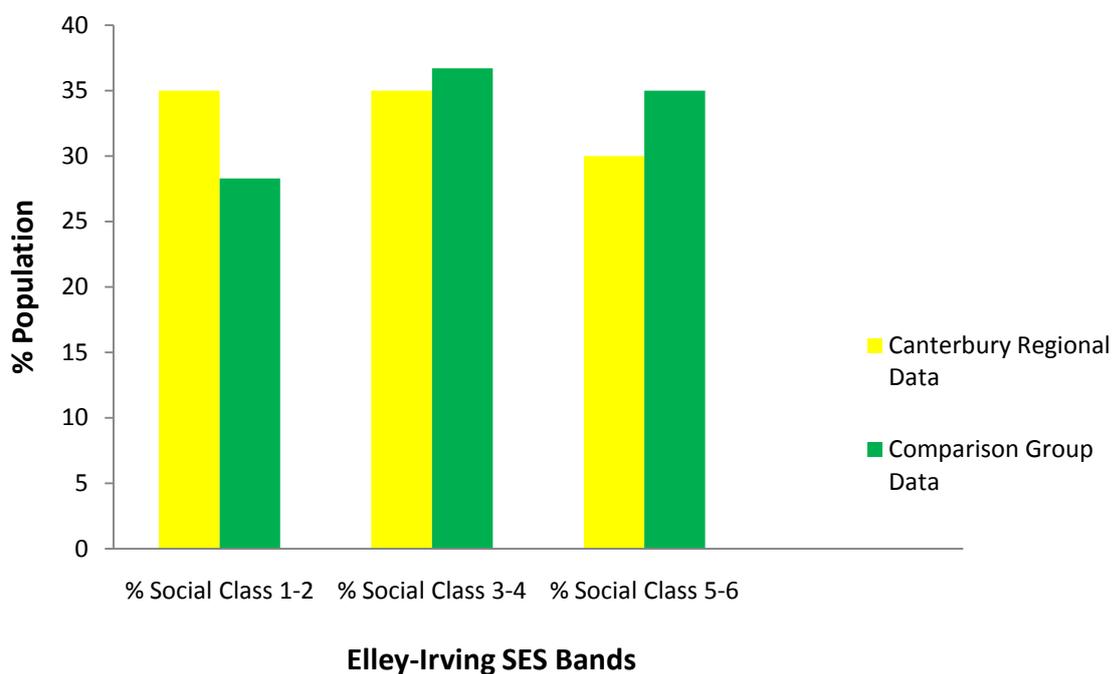


Figure 4-2: Socioeconomic Status Data of the Comparison Group compared with Canterbury Regional Socioeconomic Status Census Data

These 120 women formed a sub-group of a larger study sample of over 200 mother-infant dyads, which was recruited over six years, from 2002 to 2008. Because of this extended recruitment period, it was not possible to include all 200 participants in this PhD study. The recruitment process and the numbers of children and their mothers involved at each stage of the study is depicted in the consort statement figure in Appendix A.

Ethical Approval

Ethical approval for the developmental follow-up was obtained from the Canterbury Ethics Committee (Ref. no: CTB/04/07112) and informed, written consent was obtained from all participants (see Appendix B).

Data Collection Phase 1: Term

Procedure

After consenting to participate in the study as described above, all 120 women completed a term-phase interview. This was usually carried out shortly before the birth of the infant and took around 45-60 minutes. Women enrolled in methadone maintenance treatment were interviewed by a research nurse and comparison women were interviewed by a post-graduate psychology student. The author recruited and interviewed 28 women at term in this comparison group. Women enrolled in methadone maintenance treatment were usually interviewed in hospital, whilst attending an ante-natal clinic. Comparison women were usually seen at home. Women were interviewed alone and confidentiality was guaranteed.

Measures

Infant Clinical Data

Infant clinical data were gathered from hospital records for the 121 children in the sample. Measures included in this analysis were as follows; gender, gestational

age, weight, head circumference, number of days in hospital, any drug intervention required for neonatal abstinence syndrome and number of days of drug treatment.

Social Background and Family Characteristics

Social background data were gathered in the third trimester by means of maternal interview. Measures included in this analysis were as follows:-

Maternal age. The mother's age was entered as a continuous variable.

Maternal ethnicity. The mother's ethnicity was entered as Māori (1), NZ or other European (2), Pacific Islander (3) or Asian or African (4).

Partner status. Women were asked about their status as married or cohabiting (1) or single or having a partner, but not cohabiting (2).

Number of children. Women were asked about the number and ages of biological children they had, the number of those children in their custody, and the number of other resident children.

Educational attainment. Levels of maternal academic attainment were classified into 6 bands: leaving school with no qualifications, i.e. not passing school certificate or NCEA Level 1 at 16 years (1); having left school with a school certificate pass or NCEA Level 1 (2); having further secondary education (3); having secretarial or trades qualification (4); having professional qualifications (5); having a university degree or higher (6).

Socio-economic status. Women were asked if they were working, unemployed or full-time parents. If employed, they were asked about their occupation. The same questions were asked about cohabiting partners. Family SES was coded using the Elley-Irving scheme described in the section beginning on page 4-52.

Home ownership. Women were asked whether they were home owners (1) or in rented accommodation (2).

Maternal Mental Health

Details were acquired through interview of women's current mental health. Treatment for any mental health problem other than drug dependence was noted and coded as receiving (1) or not receiving psychiatric care (0). Details of any prescribed, psychoactive medication were recorded and classified as anti-depressant, anti-psychotic, anti-convulsant and/or benzodiazepine drug treatment. Hospital records were used to cross-check maternal reported mental health and prescription drug data.

Edinburgh Depression Scale.

The Edinburgh Depression Scale (EDS) was used during the interview to assess depression at age 18 months and at term. The Edinburgh Postnatal Depression Scale was developed as a screening tool to identify depression in new mothers in primary care settings (Cox, Holden, & Sagovsky, 1987). Cox, Chapman, Murray and Jones (1996) trialed the use of the EDS with non-postnatal women (i.e., women with older children) and concluded that the EDS was a useful general measure of depression.

The EDS is a 10-item questionnaire (see Appendix C). Statements include, ‘I have been able to laugh and see the funny side of things’ and ‘I have felt sad or miserable’. Statements were rated by participants on a 4-point scale and recoded into the following: often (0); sometimes (1); hardly ever (2); never (3). Participants were asked to complete the scale themselves with pen and paper, unless reading was a problem. In scoring, some item scores were reversed and then all were summed to give a full-scale score. A cut-off score for depression of ≥ 13 has been used for this PhD study, recognising that it is relatively conservative and that some cases of depression may be missed (Cox et al., 1996). Mean EDS scores, as well as the proportion of parents in each group who scored positive for depression were calculated (depressed=1, not depressed=0).

The EDS has been found to be an acceptable measurement tool by users and quick to complete (Murray & Cox, 1990). Cox et al (1996) reported that the measure had satisfactory sensitivity (79%) and specificity (85%) when using a cut-off score of ≥ 13 . The scale has been widely used internationally, including with substance-dependent women (Homish, Cornelius, Richardson, & Day, 2004; Pajulo, Savonlahti, Sourander, Ahlqvist, Helenius, & Piha, 2001) and post-natal men (Matthey, 2008; Matthey, Barnett, Kavanagh, & Howie, 2001)

Maternal Licit and Illicit Substance Use in Pregnancy

A detailed account was taken during the maternal interview of substance use in pregnancy, specifically including, licit substances – alcohol and cigarettes; and illicit substances – cannabis, opiates, benzodiazepines, and stimulants. Women were asked how often they used each substance per day (cigarettes) or per week (all other

substances). The measure is shown in Appendix D. Maternal mean use and any use of each substance were calculated for the pregnancy. Confidentiality was assured, so that the participants were able to report on additional substance use without the clinical implications of disclosure becoming a concern.

Data Collection Phase 2: 18-Month Data

As outlined above, 61 children born to mothers enrolled in methadone maintenance treatment and 60 comparison-group children had been recruited at term and formed the study sample for the 18-month follow-up phase of this study, involving home visit and interview. One child in the methadone-exposed group died before 18 months of age. Thus, the population re-recruited for this PhD study consisted of 60 methadone-exposed children and 60 comparison children and their 120 caregivers.

Following the initial investigations at term age, parents of children in the sample were re-contacted when their child was approaching age 18 months and were asked to participate in a follow-up phase of the study. Initial attempts were made to contact mothers enrolled in methadone maintenance treatment by the research nurse, who had recruited women in pregnancy. When successful, this contact was followed up with a phone call from the author, who made arrangements to visit and complete the 18-month interview. If not successful, the author and/or research nurse made visits to the families at home. Comparison group women were re-contacted by phone by the author and arrangements to visit were made directly with them.

In the course of re-contacting families for this follow-up phase of the study, it was established that eleven infants born to mothers enrolled in methadone maintenance

treatment were no longer being looked after by their biological parents; of those nine were with Child Youth and Family (CYF)-appointed caregivers and two were living with a relative through an informal arrangement. (CYF is the government agency charged with responsibility for child protection services.) To gain access to the children in CYF care, social workers were first contacted for permission and then foster parents were approached.

For all families, consent and arrangements to visit were made in person or by phone with written confirmation sent by post. In the 24 hours before the visit, the author sent further text messages or made phone calls as a reminder. Visits frequently had to be re-arranged. Excluding deaths ($n=1$), 100% of the study sample were successfully followed up at age 18 months. All 120 visits were arranged and completed by the author.

The goal was to complete this part of the follow-up, when the child was between 18 and 20 months. The mean age of the children at the 18-month home visit was 20 months 3 days (± 1 month 1 day, range 18-24 months). The mean age of the methadone-exposed group was 20 months 9 days (± 1 month 1 day) and the comparison group was age 19 months 3 weeks (± 1 month 13 days). There was no significant difference between the two groups ($p=.15$). It was considered acceptable to complete the 18-month phase of the study within a broader time-frame, than the 2-year child developmental assessment since this was largely time-insensitive. One parent in the comparison group, who was not a fluent English speaker, did not complete a number of measures from the interview, due to lack of time. One measure

was also omitted from the interview of two mothers enrolled in methadone maintenance treatment, due to pressure of time.

Some children were no longer living in the Canterbury area. Where families travelled to Christchurch for follow-up from overseas or other parts of New Zealand, the 18-month interview was carried out either in the home of a relative (7 interviews) or at the University (2 interviews). If significant travelling was required, sometimes the 18-month home visit and the 2-year assessment were combined and were completed when the children reached 2 years. This was the case for 5 study families. Of the 120 primary caregivers interviewed, 107 were biological mothers, 2 were biological fathers, and 11 were foster mothers or other relatives.

During the home visit, an interview with the primary caregiver was completed and a video recording was made of parent/child interaction (though not used for analysis here). The visit usually took around 1½ hours to complete. After the interview, the Home Observation for Measurement of the Environment (HOME) (Caldwell & Bradley, 1984) was completed. This measure is described on 4-69. Given the nature of the interview, it was not possible for the author to be blind to group status. However, the author was blind to details of infant clinical history and maternal methadone dose during pregnancy. The interview was used to collect data on family, infant and parental issues. Families were given a \$10 voucher to thank them for their participation in this phase of the study. Detail of the measures used follows.

Measures

Social Background and Family Circumstances

A description of the child's current family circumstances was gathered.

Child placement. Caregivers were asked whether the child was still living with both biological parents, his or her biological mother or father only, or with alternative caregivers. The status of the primary caregivers was recorded for those children in alternative care. Children were classified as living with their biological parents (1), their biological mother only (2), their biological father only (3), or in an out-of-home placement (4). These categories were then recoded into living with their biological parent/s (1) or living with alternative carers (2). Parents were also asked about the number of changes of caregiver the child had experienced: including changes of primary caregiver, as well as changes in the cohabiting partner of the primary caregiver.

Partner status. Caregivers were asked about their partnership status and coded as married or cohabiting (1) or single (2) or as living with a partner part-time (<half the week) (3).

Family size. The number of children and other adults in the house was recorded.

Parental employment status. Data regarding the employment status of the child's caregiver/s were then coded as employed (1) or unemployed (2). Parents were also asked whether the family received only income from employment, received welfare benefits in addition to paid income or was solely welfare-benefit dependant.

Housing. Parents were asked whether they were home owners (1) or in rented accommodation (2).

Parental Mental Health.

Primary caregivers completed the Edinburgh Depression Scale (EDS). This was also used in the term interview and was described on 4-57.

Substance use

Three measures of substance use were recorded.

Methadone maintenance. Biological mothers, and where appropriate primary caregivers, of children born to mothers engaged in methadone maintenance treatment were asked about their participation in methadone maintenance treatment. Answers were coded yes (1) or no (0).

Licit substance use. All primary caregivers were asked whether they engaged in any use of tobacco or alcohol. Answers were coded yes (1) or no (0).

Illicit substance use. All primary caregivers were asked about any use of a possible 12 illicit substances. Answers were coded yes (1) or no (0). From this, the total number of illicit substances used by each interviewee was calculated.

Family Functioning

Life Stress

Parents were asked about their perception of the problems involved in their lives. A scale was adapted from the Christchurch Health and Development Study

(Woodward, Fergusson, Chesney, & Horwood, 2007), which included questions about financial, relationship and parenting stressors (see Appendix D).

During the interview, parents were asked to respond to 15 problem statements, as being either, no problem (0), some problem (1) or a major problem (2). These included, 'Not having enough money for your family's needs' and 'Never having another adult to talk to'. The numbers of caregivers reporting each item as a major problem was calculated. A caregiver total life stress score was calculated by summing all items endorsed as major problem. Internal consistency was calculated using Cronbach's alpha ($r=.65$). The scale was used to measure family stress in the Christchurch Health and Development Study and was found to predict greater use of physical punishment in a New Zealand sample of young parents (Woodward, et al., 2007).

Adult Relationships

The following two measures formed part of the interview for all primary caregivers, who reported having a current, cohabiting partner, or in the case of the Revised Conflict Tactics Scale, including a partner who had left the relationship within the last 12 months. A third measure, an adaptation of the Revised Conflict Tactics Scale, was used to assess parents' exposure to conflict and violence from other adults in their lives, in addition to partners.

Partner Deviance Scale.

The Partner Deviance Scale was adapted from the Christchurch Health and Development Study (Woodward, Fergusson, & Horwood, 2002). It is a descriptive

tool, which assesses the degree to which the interviewee's current partner is involved in anti-social behaviour (see Appendix E). It is a 16-item scale, which asks about the partner's substance use, criminal and aggressive behaviour. It is answered on a three-point Likert scale ranging from, doesn't apply (0); applies somewhat (1); definitely applies (2). A total scale score was created by adding the scores for all items. Internal consistency was calculated using Cronbach's alpha ($r=.63$). Woodward, Fergusson and Horwood (2002) used this scale to assess partner behaviour amongst young adults. They reported that this measure predicted risk of offending in individuals with partners who engaged in anti-social and substance-abusing behaviour.

The Revised Conflict Tactics Scale.

The Revised Conflict Tactics Scale (CTS-2) (Straus, Hamby, Boney-McCoy, & Sugarman, 1996) was used to assess the extent of aggression and violence in the relationships of study parents and their partners (see Appendix F). For this study, the scale was administered from the perspective of the interviewee as a victim of aggressive behaviours from her/his partner. Participants were asked about the frequency with which they had experienced conflict on the following scale: never (0); once (1); twice (2); 3-5 times (3); 6-10 times (4); 11-20 times (5); more than twenty times (6) over the previous 12 months. Two subscales were used for this analysis to assess the extent of partner-perpetrated psychological aggression (n=8 items) and violence (n=12 items). Some items (n=2) in the CTS-2 sexual coercion scale were retained for this interview and summed with the violence subscale. The CTS-2 negotiation and injury subscales were not used for this analysis.

Four total scores were derived from the data; scores for (a) prevalence and (b) frequency of partner psychological aggression and then scores for (a) prevalence and (b) frequency of violence. According to test guidelines (Straus et al, 1996), prevalence scores were calculated by recoding items scored between 1 and 5, as 1 and retaining 'never' as zero, so calculating whether there had been any aggression/violence in the last year. An annual frequency score was calculated by adding the midpoints of the response categories, so scores 0, 1, and 2 remained the same, 3-5 times a year became 4, 6-10 times a year became 8, and so on. Individual item scores were summed to create total scores.

The CTS-2 is the most commonly used self-report measure of domestic violence (Vega & O'Leary, 2007). Straus et al (2007) reported internal consistency co-efficients ranging from .34 to .94 with a mean of .77. Straus suggested that coefficients were understandably low, because of the infrequent nature of some of the behaviours measured. Since the actual level of violence in a couple's relationship cannot be known, there is no clear way of testing the precision of the CTS2. Inter-rater agreement between partners has been measured and found to be low to moderate (O'Leary & Williams, 2006). However, differences in partner ratings seem likely because of social desirability and/or fear of the consequences of honesty. Vega and O'Leary (2007) reported excellent test-retest reliability with the CTS-2 in a high-risk population, suggesting there is stability in the self-reporting of acts of aggression. Construct validity has been shown by the relationship between CTS-2 scores and risk factors associated with partner violence (Straus et al, 2007.). The CTS-2 has been used in a New Zealand context (Paterson, Feehan, Butler, Williams, & Cowley-

Malcolm, 2007) and to assess partner violence amongst substance-dependent women (Minnes, et al., 2008; Schuler & Nair, 2001).

As noted above, the CTS-2 was extended to also measure conflict between study parents and adults other than partners. It was hypothesised that women engaged in methadone maintenance treatment may be involved in or exposed to aggression and violence in a wider network of adult relationships. It was also predicted that rates of single parenthood would be high amongst women in the methadone maintenance treatment group in particular and therefore significant numbers of women would be unable to complete the measure, if only partner behaviour was included.

Four further total scores were created. These were for (a) prevalence and (b) frequency of psychological aggression from others (not partner) and then for (a) prevalence and (b) frequency of violence from others (not partner). Finally, psychological aggression and violence scores for partner behaviour and other adult behaviour were summed to obtain a measure of overall frequency and prevalence of psychological aggression and violence in the lives of the primary caregivers.

Parenting Measures

Five measures of parenting were included in this analysis. These were as follows; use of child care; the provision of learning opportunities for children; the number of hours children were exposed to television; an assessment of the caregiving environment; and a measure of disciplinary strategies.

Use of Child Care.

Parents were asked about their use of childcare facilities and scored as either using childcare (1) or not using childcare (0). The number of hours per week the child spent in regular childcare was also recorded.

Learning Opportunities

A description of experiences available to children on a regular basis was gathered through an adaptation of an experiences checklist used in the Dunedin Multidisciplinary Child Development Study (Silva & Fergusson, 1976; Silva & Fergusson, 1980). This checklist consisted of 19 items, tapping experiences which the child may have had or activities the child may engage in (see Appendix G). Parents were asked how frequently these occurred in the child's life, for example, visiting relatives or going to the park. Interviewees were asked to rate the activity as engaged in: daily (4); weekly (3); monthly (2); every 1-3 months (1); or never (0). Scores for each item were summed to create a total stimulating activities score.

The measure was used with the parents of children at age 3 years. Silva and Fergusson reported an association between more enriched early experiences and better language skills (Silva & Fergusson, 1980) and higher IQ (Silva & Fergusson, 1976). Maternal ability and maternal education were both correlated with providing more stimulating experiences for their children.

Television Watching

Parents were asked about how much television their child watched each day. They were also asked about how long the TV was on in the house during the day, referred to as hours of background TV.

Home Observation for Measurement of the Environment.

The Home Observation for Measurement of the Environment (HOME) (Caldwell & Bradley, 1984) was used to assess the caregiving environment of the target study child at age 18 months. The HOME was designed to measure the quality and quantity of stimulation and support available to the child in the home. The HOME (Infant and Toddler Version) has 45 items, which are grouped into six subscales (see Appendix H). For the purposes of this study, observations were made in the child's home, before, during and after the maternal interview at 18 months over a period of about 75 minutes. Behaviours observed during the short period of time when the mother and child were involved in the recorded play session was not included. The information needed to score items on the HOME was obtained through a combination of direct observation and structured interview questions. As noted earlier, given that the interviewer completed the HOME scale, it was not possible for that person to remain blind to group status. Items were scored yes (1) or no (0). Scores for the six subscales and a full-scale score were obtained by adding items scores. Higher scores indicate a more enriched environment, whilst scores in the lowest quartile of the

normal range indicate an environment, which could be said to be detrimental to some aspect of the child's development.

The measure is based on an ecological, systems-theory approach first described by Bronfenbrenner (1979). The HOME correlates moderately with family SES, more strongly with cognitive measures of development and attachment status at 36 months (Totsika & Sylva, 2004). Internal consistency of the subscales has been found to range from .44 to .89 on the IT-HOME and longer-term test-retest reliability ranges from low (.3) to moderate (.7) (Bradley, Brisby, Johnson, & Goldman, 1990). Bradley, Caldwell, Rock, Ramey, Barnard, Mitchell et al (1989) in a large scale study of 931 children, tested the relationship between MDI scores at 24 months and HOME scale scores also completed at 24 months. They report that the correlation between HOME scores and MDI scores at age 2 was strongest for white ($r=.62$), middle class ($r=.62$) children, compared to African-American ($r=.28$), Mexican-American ($r=.24$), and low SES ($r=.21$) children. Given the proportion of Maori participants in the study group, some caution may need to be applied when interpreting HOME scores in this research. Nevertheless, the scale has been used previously in a New Zealand context (Woodward & Fergusson, 2000). The HOME has also been used widely in studies of families where drug abuse is an issue (Behnke, Davis Eyler, Duckworth Warner, Wilson Garvan, Hou, & Wobie, 2006; Brown, Bakeman, Coles, Platzman, & Lynch, 2004; Howard, Beckwith, Espinosa, & Tyler, 1995; Rodning, Beckwith, & Howard, 1991; Singer, Minnes, Short, Arendt, Farkas, Lewis et al., 2004).

Behaviour Management and Discipline

The Parent–Child Conflict Tactics Scale (CTS–PC) was used to assess the study parents’ use of psychological aggression and physical punishment/abuse. Straus, Hamby, Finkelhor, Moore and Runyan (1998) developed the CTS–PC (see Appendix I). In this study, 20 items from the CTS–PC were used. Two items were excluded from the original because of the young age of the children: ‘Threatened with a knife or gun’ and ‘Threatened to kick child out of the house’. As with the CTS-2, statements were rated by parents on a seven-point frequency scale, ranging from never (0) to more than 21 times in the last year (6) according to how often they had used various strategies over the past year. To reduce the likelihood of response bias, this measure was given to parents as a written, self-report questionnaire, unless reading difficulties were observed or recorded. The 20 items are grouped into five subscales, though four have been reported in this thesis (see Appendix H). These subscales are Psychological Aggression, Physical Punishment, Severe Assault and Very Severe Assault. Prevalence and annual frequency scores for the subscales were calculated, in the same way that the CTS-2 scores were recoded (see page 4-65).

The psychometric properties of the CTS-PC were tested using a phone survey of 1,000 US citizens (Straus, et al., 1998). Straus et al noted the difficulty in measuring family violence and child maltreatment, because of the reluctance of parents to disclose socially-undesirable behaviour. Construct validity of this measure has been demonstrated by its relation to scores on the Child Abuse Potential Inventory (Caliso & Milner, 1992). The CTS-PC has also been used to assess the parenting behaviours of substance-using parents by Miller, Smyth and Mudar (1999)

and Cohen, Hien and Batchelder (2008) and has been used in a New Zealand context (Woodward, et al., 2007).

Data Collection Phase 3: 2 year data

Procedure

All 120 children seen at age 18 months were assessed at age 2 years (± 2 weeks). The mean age of all the children at this developmental assessment was 24 months 7 days, with the group of children born to mothers maintained on methadone being slightly older at 24 months 10 days, compared to the comparison group at 24 months 3 days ($p=.04$).

The 2-year assessment was discussed at the end of the 18-month home visit. An explanation of the assessment was given and preliminary consent was attained. A few weeks prior to the child's second birthday, the author telephoned the family and a further explanation of the assessment was given. Arrangements were then made for the family to attend the University of Canterbury Child Development House for the assessment. If necessary, the author picked up the family from home by car. When the family were not able to get to the University, some assessments were completed at home. Where families lived out of town, payment for travel expenses was given or the assessment was done at home. In total, 19 (16%) children were assessed at home. Significantly more methadone-exposed children ($n=15$, 25%) were tested at home ($p=.007$). As before, there was considerable difficulty contacting parents and arranging appointments.

All 120 assessments were completed by the author, usually with the help of a 'blinded' research assistant. At the assessment, a further explanation of the process was given to parents. Families were given a \$20 voucher for their participation. The entire assessment took 75-90 minutes. Children and their parents were offered a snack in the middle of the session. Any child that appeared to be hungry on arrival at the House was offered a snack at the start. Written, informed consent (see Appendix A) was acquired and parents were informed that the session was confidential. Parents were present throughout. Feedback reports were provided to the parents within 2-3 weeks of the assessment; results were not discussed with third parties without parental consent. When there were any concerns about the child's progress, the author also spoke to the parents by phone or in person, before sending the report.

Measures

The Bayley Scales of Infant Development (BSID-II).

The second edition of the Bayley Scales of Infant Development (Bayley, 1993) were used to assess children's global cognitive and motor functioning. The BSID-II consists of three scales; Mental, Motor and Behaviour Rating Scale. The results of the Motor and the Behaviour Rating Scales were not included in this PhD study. The Mental Development Scale provides a measure of global cognitive development and includes test items tapping receptive and expressive language, memory, problem solving and number concept ability.

The BSID-II took about 40 minutes to administer. It was administered at a low table with suitable chairs. BSID-II guidelines for test administration were

followed. Items were presented in the order suggested, beginning at the level suitable for children of 24 months. Items were scored as pass or fail, and children were credited for those test items passed. Successfully completed items were summed to give a raw score and then translated via BSID tables to a normed Mental Development Index (MDI score). The assessment was recorded on camera, so that later score verification was possible. Scoring was usually completed during the testing. Those children, who could not complete the test at the 2-year level, were given easier items from the previous level. If the child was particularly anxious or needed help with focusing his or her attention, the child sat on the lap of a parent or another team member. Some children could not complete the test during the session and these children were visited at home to finish the testing. Four children in the comparison group were being raised in a language other than English. For these children, the author recruited interpreters from the University student population to help with translating the instructions and the child's response. Correct answers, when made in another language, were marked correct.

The BSID assessment is a very widely-used standardised measure of infant intellectual and motor development (Sternberg, Grigorenko, & Bundy, 2001). Reliability coefficients range between 0.78 and 0.92; and test-retest stability coefficients of between 0.77 and 0.83 on the MDI (Bayley, 1993). Bayley noted that the BSID-II reliably discriminates between infants at risk and typically-developing children. Nevertheless, the BSID-II has been criticised for its reliance on a unitary score, which may disguise specific difficulties in some developmental domains (Morrison, et al., 2000). The BSID-II has also been found to have only moderate

predictive value when used in children's second year (Roberts, Anderson, Doyle, & the Victorian Infant Collaborative Study Group, 2010).

The BSID-II has been widely used to assess children prenatally exposed to substances, including cocaine (Alessandri, et al., 1998; Behnke, Eyler, Warner, Garvan, Hou, & Wobie, 2006; Lewis, Misra, Johnson, & Rosen, 2004; Mayes, Cicchetti, Acharyya, & Zhang, 2003; Messinger, Bauer, Das, Seifer, Lester, LaGasse et al., 2004), polydrug use (Moe & Slinning, 2001; Schuler, Nair, & Kettinger, 2003), and methadone (Bernstein & Hans, 1994; Hunt, et al., 2008; Jeremy & Bernstein, 1984; Johnson, Diano, & Rosen, 1984).

Early Social Communication Scales.

Children were assessed using the Early Social Communication Scales (ESCS) (Mundy, et al., 1996). The ESCS is a semi-structured measure of the non-verbal communication skills, which children typically acquire between the ages of 8 and 30 months. Novel toys were used to elicit communicative responses from the child. Appendix J provides a list of behaviours coded. These behaviours were recorded and coded later. For this study, the focus has been on classifying two, mutually-exclusive, response behaviours:-

- a) Initiating Joint Attention behaviours (IJA) are child-initiated bids which communicate interest in an object to another person. These are bids which do not appear to serve an instrumental purpose, but rather have an affect-sharing function (see Figure 4-3 below)

b) Initiating a Behavioural Requests (IBR) are child-initiated bids which communicate a request for an object. These bids have an imperative function, usually in soliciting aid (see Figure 4-4 below).

As can be seen in Appendix J, the timing of the bid, in relation to the presentation of toys, is important.

The test was the first to be administered in the 2-year assessment. Toys and games were used to elicit verbal and non-verbal responses from the child. Small toys were purchased for use in the test, as described in the manual (Mundy, et al., 1996). They were largely wind-up or moving toys as specified. The tester sat across a low table from the child, slightly to one side of the child (see Figures 4.3 & 4.4). A camera was placed behind, but to the side of the tester, so that both the adults' eyes and the gaze direction of the child could be recorded. IJA or IBR bids were elicited by the tester by demonstrating the operation of a moving toy on the table in front of, but out of reach of, the child. The child typically responded by looking at the toy, at the examiner or alternating between the two; the child frequently also vocalised, pointed, or gestured towards the toy. This behaviour occurred while the toy was moving or after it had stopped. The child's behaviour in response to the toy was categorised according to the instructions in the manual and coded from video. Overall, if the toy was moving or being moved, attempts to communicate were coded as sharing interest (IJA), whereas if the toy had stopped moving or the child was holding it, but could not activate it, then the child's behaviours were coded as requesting (IBR).



Figure 4-3: Comparison Child Using Eye Contact (IJA) Behaviour During ESCS Assessment



Figure 4-4: Comparison Child Using 'Reach' behaviour (IBR) During ESCS Assessment

The videotaped assessment was scored by two psychology students, 'blinded' to group status. The students were trained by this author (A. D-G) to code according to the manual and reference video tapes supplied by the authors of the test. First, they were trained to reach agreement with this author. Once reliability was achieved with the author and with each other, they then proceeded to code videos independently. Any disagreements were viewed by the author and consensus was agreed. Inter-rater reliability was checked at intervals. Inter-rater reliability for this project was assessed

using Cohen's kappa and was .64 for Total IJA behaviours and .69 for Total IBR behaviours.

Behaviours were then classified, frequencies were counted and summed to form measures of total IJA and IBR scores. Following this, total IJA and IBR scores for each child were summed and then the proportion of the total score that was either IJA or IBR behaviours was calculated. These scores were expressed as a percentage, so the % IBR score + % IJA score = 100%. The purpose of this calculation was to examine the tendency of children to use typically more or less joint attention or requesting behaviours within their total number of communications.

The ESCS has been shown to have good predictive validity with regard to concurrent and later language development in children with perinatal hazards (Ulvund & Smith, 1996), children with autistic spectrum disorder (Dawson, Toth, Abbott, Osterling, Munson, Estes et al., 2004) and typically-developing infants (Mundy & Gomes, 1998). Sheinkopf et al (2004) and Mallik (2001) used the ESCS to measure early communication in children prenatally exposed to cocaine. They found joint attention behaviours to be predict later behavioural outcome in a sample of children prenatally exposed to cocaine. The ESCS subscales have been reported to show varying patterns of correlation with language and MDI scores. In this study, total IJA behaviours score did not correlate with any other scores, whilst the total IBR behaviours score showed a small correlation with the Bayley language items score ($r=.20$, $p=.05$). Neither score correlated with MDI score.

BSID-II Language Items.

Due to time constraints and the attention span of 2-year-old children, it was not possible to add a formal standardised test of language to the assessment session. As an alternative, the items from the BSID-II, which required language skills, were identified by the author. The number of correct responses by the child was summed independently to give a BSID raw score for language development. The items included both receptive and expressive language items, for example, ‘child listens to a story’ and child can name objects when presented, cup, car, ball etc. (For reasons of copyright, the items included in the measure have not been reproduced in this document, but are available on request). There was a possible maximum score of 20. Internal consistency was calculated using cronbach’s alpha ($r = .83$). This approach to assessing the language skills, in addition to cognitive development, of drug-exposed children under 2 years of age has been previously used by Johnson et al (1984).

Communication and Symbolic Behaviour Scales-Developmental profile (CSBS—DP).

The CSBS—DP is a three-part assessment measure for language and communication difficulties in young children developed by Wetherby and Prizant (1998). In this study, the one-page, parent-completed rating scale from the measure was used (Wetherby, Allen, Cleary, Kublin, & Goldstein, 2002). It is a screening tool, which aims to identify children at age 2 years or below, who are at risk of developing persistent language problems and who may need further assessment. It

was available online. Seven domains of language and communicative development are measured with 24 questions. The questionnaire is reproduced in Appendix K.

The checklist was administered at the end of a 2-year parental interview. Each item was scored as described in the manual. Most items were rated on a 3-point scale; others are scored according to the child's proficiency, as for 'Use of words' and 'Use of Objects'. A total score was derived. For children at 2 years, total scores between 42 and 57 suggest no concern and lower scores suggest further assessment is required.

This one-page checklist has been found to correlate well with the lengthier, parent-completed CSBS questionnaire ($r = .92$) and with the CSBS face-to-face evaluation of the child by a professional ($r = .72$). Test-retest trials showed no significant differences in standardised scores over time and the authors reported that the checklist correlated well with receptive and expressive language scores of the Mullen Scales of Early Learning (Mullen, 1995; Wetherby, et al., 2002). Wetherby, Woods, Allen, Cleary, Dickinson and Lord (2004) reported the checklist had a sensitivity and specificity rate of 88.9% in a sample of over 3,000 2-year-old children. The CSBS checklist was used recently in a large scale study of 1911 Australian infants (Reilly, Eadie, Bavin, Wake, Prior, Williams et al., 2006).

CHAPTER 5: CHARACTERISTICS OF THE SAMPLE AT TERM AGE

The main focus of this thesis is the early cognitive and language development of infants born to mothers maintained on methadone during their pregnancy. Of particular interest are the clinical and social processes, associated with maternal methadone use during pregnancy that contribute to later infant cognitive and language risk. As reviewed in the introductory chapters of this thesis, findings from international studies have shown that children born to mothers enrolled in methadone maintenance treatment, or indeed children raised in families affected by any opiate dependence, are subject to multiple disadvantages, both biological and environmental, in addition to prenatal drug exposure (Hans, et al., 1999; Ornoy, et al., 1996; Powis, Gossop, Bury, Payne, & Griffiths, 2000). Many of these biological and environmental factors may also have an adverse effect on developmental progress. Risk factors, such as cigarette and other drug exposure during pregnancy, poor maternal nutrition, maternal psychopathology and parenting difficulties may all play a part in shaping children's developmental pathways. Given the important role of these other factors in contributing to the later outcomes of children born to mothers engaged in methadone maintenance during pregnancy, this chapter provides a descriptive profile of infants included in the study and their social backgrounds at term age. Specifically, infant clinical characteristics during their first weeks are described, followed by the social background of their families. Finally, the two groups were contrasted on measures of maternal mental health, as well as the extent of mothers' use of prescribed, licit and illicit substances during pregnancy, including tobacco, alcohol, cannabis, opiates, benzodiazepines and stimulants.

For these analyses, between group differences were tested using either the Chi squared statistic in the case of dichotomous variables, or the independent-samples t-test for continuous variables. Data reported in all tables are either percentages in the case of dichotomous descriptors or means and standard deviations in the case of continuous descriptors. All data for the study were analysed using the Statistical Package for the Social Sciences (SPSS; Version 17.0).

Infant Clinical Data

Table 5.1 describes the perinatal history of infants in the two study groups at birth and during their early weeks of life, on measures of : gestational age; birth weight; birth length; head circumference; growth restriction (small for gestational age); APGAR score at birth (Apgar, 1953); number of days spent in hospital; and pharmacological treatment for Neonatal Abstinence Syndrome. Data were available for all 121 children, with the exception of an APGAR score for one infant who was born at home and three comparison children for whom birth length data were missing and one comparison child for whom head circumference was missing.

As shown in Table 5.1, infants born to mothers engaged in methadone maintenance treatment during their pregnancy, were delivered on average at around 39 weeks gestation, which was similar to infants in the comparison group ($p = .08$). However, examination of other infant birth data showed that despite their similar gestational ages at birth, infants born to mothers enrolled in methadone maintenance treatment tended to be somewhat smaller than non-exposed comparison children at birth. Specifically, they weighed less ($p < .0001$), had a smaller head circumference ($p < .002$), and they were

significantly shorter compared to non-exposed infants ($p = .001$). There was no significant difference in APGAR score between the two groups ($p = .37$), but clear differences were seen between the two groups in terms of post-natal clinical intervention, with most methadone-exposed infants requiring treatment for Neonatal Abstinence Syndrome (84%). As a result, children born to mothers enrolled in methadone maintenance stayed longer in hospital, on average around 17 days (range of 4 to 77 days), whilst comparison children went home much more quickly, staying an average of only 2-3 (range of 0 to 7) days, ($p < .0001$). Morphine and phenobarbitone were used to treat infant NAS symptoms. The average length of drug treatment for NAS was 74½ days (range 16-184 days).

Table 5.1: Clinical Characteristics of Methadone-Exposed and Comparison Infants at Term Age.

| | Methadone- exposed infants (n=61) | Comparison infants (n=60) | $\chi^2/t(df)$ | <i>p</i> |
|--|---|---------------------------------|----------------|----------|
| <i>M (SD)</i> gestational age (wks) | 38.67 (1.64) | 39.18 (1.44) | -1.43 (118) | .08 |
| <i>M (SD)</i> birth weight (g) | 3043.08 (445.84) | 3422.42 (513.34) | -4.34 (118) | <.0001 |
| <i>M (SD)</i> birth length (cm) | 50.39 (2.84) | 52.20 (2.79) | -1.63 (116) | .001 |
| <i>M (SD)</i> head circumference (cm) | 33.96 (1.73) | 34.81 (1.20) | -3.15 (117) | .002 |
| % small for gestational age | 1.7 (n=1) | 0 | 1.01 (1) | .32 |
| <i>M (SD)</i> 10 min APGAR | 9.90 (.40) | 9.82 (.60) | .90 (118) | .37 |
| <i>M (SD)</i> days NAS treatment | 74.46 (36.68) | — | | |
| % NAS treatment | 83.6 | — | | |
| <i>M (SD)</i> days in hospital | 16.67 (12.67) | 2.83 (1.60) | 8.59 (119) | <.0001 |

In summary, there were some between group differences in terms of infant clinical outcomes for children born to mothers enrolled in methadone maintenance treatment and comparison infants, including lower birth weight, smaller head circumference, smaller length and longer hospital stays for methadone-exposed infants. In addition, high rates (84%) of drug intervention for Neonatal Abstinence Syndrome were evident amongst infants born to mothers enrolled in methadone maintenance treatment within this Christchurch cohort.

Maternal Social Background and Family Circumstances

Table 5.2 describes the socio-economic and family backgrounds of the two groups of infants recruited in the study. Results show that as a group, newborn methadone-exposed infants were born into families characterised by greater social disadvantage than comparison infants, with these disadvantages spanning maternal educational underachievement, unemployment, and single parenthood. As can be seen in Table 5.2, in terms of maternal characteristics, over three quarters of infants in the methadone-exposed group, had mothers who had left school before the age of 16 years without school qualifications, compared to only a quarter of infants in the comparison group ($p < .0001$). Equally, methadone-exposed infants were nearly three times more likely to be living in welfare dependent or low income households than comparison group infants ($p < .0001$). Specifically, nearly 70% of families where mothers were enrolled in methadone maintenance had no income from employment and therefore were solely welfare dependent, compared to 20% of the comparison group families. Whilst the social class profile of the comparison group was clearly higher than that of the families of methadone-exposed infants, nevertheless comparison of the socioeconomic profile of the comparison group with the regional census data for the same period (Statistics New Zealand, 2006), showed that this comparison cohort was representative of the wider Canterbury region from which these infants and their families were recruited (see Methods section, page 4-56).

As noted above, newborn infants born to mothers enrolled in methadone maintenance, tended to stay much longer in hospital than their non-exposed peers. Analysis of the data showed that when they went home, nearly half (45%) of these

infants went home with a single mother, compared to around 1 in 10 comparison infants ($p < .0001$). Women enrolled in methadone maintenance treatment were less likely to be first-time parents and had more biological children than the comparison mothers (methadone group $M = 2.1 \pm 1.6$ children vs comparison group $M = 1 \pm .5$ children). However, mothers enrolled in methadone maintenance treatment, were twelve times less likely to be looking after all their biological children, than mothers in the comparison group ($p < .0001$). Examination of the care placements of these siblings of methadone-exposed children showed that they were with their fathers, other family members or in the care of Child, Youth and Family. As a result, when infants born to mothers enrolled in methadone maintenance and their comparison group peers went home, it was to similar numbers of brothers and sisters.

With regard to housing, families of mothers enrolled in methadone maintenance, tended to live in rental and/or poorer quality housing. Children born to mothers enrolled in methadone maintenance treatment were four times less likely to be living in a home owned by their parents. Most infants born to mothers enrolled in methadone maintenance were living in privately-rented accommodation, only 7% were in state-owned housing and 5% were living with grandparents or in the home of other extended family members ($p = < .001$).

The two groups of women, those enrolled in methadone maintenance treatment and those not enrolled, showed fewer between group differences in terms of age at child birth and maternal ethnicity. At the time of the term interview, women enrolled in methadone maintenance were around a year younger than comparison women ($p = .15$). Few women in either group were teenage mothers. There were however, some ethnic

differences between the two groups, with somewhat more Māori women (23%) and women of European descent (77%) in the group of women enrolled in methadone maintenance. In contrast, the comparison group was somewhat more ethnically diverse, including a wider range of more recent immigrants to New Zealand. The comparison group also included women from the Pacific Islands (1%), Asia and Africa (6.7%), nevertheless Māori women (17%) and women of European descent (75%) still made up the majority. Between group differences were not significant ($p = .13$). The profile of the comparison group was similar to regional census results: European (79%), Māori (7%), Pacific Islander (2%) and Asian/African (6.5%) (Statistics New Zealand, 2006).

In summary, an examination of the family background data suggests that the households of infants born to mothers enrolled in methadone maintenance treatment showed pervasive socio-economic adversity. Their mothers typically had fewer educational qualifications and a higher rate of welfare dependence than mothers in the comparison group. These infants were more likely to be being raised by single mothers and they more often had older siblings who lived elsewhere. Children born to mothers enrolled in methadone maintenance treatment who had resident fathers, had fathers who were more likely to be in unskilled jobs, when compared to children whose mothers were not engaged in methadone maintenance treatment in pregnancy.

Table 5.2: Social Background and Family Characteristics of Methadone-Maintained and Comparison Women in Pregnancy at Term Age.

| | Methadone- maintained women (n=61) | Comparison women (n=60) | <i>t/χ² (df)</i> | <i>p</i> |
|---|---|-------------------------------|-----------------------------|----------|
| <i>Education and Social Class</i> | | | | |
| % Mother left school with no qualifications | 79.0 | 27.0 | 44.66 (1) | <.0001 |
| % Social class 1 & 2 (professional, managerial) | 0.0 | 28.3 | | |
| % Social class 3 & 4 (clerical, technical, skilled) | 3.3 | 36.7 | | |
| % Social class 5 & 6 (semi-skilled, unskilled) | 21.7 | 15.0 | | |
| % Unemployed | 75.0 | 20.0 | 53.50 (3) | <.0001 |
| <i>Family Circumstances</i> | | | | |
| % Single parents | 45 | 13.3 | 55.24 (1) | <.0001 |
| <i>M (SD) maternal age</i> | 29.80 (4.76) | 31.12 (5.27) | -1.48 (119) | .15 |
| <i>M(SD) number of biological children</i> | 2.08 (1.60) | 1.00 (.50) | -4.25 (119) | <.0001 |
| % Mothers with biological children living elsewhere | 37.7 | 3.3 | 21.8 (1) | <.0001 |
| % Home owners | 12.5 | 55.7 | 26.17 (1) | <.0001 |
| <i>Maternal Ethnicity</i> | | | | |
| % Maori | 23.0 | 16.7 | | |
| % NZ European | 77.0 | 75.0 | | |
| % Pacific Islander | 0.0 | 1.7 | | |
| % African/Asian | 0.0 | 6.7 | 5.70 (3) | .13 |

Maternal Mental Health and Substance Use

Mental Health

Infants born to mothers enrolled in methadone maintenance were much more likely to be born to a mother who had been depressed in late pregnancy, and who had other comorbid mental health problems (see Table 5.3). Specifically, results from the Edinburgh Depression Scale showed that methadone-maintained women had on average higher mean depression scores than non-methadone-maintained women, at the time of the term age interview ($p < .0001$). Further examination of the rates of clinically defined levels of depression showed that 43% of women, enrolled in methadone maintenance, met criteria for depression (total score ≥ 13), compared to 7% of comparison women ($p = .0001$). Many of these women also reported being treated for other mental health problems, in addition to drug dependency (61%). In contrast, 20% of the comparison-group mothers reported any psychiatric treatment. Some women in both groups were taking prescribed medication for their mental health problems, including anti-depressants, benzodiazepines, and anti-psychotics, as well as anti-convulsants for epilepsy. Significant differences were found in relation to patterns of some prescribed medication use in pregnancy with 3% of methadone-maintained women using anti-depressant medication in pregnancy compared to 13% of women in the comparison group ($p = .05$). On the other hand, 15% of women enrolled in methadone maintenance, but no comparison group women, were prescribed benzodiazepines ($p = .002$). No significant between group differences were found in prescribing rates for anti-psychotics ($p = .32$) or anti-convulsant drugs ($p = .56$).

Table 5.3: Mental Health of Methadone-Maintained and Comparison Women at Recruitment.

| | Methadone-maintained women (n=61) | Comparison women (n=60) | t/ χ^2 (df) | p |
|---|--------------------------------------|----------------------------|------------------|--------|
| M(SD) Edinburgh Depression Scale (EDS) score | 11.39 (6.60) | 5.10 (4.66) | 6.07 (119) | <.0001 |
| % Mothers in clinical range (≥ 13) on EDS over last 2 weeks | 42.6 | 6.7 | 20.97 | <.0001 |
| % Mothers receiving psychiatric care (other than for drug dependence) | 60.7 | 20.0 | 20.75 | <.0001 |
| % Anti-depressant drug treatment | 3.3 | 13.1 | 3.92 | .05 |
| % Anti-psychotic drug treatment | 1.6 | 0.0 | 1.01 | .32 |
| % Anti-convulsant drug treatment | 3.3 | 1.6 | 0.34 | .56 |
| % Benzodiazepine drug treatment | 14.8 | 0.0 | 9.72 | .002 |

df= 1 unless otherwise specified

Maternal Licit and Illicit Substance Use in Pregnancy

A detailed account was taken during the maternal interview of licit and illicit substance use during pregnancy. Licit drug use included alcohol and tobacco use. Illicit drug use included cannabis, opiates, benzodiazepines and stimulants. Results of interview data showing rates and levels of maternal licit and illicit substances use in pregnancy, other than methadone are shown in Table 5.4.

First, with regard to maternal reported licit substance use, results show that nearly all women enrolled in methadone maintenance treatment smoked tobacco when pregnant (93%). However, a number of comparison women also continued to smoke tobacco in pregnancy (23%), though women in the comparison group smoked on average significantly fewer cigarettes per day than methadone-maintained women ($p < .0001$). In contrast, the rates of alcohol use tended to be similar across both groups, with around 20% of women in both groups continuing to use alcohol in pregnancy with the average number of drinks consumed being about one per week across both groups ($p = .84$).

As shown in Table 5.4, women enrolled in methadone maintenance often reported continuing to use illicit substances throughout their pregnancy, though there was evidence of decreased drug use compared to pre-pregnancy levels. Cannabis was the most commonly-used illicit substance in pregnancy, with 44% of methadone-maintained women using cannabis at some point whilst pregnant. Opiates, in addition to methadone, were used by about one quarter of the women enrolled in methadone maintenance. Similar numbers continued to use illicit benzodiazepines and about one in five used stimulants. Overall 30% of methadone maintained women said they had used an illegal substance in the month before the interview and 14% reported using an illicit substance up to seven times a week. In contrast, few comparison-group women used illicit drugs during pregnancy. One woman reported using methamphetamines and other drugs, and another used cannabis, but other than these two, there was no other acknowledged use.

These analyses of the mental health data at term suggested that women enrolled in methadone maintenance were more likely to have depression scores in the clinical range

on the Edinburgh Depression Scale, as well as other co-morbid psychiatric problems during pregnancy. In addition, findings indicate that a number of infants in both groups were exposed to some other licit and illicit substances in utero, though this was much more common amongst infants, born to mothers enrolled in methadone maintenance. For comparison group infants, this drug exposure was largely confined to licit substances, mostly tobacco and alcohol. On the other hand, infants born to mothers enrolled in methadone maintenance were additionally exposed to a considerable range and amount of supplementary, illicit drug use, in addition to prescribed methadone.

Table 5.4: Maternal Reported Use of Licit and Illicit Substance Use in Pregnancy.

| | Methadone- maintained women (n=61) | Comparison women (n=60) | <i>t</i> / χ^2 (df) | <i>p</i> |
|--|--|-------------------------------|--------------------------|----------|
| <i>Cigarettes</i> | | | | |
| % Smoking | 93.4 | 23.3 | 61.32 | <.0001 |
| <i>M</i> (<i>SD</i>) daily cigarette consumption | 13.78 (9.07) | 2.07 (4.53) | 9.00 (119) | <.0001 |
| <i>Alcohol</i> | | | | |
| % Drinking alcohol | 18.3 | 25.0 | .79 | .37 |
| <i>M</i> (<i>SD</i>) drinks per week | .94 (3.12) | .83 (3.31) | .20 (119) | .84 |
| <i>Cannabis</i> | | | | |
| % Using cannabis | 44.3 | 3.3 | 27.81 | <.0001 |
| <i>M</i> (<i>SD</i>) use of cannabis (joints per week) | 1.14 (2.21) | .02 | 3.96 (119) | <.0001 |
| <i>Opiates</i> | | | | |
| % Using other opiates in pregnancy | 26.2 | 0.0 | 18.14 | <.0001 |
| <i>M</i> (<i>SD</i>) weekly use of opioids | .94 (1.94) | 0.0 | 3.78 (119) | <.0001 |
| <i>Benzodiazepines</i> | | | | |
| % Using benzodiazepines | 27.9 | 0.0 | 19.45 | <.0001 |
| <i>M</i> (<i>SD</i>) weekly use of benzodiazepines | .77 (2.17) | 0.0 | 2.73 (119) | .008 |
| <i>Stimulants</i> | | | | |
| % Using stimulants | 21.3 | 1.7 | 11.409 | .001 |
| <i>M</i> (<i>SD</i>) weekly use of stimulants | .80 (1.92) | .04 | 3.04 (119) | .003 |

In summary, analysis of the infant clinical and family background characteristics of methadone-maintained infants suggests that children born to mothers enrolled in methadone maintenance treatment were characterised by higher levels of risk than their non-exposed peers as neonates. They tended to weigh less, had smaller heads, shorter body lengths, spent longer in hospital and many were treated for NAS. In addition, they left hospital with mothers who faced significant socio-economic adversity, had less family support and were more likely to be living in poorer accommodation compared to infants of the comparison group mothers. Mothers enrolled in methadone maintenance were more often depressed, had more psychiatric problems and were more often engaged in continuing poly-drug use, than the comparison group. This analysis highlights the high risk nature of this group of infants, as well as the need to consider these contextual factors when examining the effects of methadone exposure on early child development. The results of the next phase of the study seek to shed more light on the progress of these vulnerable infants and their families over the next two, crucial years in their lives.

CHAPTER 6: DEVELOPMENTAL OUTCOMES AT AGE 2

Children whose parents have drug-use problems are at risk for long-term educational and behavioural difficulties, but the nature of the possible early developmental precursors of these longer-term functional outcomes is uncertain. If research is to guide early intervention for this vulnerable group, then a focus on identifying early markers for later potential risk of emotional, behavioural or learning problems in later childhood is needed. To date, little research has compared the specific developmental consequences for the children born to mothers engaged in methadone maintenance treatment. Indeed, even when a broader approach is taken and studies of other opiate-exposed infants are also included, findings tend to be somewhat inconclusive. What research there has been, has tended to focus primarily on the cognitive skills of methadone or opiate-exposed children. Some authors have reported increased rates of cognitive delay in this group (Hunt, et al., 2008; Steinhausen, et al., 2007; van Baar & de Graaff, 1994); though with adequate control for confounders, others have argued that any observed adverse effects may reflect the effects of environmental disadvantage (Hans & Jeremy, 2001; Messinger, et al., 2004; Ornoy, et al., 1996). In an overview of research, Shankaran, Lester, Das, Bauer, Bada, Lagasse, et al (2007) concluded that there was little evidence for clear teratogenic effects of methadone- or opiate-exposure on cognitive development. Nevertheless, they reported that when opiate-exposed children were assessed at age 9, as part of the Maternal Lifestyles Study, they showed mild deficits in language and phonological processing, which might account for some of the longer-term negative outcomes in this group of children.

No published research exists on the developing social and non-verbal communication skills of methadone-exposed toddlers, yet these skills play an important role in shaping children's behavioural style and capacity to learn (Rochat, 2001). By assessing methadone-exposed children and a comparison peer group at age 2, using a number of complimentary social, communication and cognitive measures, this study aims to contribute to international understanding of the early developmental progress and outcomes of this at-risk group of children and their families.

In this chapter, the results of the 2-year assessment, comparing methadone-exposed and comparison children's communication and cognitive skills, will be presented. First, the results from the Mental Development Index of the Bayley Scales of Infant Development –Version II (BSID–II) will be described to provide a context for the results of the language and joint attention measures. The Bayley Scales of Infant Development –Version II (BSID–II) Mental Development Index (Bayley, 1993) was used at 2 years to assess children's global cognitive development and in particular, risk of cognitive delay. Social and communication skills were assessed using (a) the Early Social Communication Scales (Mundy, et al., 1996), (b) a composite score of language items from the BSID and (c) parent report from the Communication and Symbolic Behaviour Scale (Wetherby & Prizant, 1998).

The analysis of between group differences on each of these outcome measures was undertaken using a number of steps. First, data were explored using frequency checks, scatter and box plots to identify outliers and missing values in the data. Errors were corrected where possible from the records. Preliminary assumption testing was also completed to check for normality, linearity, skewness and kurtosis. Then, between

group differences were tested for significance using either the Chi squared test for dichotomous measures or the independent samples t-test for continuous measures.

Following the presentation of the unadjusted between group differences on these outcome measures, the results of covariate analyses will be described. The aim of these covariate analyses was to examine the extent to which between group differences remained after the effects of potential child, maternal and environmental confounding factors, correlated with methadone exposure, were taken into account. These potential confounding factors were selected on the basis of the analyses described in Chapter 5.

Cognitive Outcomes.

Results for the Mental Development Index (MDI) of the Bayley Scales of Infant Development-II were obtained for all, but three study children. Of the three children who could not be tested, one child in the comparison group had profound physical and learning disabilities and was not tested at all. Attempts were made to assess the two other children, but despite two or three attempts with each child on different occasions and in different locations, the children were unable to be tested. These two children were both boys, from the methadone-exposed group. It was unclear whether their difficulties were predominantly behavioural or cognitive. These three children were assigned a score of 40. Four further methadone-exposed children could be assessed, but were unable to reach the basal test level at 24 months. As a result, their standardised scores would have been less than 50. These children were assigned a score of 45. The practice of substituting nominal scores for children, who could not be meaningfully assessed is well-established (Roberts, et al., 2010;

Woodward, Anderson, Austin, Howard, & Inder, 2006). However, between group comparisons both with and without these children were completed. Results revealed that the final inclusion or exclusion of these children's scores in the study sample did not substantially alter the results.

Table 6.1 shows the proportions of children whose MDI scores placed them within each of these four cognitive ability groups. As shown, there were significant between group differences in the proportions of children across these four groups ($p < .0001$). Very few methadone-exposed children (2%), relative to comparison children (15%) had scores in the accelerated range. Half the methadone-exposed children obtained MDI scores within the normal cognitive ability range, compared to almost three-quarters of the children in the comparison group. On the other hand, methadone-exposed children had higher rates of mild and severe cognitive delay, with 33% of methadone-exposed children and 10% of comparison children being mildly delayed and 13% of methadone-exposed and 3% of comparison children being severely delayed. These findings suggest that in comparison to a random sample of non-exposed, comparison children of the same age, children born to mothers enrolled in methadone maintenance are subject to higher rates of global cognitive delay.

Table 6.1: Performance of Methadone–Exposed and Comparison Children on the Mental Development Index of the BSID at Age 2 Years.

| | Methadone- exposed children (n=60) | Comparison children (n=60) | <i>t</i> / χ^2 (df) | <i>p</i> |
|----------------------------------|---|--------------------------------------|--------------------------|----------|
| <i>M</i> (<i>SD</i>) MDI score | 76.00 (17.66) | 92.35 (16.99) | -5.18 (118) | <.0001 |
| <i>Cognitive level</i> | | | | |
| % Accelerated | 1.7 | 15.0 | | |
| % Average performance | 51.7 | 71.7 | | |
| % Mild delay | 33.3 | 10.0 | | |
| % Severe delay | 13.3 | 3.3 | 19.48 (3) | <.0001 |

Social Communication and Language Outcomes

Social communication behaviour was measured at 2 years by the Early Social Communication Scales (ESCS) (Mundy, et al., 1996). In addition, children's language development was assessed using a composite measure from the BSID-II (Bayley, 1993) as well as the Communication and Symbolic Behaviour Scales—Developmental Profile (Wetherby & Prizant, 1998).

Early Social Communication.

The ESCS assesses aspects of largely pre-verbal communicative behaviour. For this study, the focus was on two measures, (a) Initiating Joint Attention (IJA) and (b) Initiating a Behavioural Request (IBR). The first of these subscales (IJA) provides a measure of the frequency with which the child engages in joint attention to share

interest in an object. The second subscale (IBR) measures the frequency with which the child communicates with the examiner by making a request. These two behaviours were of particular interest since Sheinkopf et al (2004) reported that, in a group of cocaine-exposed children, frequency of IJA and IBR behaviours were differentially predictive of the presence or absence of later disruptive behaviours, with more IBR showing an association with more later behaviour problems and more IJA behaviours showing an association with more later prosocial behaviour.

An assessment using the ESCS was attempted with all children, with the exception of the one child, described above, in the comparison group who had profound disabilities. Of the remaining 119 children, three methadone-exposed children were unable to complete the ESCS. Two of these three children also failed to complete the BSID-II, described above. The third child was unable to comply with the social requirements of the ESCS, but could complete some non-verbal tasks of the BSID-II. The scores of these four children were excluded from this analysis.

Table 6.2 describes the performance of children in the two study groups on the two ESCS subscales at 2 years. First, when examining the total number of Initiating Joint Attention (IJA) behaviours used by study toddlers, results revealed a tendency for children born to mothers on methadone to initiate somewhat fewer joint attention behaviours than children in the comparison group. However, this difference failed to reach statistical significance ($p=.27$). Analysis of the total number of Initiating Behavioural Request (IBR) behaviours showed that children born to mothers enrolled in methadone maintenance, used significantly more IBR behaviours, than comparison children ($p=.02$). This indicates that these children, as a group, made more requests or

demands in response to the presentation of a novel toy by an examiner, than children in the comparison group.

Next, all child-initiated communication bids were considered as a whole (i.e. all IJA and IBR bids in total). Then, the proportion of bids that were IJA behaviours or IBR behaviours were examined for each group of children. As shown in Figure 6.1, most of the communicative bids to the examiner from both groups of children were requests for an object; with an average of 67% of all bids being of this kind in both groups. However, the non-verbal communication behaviour of children born to mothers enrolled in methadone maintenance, consisted of a greater proportion of requesting bids (70%) relative to comparison children (64%). In contrast, toddlers from the comparison group used a higher proportion of joint attention bids (i.e. IJA behaviours) (36%), compared to methadone-exposed toddlers (30%, $p=.03$). This suggests that when children born to mothers enrolled in methadone maintenance, chose to initiate communication with an adult, the bid was more often a request or a demand for something they wanted whereas comparison-group children made requesting bids less often. Comparison-group children, on the other hand, made somewhat more joint attention bids than the methadone-exposed group. This style of communicating may have the effect on social partners of making methadone-exposed children appear more demanding and non-exposed children more affectively engaging.

Table 6.2: Performance of Methadone-Exposed and Comparison Children on the Early Social Communication Scales at Age 2 Years.

| | Methadone- exposed children n=57 | Comparison children n=59 | t/ χ^2 (df) | p |
|---|---|------------------------------------|------------------|-----|
| <i>Initiation of shared interest in an object (IJA)</i> | | | | |
| M (SD) IJA behaviours | 11.23 (7.15) | 12.83 (8.18) | -1.12 (114) | .27 |
| IJA behaviours as a % of total communications | 30.2 | 35.9 | -2.2 (114) | .03 |
| <i>Initiation of request for an object (IBR)</i> | | | | |
| M (SD) IBR behaviours | 25.00 (8.72) | 21.46 (7.18) | 2.39 (114) | .02 |
| IBR behaviours as a % of total communications | 69.8 | 64.1 | -2.15 (114) | .03 |

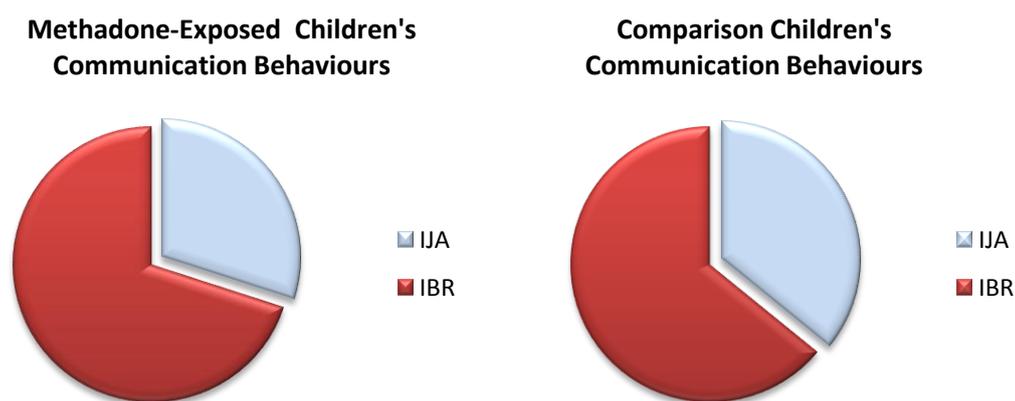


Figure 6-1: The Ratio of IBR to IJA Behaviours Displayed by Methadone-Exposed and Comparison Children.

Language Development.

Table 6.3 compared the early language development of methadone-exposed children and comparison children. Measures included a composite measure of language items from the MDI of the Bayley Scales of Infant Development, and a parent report measure of language development from the Communication and Symbolic Behaviour Scales.

Three children, who were unable to complete the BSID-II were excluded from the analysis of the language items of this measure, though the scores of the four children, who did not reach the basal level, were still included. Since preliminary analysis revealed that removing their scores made no substantial difference to the results, the language scores of four comparison children who were being raised in non-English speaking households were also included. (A description of the steps taken to assess non-English-speaking children was given on page 4-73).

Table 6.3 shows that based on this language scale, children born to mothers

Table 6.3: Language Outcomes of Methadone-Exposed and Comparison Children at Age 2 Years.

| | Methadone-exposed children | Comparison children | $t/\chi^2(df)$ | p |
|--|----------------------------|---------------------|----------------|--------|
| <i>BSID Language Items Score</i> | $n=58$ | $n=59$ | | |
| $M(SD)$ Composite Language Items Score | 5.17 (4.45) | 8.54 (4.99) | 3.84 (115) | <.0001 |
| <i>CSBS Parent Questionnaire</i> | $n=58$ | $n=58$ | | |
| $M(SD)$ Total score | 50.26 (5.95) | 53.26 (7.82) | -3.27 (114) | .001 |

enrolled in methadone maintenance treatment obtained significantly fewer items correct than comparison children ($p < .0001$). On average, they scored less than five correct language items (± 0 to 17), compared to comparison children, who scored an average of eight correct items (± 1 to 18).

Parent Report of Language and Other Communicative Behaviours

Table 6.3 also describes the results of the parent report Communication and Symbolic Behaviour Scales–Developmental Profile. These analyses were based on a total sample of 116 children. The checklist was not completed by three parents due to pressure of time ($n=3$) or severe disability ($n=1$). As shown, parents of children born to mothers enrolled in methadone maintenance treatment, rated their children as having less well-developed communication skills than children in the comparison group ($p = .001$). However, it is important to note, that of those children whose parents completed the checklist, there was only one child whose scores fell into the ‘of concern’ range. He was in the methadone-exposed group.

These results suggested that children born to mothers enrolled in methadone maintenance treatment showed significantly poorer language and communication development at age 2 years, when compared to children born to mothers not enrolled in methadone maintenance treatment, with these results being evident across both standardised testing and parent report.

*Prenatal Methadone Exposure and Cognitive and Communication Outcome after
Adjustment for Confounding Factors*

The above analyses of the bivariate relationship between methadone exposure and cognitive, social communication and language development by age 2 years suggests that methadone-exposed children were characterised by significant early cognitive and language delay, as well as communication differences relative to their non-exposed peers. However, the findings from the term phase of the study, described in chapter 5, also raise the possibility that these between group differences may have arisen because mothers engaged in methadone maintenance treatment during pregnancy were characterised by multiple adverse health and social circumstances. These risk factors may have placed their children at greater risk for developmental problems, independently of any risk associated with prenatal methadone exposure. Therefore, further analysis was undertaken to examine the extent to which differences in developmental outcome at age 2, might (a) reflect the direct effects of methadone exposure during pregnancy and/or (b) either in full or in part – reflect the effects of other confounding factors correlated with maternal methadone treatment. This analysis proceeded as follows:-

1. The selection of potential confounders was informed by two issues; a) data from the term phase of the study, showing that the two groups differed on the variable in question and b) previous research and theory, linking the confounder to infant cognitive and communication skill development. First, associations between each outcome measure and a wide range of infant and social background measures were examined. Infant clinical variables included gestational age, birth weight and gender.

Maternal characteristics included socio-economic status (SES), maternal education, other substance use in pregnancy, ethnicity and maternal age. Those variables which showed a significant, bivariate correlation ($r < .3$, $p < .05$) with an outcome were retained for further analyses. High levels of shared variance between some covariates, as well as between 'group' (methadone-exposed or comparison) and some covariates was observed. For example, low SES and low levels of maternal education were highly correlated with each other ($r = .59$). As a result, a number of intervening steps were taken. First, consideration was given to combining a number of variables to create a single social risk variable in order to overcome problems associated with co-linearity. However, after preliminary statistical analyses using both composite and individual variables, it was decided to use maternal education as the prime, single, social-risk confounder. As Suchman et al have argued, for a population of pregnant or young mothers, who are in treatment for mental health difficulties, and who are mostly welfare-dependent and often single, using a social class variable, which relies heavily on employment status, is inappropriate (Suchman & Luthar, 2001; Suchman, McMahon, Slade, & Luthar, 2005). In addition, statistical analysis showed that similar results were achieved, with both a composite social risk variable and with the variable, maternal education. Thus the simpler alternative was chosen.

As well as some social risk variables, prenatal use of substances other than methadone, particularly average tobacco use, was also highly correlated with methadone use ($r = .64$). For this reason, use of each licit and illicit substance, specifically tobacco, alcohol, cannabis, opiates, benzodiazepines and stimulants, were entered separately as dichotomous variables (use/non-use) rather than as continuous

variables (average amount of substance used) in the further analyses. Gestational age was also entered as a covariate, given previous evidence linking prematurity with later developmental delay, even though children born very preterm were excluded from the sample.

2. Next, a series of linear regression models were tested, where each outcome was regressed on: (a) group status (methadone vs. comparison) (b) maternal education and (c) maternal use in pregnancy of other substances, including cigarettes, alcohol, cannabis, benzodiazepines, opiates and stimulants and (d) gestational age. Variables were added and removed in a forwards and backwards fashion to identify key confounding variables. This analysis continued until a stable set of confounding factors emerged for each dependent variable. Results of the analysis for each outcome measure are shown in tables and in the relevant sections of text. Values are given for unstandardised regression coefficients (B) and standard error of B ($SE B$), the standardised regression coefficients (β) and the probability level (p). The unstandardised regression coefficient (B) provides a measure of the amount of change in the specific independent variable that is associated with change in the dependent variable and standard error of B ($SE B$) is the standard deviation of the residual variance after prediction. The standardised regression coefficient (β) provides a measure of the partial prediction of the independent variable on the dependent variable when all variables are standardised

3. Finally, the main effect of gender and gender x group interactions were undertaken using linear regression modeling, given evidence to suggest that boys may

be at greater risk of developmental delay than girls, and to assess the possibility that boys or girls may be differentially affected by methadone exposure.

Analysis of the results of the cognitive assessment is described first, followed by the results for the social communication and language measures. The outcome of all these analyses are finally summarised in Table 6.8.

Cognitive Development

Following the steps outlined above, linear regression modeling was used to assess the extent to which between group differences in children's MDI scores were explained by confounding factors. The results of this analysis are summarised in Table 6.4. As shown, three covariates were found to be significant. These were (a) maternal education ($p = .001$), (b) gestational age ($p = .04$) and (c) gender ($p = .003$). However, whilst control for confounding factors; maternal education, gestational age and gender, reduced the association between prenatal methadone-exposure and MDI scores, between group differences remained significant. These findings clearly suggest that the association between lower MDI scores and being born to a mother engaged in methadone maintenance could not be explained by confounding factors. Boys scored less well than girls, but there was no group x gender interaction, suggesting the performance of boys exposed to methadone is not significantly or specifically impaired compared to their comparison peers.

Table 6.4: Summary of Linear Regression Analysis for Confounding Factors Associated with Mental Development Index Scores.

| Variable | <i>B</i> | <i>SE B</i> | β | <i>p</i> |
|---|----------|-------------|---------|----------|
| Step 1- Unadjusted | | | | |
| Group status | 16.35 | 3.18 | .43 | <.0001 |
| $F(1,118) = 26.82, p = <.0001, R^2 = .19, \text{Adjusted } R^2 = .18$ | | | | |
| Step 2-Adjusted for confounders | | | | |
| Group status | 9.82 | 3.29 | .26 | .004 |
| Maternal education | 2.82 | .85 | .28 | .001 |
| Gestational age | 2.21 | 1.04 | .16 | .04 |
| Gender | 8.87 | 2.93 | .23 | .003 |
| $F(1,115) = 14.68, p = <.0001, R^2 = .34, \text{Adjusted } R^2 = .32$ | | | | |

Social Communication and Language Development

Early Social Communication Scales

Initial analysis of results of the subscales of the Early Social Communication Scales for Initiating Joint Attention and Initiating a Behavioural Request only showed significant group differences in two of the variables examined. These were (a) mean total number of IBR behaviours, and (b) the ratio of IBR to IJA scores. Thus, further linear regression modeling to examine the effects of confounding factors was confined to these variables. First with regard to a) the total IBR score variable, analysis revealed that there were no significant confounders, nor any gender or gender x group interaction effects, $F(1,115) = 5.77, p = .02, R^2 = .05, \text{Adjusted } R^2 = .04$.

With regard to the variable describing the ratio of IBR behaviours to IJA behaviours, a summary of the linear regression modeling is found in Table 6.5. It shows that between group differences in the ratio of IBR behaviours to IJA behaviours were explained by maternal pregnancy tobacco use ($p=.01$).

Adjusted means for the two ESCS variables are shown in Table 6.8. Variable (a) mean total number of IBR behaviours, remains unchanged with no significant covariates seen; between group differences in variable (b) the ratio of IBR to IJA scores were explained by maternal tobacco use. These findings suggest that the association between being born to a mother engaged in methadone maintenance and differences in early social communication behaviours can be in part explained by confounding factors, but significant differences in frequency of requesting behaviours remain.

Table 6.5: Summary of Linear Regression Analysis for Confounding Factors Associated with Ratio of IBR Behaviours to IJA Behaviours.

| Variable | <i>B</i> | <i>SE B</i> | β | <i>p</i> |
|---|----------|-------------|---------|----------|
| Step 1-Unadjusted | | | | |
| Group status | -6.04 | 2.68 | -.21 | .03 |
| $F(1,115) = 5.09, p = .03, R^2 = .04, \text{Adjusted } R^2 = .03$ | | | | |
| Step 2-Adjusted for confounders | | | | |
| Group status | .81 | 3.76 | .03 | .83 |
| Tobacco | 9.64 | 3.80 | .33 | .01 |
| $F(2,114) = 5.88, p = .004, R^2 = .09, \text{Adjusted } R^2 = .08.$ | | | | |

Language Outcomes

A summary of the results of the linear regression analysis for the BSID language items is shown in Table 6.6. When the covariate analysis was completed, modeling revealed that any use of benzodiazepines in pregnancy was a significant confounder ($p = .01$). Again, there was a main effect of gender, suggesting that across both groups, the language development of boys lagged behind that of girls ($p = <.0001$). However, there was no gender x group interaction. As shown in Table 6.8, after controlling for benzodiazepine use and gender, the difference in BSID language scores between methadone-exposed and comparison 2-year-olds was attenuated but remained significant.

Table 6.6: Summary of Linear Regression Analysis for Confounding Factors Associated with BSID Language Item Scores.

| Variable | <i>B</i> | <i>SE B</i> | β | <i>p</i> |
|--|----------|-------------|---------|----------|
| Step 1-Adjusted | | | | |
| Group status | 3.28 | .88 | .33 | <.0001 |
| $F(1,114) = 13.96, p = <.0001, R^2 = .11, \text{Adjusted } R^2 = .10.$ | | | | |
| Step 2- Adjusted for confounders | | | | |
| Group status | 2.04 | .90 | .21 | .025 |
| Benzodiazepines | -3.02 | 1.2 | -.23 | .014 |
| Gender | 3.55 | .81 | .36 | <.0001 |
| $F(3,112) = 14.34, p = <.0001, R^2 = .26, \text{Adjusted } R^2 = .28$ | | | | |

Communication and Social Behaviour Scales

Linear regression modeling was also used to assess the extent to which differences in CSBS score were explained by confounding factors. Results are shown in Table 6.7. First, the CSBS data were transformed using a reflect and logarithm transformation, because of negative skew and this transformation was used in subsequent regression analyses. Group status (i.e. methadone exposed or non-exposed), was then regressed on the transformed CSBS score. When covariates were examined, the analysis revealed that maternal education was also significantly associated with CSBS scores ($p=.02$). There was a main effect of gender, suggesting that across both groups, parents viewed boys were communicating less well than girls ($p =.04$). However, there was no gender x group interaction.

After controlling for maternal education and gender, the difference in CSBS scores between methadone-exposed and comparison toddlers, was attenuated but remained significant. Findings suggest that the association between methadone-exposure and language delay could not be explained by confounding factors.

Table 6.7: Summary of Linear Regression Analysis for Confounding Factors Associated with CSBS scores.

| Variable | <i>B</i> | <i>SE B</i> | β | <i>p</i> |
|--|----------|-------------|---------|----------|
| Step 1-Unadjusted | | | | |
| Group status | -.62 | .17 | .32 | .0001 |
| $F(1,114) = 13.24, p < .0001, R^2 = .10, \text{Adjusted } R^2 = .10$ | | | | |
| Step 2- Adjusted for confounders | | | | |
| Group status | -.39 | .19 | -.20 | .04 |
| Maternal Education | -.12 | .05 | -.23 | .02 |
| Gender | -.35 | .17 | -.18 | .04 |
| $F(3,112) = 8.06, p < .0001, R^2 = .18, \text{Adjusted } R^2 = .16$ | | | | |

Table 6.8: Comparison of Outcome Means for Methadone-Exposed and Comparison Children at Age 2 Years after Adjustment for Covariates.

| Scale | Adjusted means for methadone-exposed children | Adjusted means for comparison children | <i>p</i> | Covariates ^a |
|----------------------------------|---|--|----------|-------------------------|
| Mean (<i>SE</i>) MDI | 79.26 (2.19) | 89.09 (2.19) | .004 | 1,4,5 |
| Mean IBR (<i>SE</i>) | 25.0 (8.7) | 21.46 (7.18) | .02 | – |
| Ratio of IBR/IJA | 66.64 | 67.50 | .9 | 3 |
| Mean (<i>SE</i>) BSID language | 5.84 (.61) | 8.00 (.59) | .02 | 2,5 |
| Mean (<i>SE</i>) CSBS | 50.73 (.69) | 52.71 (.69) | .06 | 1,5 |

^a1= maternal education; 2=any benzodiazepine use in pregnancy; 3 = any tobacco use in pregnancy; 4 = gestational age; 5=gender

In summary, analysis of the developmental assessment results at age 2 suggests that infants born to mothers enrolled in methadone maintenance treatment, show signs of developmental delay in their early years. Methadone-exposed infants had lower mean MDI scores than comparison infants, with nearly half of the children in the methadone group showing mild or severe cognitive delay. There were also subtle differences in communication behaviours as measured by the ESCS, with methadone-exposed children using more requesting or demanding behaviours and fewer affect sharing behaviours than comparison children. In addition, methadone-exposed children had poorer language skills than comparison children, when tested using a composite measure from the BSID-II and on the basis of parent report. To some extent, these differences were attenuated by controlling for confounders. Significant confounders included; maternal education; gender; gestational age; and other prenatal substance exposure. However, even after controlling for confounders, being born to a mother enrolled in methadone maintenance treatment continued to be associated with poorer outcomes, on measures of cognitive, language and communication behaviours at age 2. These results further raise the question of why this may be the case and in particular, query the potential mechanisms that account for the poor developmental progress of children born to mothers engaged in methadone maintenance during pregnancy. To address this issue, Chapter 7 examines the family environment and social context in which toddlers were growing up.

CHAPTER 7: FAMILY ENVIRONMENT AT AGE 18-MONTHS

Chapter 5 described the family environments into which all the study children were born. Examination of the recruitment data showed that infants of mothers enrolled in methadone maintenance treatment were born into families challenged by significant adverse health and social circumstances. They left hospital to start life with mothers who were often single parents, on low incomes, predominantly unemployed, with few educational qualifications and often with mental health problems, in addition to drug dependency. Evidence from other studies suggests that these trends in early disadvantage, present around the time of birth for these children, often continue through their first years (Hans, et al., 1999; Messinger, et al., 2004; Ormoy, et al., 1996; Powis, et al., 2000). The focus of this chapter is on the other intervening factors, which might help to explain the between group differences in early developmental outcome seen in chapter 6. As children grow up, social and health difficulties are frequently compounded by additional parenting and relationship difficulties (Suchman, et al., 2005). In order to better understand these psychosocial and family processes, this chapter describes the results from the parental interview and the HOME Scales collected as part of the 18-month home visit.

The first data described below detail the family context in which study children found themselves at 18 months, whether with birth parent/s or alternative caregivers. The term 'parent' or 'parental' has been used in this chapter, recognizing that not all respondents were a biological parent to the child. Following this is an outline of the social background and family circumstances of these families at age 18 months. Next, maternal mental health and licit and illicit substance use is described. Then the two groups are contrasted on measures of family functioning, including family stress and partner and other relationships.

Finally, measures of parenting are examined, including parental childcare practices, provision of learning opportunities for their child, the quality of the home environment and behaviour management strategies. For these analyses, between group differences were tested using either the Chi squared test in the case of dichotomous variables, or the independent-samples t-test for continuous variables. Data reported in all tables are either percentages in the case of dichotomous descriptors or means and standard deviations in the case of continuous descriptors.

Social Background and Family Circumstances

The following section details data from the interviews with primary caregivers and first outlines the placement of children at 18 months, whether with biological or with other parents. In addition, the characteristics of the families in which children were growing up are described. Data were available for all 120 children in the study.

Child Placement

Table 7.1 describes the family placement of all children in the study. Children were recorded as living with one or both biological parents; or informally with other family members or with a CYF-appointed foster carer.

Table 7.1 shows that at age 18 months, one in six children born to mothers enrolled in methadone maintenance treatment were no longer living with their biological mothers. One child moved to live with his biological father and eleven others (18.3%) were living with alternative caregivers at the time of interview. Of these eleven, three were living with grandparents who had been appointed by CYF; six were with non-family, CYF-appointed

foster carers; and two children were living with family members on an informal basis. In contrast, all of the comparison children were living with their biological mothers and most with both biological parents (97%).

Whilst at the point of interview, there were eleven methadone-exposed children who were living in out-of-home care, there were a further two children from this group, who had also spent significant periods of time away from their parents, but had moved back by 18 months. Of the 13 children who had ever lived away from their parents, five children had never lived with their biological parents or only very briefly; a further five had been removed in the first six months; another three had been removed between six and 18 months of age.

Ninety percent of children born to mothers enrolled in methadone maintenance treatment had had one consistent, primary caregiver, either their biological parent or a foster parent, compared to 100% of the comparison toddlers. Data, showing the number of moves children had made over the first 18 months, revealed a greater instability in the lives of children born to mothers enrolled in methadone maintenance treatment. This group had had a mean of 0.6 caregiver changes compared to comparison children, who had experienced a mean of 0.1 caregiver changes ($p=.004$). Moreover, five children had had more than two changes of primary caregiver and one child had had more than five changes of primary caregiver in the first 18 months of life.

Table 7.1: Family Placement of Methadone-Exposed and Comparison Children at Age 18 Months.

| | Methadone- exposed children (n=60) | Comparison children (n=60) | $\chi^2/t(df)$ | <i>p</i> |
|--------------------------------------|---|--------------------------------------|----------------|----------|
| % Living with two biological parents | 31.7 | 96.7 | | |
| % Living with biological mother only | 48.3 | 3.3 | | |
| % Living with biological father only | 1.7 | 0 | | |
| % Living with other caregiver | 18.3 | 0 | 55.27 (3) | <.0001 |
| M (SD) no. of caregiver changes | 0.60 (1.18) | 0.12 (0.45) | 2.96 (118) | .004 |

Family Characteristics

The circumstances of families caring for children in the study were gathered through interview. Parents were classified as single or cohabiting. They were also questioned about the numbers of other people living with them, their income and employment status and the family's accommodation.

Partner status. As shown in Table 7.2, by age 18 months, 43% of the children born to mothers enrolled in methadone maintenance treatment were living in single parent families, compared to 3% of the comparison group ($p=.0001$). A further 12% of children born to mothers enrolled in methadone maintenance treatment were living at age 18 months in a household where the father-figure was resident only some of the time. This was not reported by any of the comparison parents. By 18 months, 15% of methadone-exposed

children had a new father-figure, who was not their biological father, compared to 3% of comparison children ($p=.0001$).

Family size. A comparison of numbers of people and numbers of children living with methadone-exposed and comparison group toddlers showed no significant difference, suggesting over-crowding or large family size was not a particular problem.

Family income and employment status. Analysis of social class and income data revealed that, as at term, the parents of methadone-exposed children were more likely to be welfare dependent ($p<.0001$). Few primary caregivers of methadone-exposed children were working (18%), compared to the primary caregivers of comparison children, where 62% were working ($p<.0001$). The addition of eleven, alternative caregivers of children born to mothers enrolled in methadone maintenance treatment did not significantly alter the socio-economic profile of the group.

Housing. Parents of methadone-exposed children were less likely to be home owners at 18 months (22%), whereas the parents of comparison children were more likely to be home owners (56%, $p=.0001$).

Table 7.2: Family Circumstances of Methadone-Exposed and Comparison Children at Age 18 Months.

| | Methadone – exposed children (<i>n</i> =60) | Comparison children (<i>n</i> =60) | <i>t</i> / χ^2 (<i>df</i>) | <i>p</i> |
|---|---|---|-----------------------------------|----------|
| % Single parent | 43.3 | 3.3 | | |
| % Parents cohabiting/married | 45.0 | 96.7 | | |
| % Parents cohabiting part-time | 11.7 | 0 | 38.76 (2) | <.0001 |
| <i>M</i> (<i>SD</i>) Individuals in the household | 4.13 (1.73) | 4.18 (1.44) | -.17 (118) | .86 |
| <i>M</i> (<i>SD</i>) Children in the household | 2.50 (1.56) | 2.12 (1.25) | 1.49 (118) | .14 |
| % Primary caregiver employed | 18.3 | 61.7 | 23.89 (1) | <.0001 |
| % Family solely welfare dependent | 71.7 | 16.7 | 36.80 (1) | <.0001 |
| % Family receiving any welfare support | 83.3 | 45.0 | 21.19 (1) | <.0001 |
| % Home owners | 22.2 | 55.7 | 14.6 (1) | <.0001 |

In summary, by age 18 months children born to mothers enrolled in maintenance treatment were more likely to be living with a caregiver other than their biological parent and to have experienced more disruption in their care. They were also more likely to be living in single parent families, on low incomes and often dependent on welfare support. Their parents were less likely to be homeowners. However, there was no evidence of overcrowding in either group.

Mental Health and Substance Use

The next section outlines the data from the 18-month interview with the primary caregivers, relating to mental health and their use of substances since the birth of the study child. Interview data were available for the primary caregivers of all children, except one child in the comparison group.

Mental Health

As shown in Table 7.3, the primary caregivers of methadone-exposed children at age 18 months more frequently reported problems with depression. Specifically, mean scores for depression on the Edinburgh Depression Scale amongst caregivers of methadone-exposed children were significantly higher than the comparison group ($p = <.0001$). Number of parents scoring positive for depression in the group of caregivers of methadone-exposed children were eleven times higher than amongst caregivers of comparison children. However, compared to earlier rates of depression in pregnancy (42.6%), depression amongst caregivers of methadone-exposed toddlers was less common (33%).

Table 7.3: Mental Health of Primary Caregivers of Methadone-Exposed and Comparison Children at Age 18 Months.

| | Primary caregivers of methadone – exposed children (n=60) | Primary caregivers of comparison children (n=59) | $\chi^2/t(df)$ | <i>p</i> |
|--|---|--|----------------|----------|
| <i>M (SD)</i> EDS score | 10.12 (7.44) | 4.91 (4.04) | 4.73 (117) | <.0001 |
| % EDS score positive for depression | 33.3 | 3.4 | 17.70 (1) | <.0001 |

Substance Use

All primary caregivers were asked whether they had used any licit and illicit substances in the last 18 months, including methadone, alcohol, tobacco, cannabis, amphetamines or methamphetamines, benzodiazepines, barbiturates, cocaine and opiates.

Methadone

At age 18 months, 75% of methadone-exposed children were living with a primary caregiver engaged in methadone maintenance treatment. This in large part reflected the 20% of the methadone-exposed children who were not living with their biological mothers, but with an alternative caregiver not engaged in methadone maintenance treatment. Five percent (*n*=3) of previously methadone-maintained, biological mothers were no longer engaged in methadone maintenance treatment.

Licit and Illicit Substance Use

Primary caregivers were asked about their use of alcohol, tobacco, cannabis, amphetamines and methamphetamines, benzodiazepines, barbiturates, cocaine and opiates since the birth of the toddler in their care. Use of tobacco and alcohol were examined as individual substances. Since illicit substance use was less common, illicit substances were combined to create a measure of total illicit substance use, and then the data were also reduced to an 'any use' variable. A total number of illicit substances used score was also calculated.

Table 7.4 shows that 80% of primary caregivers of methadone-exposed children smoked tobacco, compared to 27% of primary caregivers of comparison children ($p < .0001$). On the other hand, 73% of comparison group caregivers drank alcohol compared to 43% of methadone-exposed group caregivers ($p = .001$). Illicit drug use was reported by 48% of primary caregivers of methadone-exposed children, compared to 7% of comparison group primary caregivers ($p < .0001$). Twenty-eight percent of methadone-exposed-group primary caregivers and all of the comparison group primary caregivers reported only cannabis use, but amongst the methadone-exposed-group primary caregivers, some (20%) were continuing to use other illicit drugs, including amphetamines, benzodiazepines, barbiturates and other opiates.

Table 7.4: Reported Use by Primary Caregivers of Licit and Illicit Substances at Age 18 Months.

| | Primary Caregivers of methadone – exposed children (<i>n</i> =60) | Primary Caregivers of comparison children (<i>n</i> =59) | $\chi^2/t(df)$ | <i>p</i> |
|--|---|--|----------------|----------|
| % Smoking tobacco | 80.0 | 27.1 | 33.47 (1) | <.0001 |
| % Drinking alcohol | 43.3 | 72.9 | 10.66 (1) | <.001 |
| % Using any illicit substances | 48.3 | 6.8 | 26.06 (1) | <.0001 |
| % Using illicit substances, other than cannabis | 20.0 | 0.0 | 13.12 (1) | <.0001 |
| <i>M (SD)</i> number of illicit substances used | .62 (.78) | .07 (.25) | 5.16 (117) | <.0001 |

As seen in Chapter 5, during pregnancy, methadone-maintained women experienced significantly more mental health problems and were using more licit and illicit substances than comparison group women. In the intervening 18 months, interview data suggested that trends in maternal antenatal health and substance use tended to persist, although decreases in overall rates of depression and substance use were evident. Nevertheless, mothers of methadone-exposed children still reported higher rates of depression and more substance use, than mothers of comparison group children.

Family Functioning

As part of the 18-month interview, primary caregivers were asked about sources of stress in their lives and their exposure to interpersonal violence. Data in this section are missing for one mother in the comparison group and one mother in the methadone-maintained group did not complete the Conflict Tactic Scales.

Family Stress

As can be seen in Table 7.5, in general, primary caregivers of methadone-exposed children had a higher mean life stress scores than comparison primary caregivers ($p=.004$), with primary caregivers of methadone-exposed children reporting more major stressors in their lives than comparison primary caregivers. Nevertheless, 37% of caregivers of methadone-exposed children and 58% of comparison caregivers reported no major problems. In relation to particular problem areas, financial stressors were more of a concern to primary caregivers of methadone-exposed children than the comparison-group mothers. They reported more frequent problems with money, transport and housing.

Secondly, relationships were another problem area for methadone-exposed group primary caregivers in particular. Some group differences probably reflected the higher numbers of single parents amongst those caring for methadone-exposed children. Significantly more primary caregivers of methadone-exposed children felt they had too little time to themselves ($p=.02$). On the other hand, the primary caregivers of comparison children wanted to spend more time with their partners ($p=.006$). Most single women in both groups had problems with ex-partners, showing no between group differences ($p=.37$). Primary caregivers of methadone-exposed children more commonly reported major

relationship difficulties with their own parents ($p = <.0001$) and their partner's parents ($p=.05$). However, both methadone-exposed and comparison group primary caregivers managed to find time to see friends. There was a non-significant tendency for primary caregivers in methadone-exposed group to report having no-one to talk to more often than comparison primary caregivers ($p = .06$).

On the other hand, the stressors originating from being the primary caregiver of a toddler, did not appear to distinguish between the two groups so clearly. Lack of sleep was equally common amongst methadone-exposed and comparison groups ($p =.75$); being told how to be a parent was not regarded as a problem for many ($p =.17$); and most could call on help if necessary ($p =.45$). Whilst child behaviour problems were somewhat more common for methadone-exposed group primary caregivers, the difference did not reach statistical significance ($p =.07$).

Table 7.5 : Life stressors of Primary Caregivers of Methadone-exposed and Comparison Children at Age 18 Months.

| | Primary caregivers of methadone – exposed children (n=60) | Primary caregivers of comparison children (n=59) | χ^2/t (df) | p |
|--|--|--|-----------------|--------|
| <i>M(SD)</i> major stressors | 1.67 (1.88) | .83 (1.16) | 2.91 (117) | .004 |
| <i>Financial problems</i> | | | | |
| % Not having enough money for family's needs | 28.3 | 11.9 | 13.92 | <.001 |
| % Transport difficulties | 20.0 | 6.8 | 7.26 | .03 |
| % Inadequate accommodation | 5 | 1.7 | 5.81 | .05 |
| <i>Relationship problems</i> | | | | |
| % Not having enough time to self | 23.3 | 15.3 | 8.12 | .02 |
| % Not having enough time to spend with your partner (of those with a partner) | 2.9 | 12.7 | 12.32 | .006 |
| % Relationship with ex-partner/non-resident parent (of those with an ex-partner) | 18.5 | 50.0 | 1.98 | .37 |
| % Relationship with parents | 11.7 | 1.7 | 28.62 | <.0001 |
| % Relationship with your partner's parents (of those with a partner) | 20.7 | 3.8 | 26.11 | .05 |
| % Never having another adult to talk to | 8.23 | 0.0 | 7.32 | .06 |
| % Not having enough time to see friends | 0.0 | 0.0 | N/A | |
| <i>Parenting problems</i> | | | | |
| % Never having enough sleep | 13.3 | 13.6 | .570 | .75 |
| % Other people telling you how to bring up children | 8.3 | 1.7 | .05 | .17 |
| % Not having anyone you could call on for assistance with the children | 10.0 | 5.1 | 1.60 | .45 |
| % Managing child's behaviour | 8.3 | 1.7 | 5.26 | .07 |

df = 2 unless otherwise indicated

Psychological and Physical Aggression in Partner and Other Relationships

Partner Relationships

The Partner Deviance Scale and the Revised Conflict Tactics Scale (CTS-2) were used to assess the partner relationships of primary caregivers caring for toddlers in the study. The Partner Deviance Scale assessed the extent to which primary caregivers were involved with a partner who engaged in deviant behaviour, including criminal activity and drug use. The CTS-2 measured both psychological aggression and violence directed at the primary caregiver by her partner over the last 12 months. Only those primary caregivers with cohabiting partners (or partners who had been cohabiting in the past 12 months for the CTS-2) completed this part of the interview ($n=34$ primary caregivers of methadone-exposed children and $n= 59$ primary caregivers of comparison children).

As shown in Table 7.6, results from the partnership measures suggest that there were some between-group differences with regard to partner deviance and aggression. Partners of primary caregivers of methadone-exposed children had significantly higher mean scores on the Partner Deviance Scale, than partners of comparison group primary caregivers ($p=.004$). More specifically, partners of primary caregivers of methadone-exposed children more often broke the law ($p=.02$), more frequently used cannabis ($p<.0001$), other illicit drugs ($p=.03$), and methadone or opiates ($p<.0001$).

With regard to psychological aggression, results from the CTS-2 indicated that whilst primary caregivers from both groups reported similar rates of partner psychological aggression, primary caregivers of methadone-exposed children reported a higher mean frequency partner-perpetrated psychological aggression ($p=.03$). With regard to partner

violence, there was a slight tendency for higher rates of violence ($p = .14$) and also more frequent violence ($p = .17$) amongst primary caregivers of methadone- exposed children. However, these group differences did not reach statistical significance.

Table 7.6 Report of Partner Deviance and Partner Psychological Aggression and Violence towards Primary Caregivers of Methadone-Exposed and Comparison Children at Age 18 Months.

| | Primary caregivers of methadone – exposed children <i>n</i> =34* | Primary caregivers of comparison children <i>n</i> =58* | $\chi^2/t(df)$ | <i>p</i> |
|--|---|--|----------------|----------|
| <i>Partner Characteristics</i> | | | | |
| <i>M (SD)</i> total partner deviance score | 20.91 (4.40) | 18.29 (3.28) | 3.01 (90) | .004 |
| % Breaks the law | 25.7 | 5.1 | 8.31(2) | .02 |
| % Smokes cannabis | 44.5 | 10.3 | 19.00 (2) | <.0001 |
| % Illicit drug problems | 16.7 | 1.7 | 9.28 (2) | .03 |
| % Methadone/heroin user | 34.3 | 0 | 22.85(2) | <.0001 |
| <i>Partner Conflict</i> | | | | |
| | <i>n</i> =36 | <i>n</i> = 58 | | |
| % Subjected to psychological aggression from partner | 69.4 | 60.3 | .80(1) | .37 |
| <i>M(SD)</i> Frequency of partner psychological aggression | 28.94 (45.79) | 10.65 (19.27) | 2.27 (90) | .03 |
| % Subjected to violence from partner | 13.9 | 5.2 | 2.17(1) | .14 |
| <i>M(SD)</i> Frequency of partner violence | 11.22 (47.34) | .10 (.55) | 1.41(90) | .17 |

Other Adult Relationships

A second line of enquiry using the CTS-2 was completed to assess the extent to which primary caregivers of children in the study were exposed to any psychological aggression or violence, from people *other* than partners over the last 12 months. To establish a measure of total levels of aggression and violence in households over the previous 12 months, partner and other adult aggression and violence scores were summed. These total scores, seen in Table 7.7, showed a higher prevalence of psychological aggression in households of methadone-exposed children than in comparison group households ($p = .002$). Furthermore, primary caregivers of methadone-exposed children who experienced psychological aggression, experienced higher levels of aggression ($p = .001$). Nearly half the primary caregivers of methadone-exposed toddlers were exposed to some violence compared to 7% of comparison primary caregivers ($p = <.0001$), and again primary caregivers of methadone-exposed children were also exposed to more frequent violence than the comparison primary caregivers ($p = .04$).

In summary, results from measures of family stress and the Conflict Tactics Scale highlight the difficulties experienced by primary caregivers of methadone-exposed children during their children's early years. Dysfunctional relationships were found to be endemic in a wider social network of this population. Primary caregivers of methadone-exposed children reported more stress and more relationship problems, resulting in aggression and violence than primary caregivers of comparison children.

Table 7.7: Report of Any Psychological Aggression and Violence towards Primary Caregivers of Methadone-Exposed and Comparison Children at Age 18 Months.

| | Primary caregivers of methadone – exposed children (n=59) | Primary caregivers of comparison children (n=59) | $\chi^2/t(df)$ | <i>p</i> |
|--|--|---|----------------|----------|
| <i>Total levels of aggression and violence</i> | | | | |
| % Subjected to any psychological aggression | 93.2 | 71.2 | 9.79 (1) | .002 |
| <i>M(SD)</i> Frequency of psychological aggression | 43.25 (56.27) | 15.25 (30.20) | 3.37 (116) | .001 |
| % Subjected to any violence | 47.5 | 6.8 | 24.70 (1) | <.0001 |
| <i>M(SD)</i> Frequency of violence | 15.17 (56.15) | .14 (.60) | 2.06 (116) | .04 |

Parenting

At the 18-month interview, primary caregivers were asked about their use of paid childcare and the opportunities for learning that were available to their children at home. In addition, primary caregivers were asked about their management strategies for dealing with difficult toddler behaviour. The interviewer also completed the HOME scales to assess the quality of the home environment, based on observations from the 18-month home visit.

Childcare Practices

Parents were asked about their child's attendance at any pre-school service and the numbers of hours per week they spent there. Data were collected for all children in the

study. Table 7.8 shows that use of any form of paid childcare was common amongst all families of toddlers in the study. Significantly more primary caregivers of children in the comparison group were working and this perhaps underlies their tendency to be using more child care ($p=.06$). Across both groups, group day care was the most commonly used form of pre-school service, used by 63.4% of those using any care service. There was no significant difference in the mean number of hours that methadone-exposed and comparison toddlers spent in paid childcare.

Table 7.8: Use of Child Care by Families of Methadone-Exposed and Comparison Children at Age 18 Months.

| | Methadone – exposed children (n=60) | Comparison children (n=60) | χ^2/t (df) | p |
|---|---|----------------------------------|-----------------|-----|
| % Parent/s using any provider of child care | 51.7 | 68.3 | 3.47 | .06 |
| M (SD) no. of hours in child care | 8.18 (11.82) | 10.49 (11.71) | -1.07 (118) | .44 |

Learning Opportunities

The experiences checklist examined the learning opportunities experienced by this population of children at age 18 months (see Table 7.9). Primary caregivers were asked how often the child would have the opportunity to engage in 17 different activities; possible answers being daily, weekly, monthly, even less or not at all. Activities included visiting friends and being read stories. Data were collected for all children in the study.

There were significant differences in the number of experiences available to methadone-exposed and comparison children, with families of comparison group children

engaging in more stimulating activities than families of methadone-exposed children ($p = .0001$). It is noteworthy that although around 90% primary caregivers of the methadone-exposed children played with ($p = .06$), or read to ($p = .03$), their children at least once a month, this compared to 98% of comparison primary caregivers. The families of methadone-exposed children tended to visit zoos and wild-life centres less frequently ($p < .0001$). There was no significant difference in the frequency with which the two groups of parents reported going on less expensive outings, to the library, playground, shops etc. with their children ($p = .67$).

The methadone-exposed children had less involvement with their fathers: they were less likely to play at least weekly ($p < .0001$); or be cared for by them at least weekly ($p < .0001$). Clearly these results are indicative of the high numbers of parents of methadone-exposed children who were not living together, and though numbers of comparison group parents not cohabiting were small, there is some indication that once the partner relationship had broken down, partners in both groups tended not to keep in regular contact.

Mothers were also asked about how much television their child watched and how long the television was left on during the day. Nearly all the children in the study were watching some television every day: the average viewing being close to one hour a day in both groups. No significant between group difference was found between the length of time mothers reported that their children were watching TV ($p = .18$). However, group differences were evident in the amount of background TV to which children were exposed. In the houses of methadone-exposed children, the television was left on for more hours each day, than in the houses of comparison families ($p = .001$).

Table 7.9: Methadone-Exposed and Comparison Children's Opportunities for Learning at Age 18 Months.

| | Methadone – exposed children (n=60) | Comparison children (n=60) | χ^2/t (df) | p |
|--|--|--------------------------------------|-----------------|--------|
| <i>M(SD)</i> Number of stimulating activities | 39.67 (5.99) | 43.77 (5.46) | -3.92 (118) | <.0001 |
| <i>Activities</i> | | | | |
| % Regularly played with parent | 90.0 | 98.3 | 3.79 (1) | .06 |
| % Regularly read to by parent | 88.3 | 98.3 | 4.82 (1) | .03 |
| % Regularly visited animal park or zoo | 10 | 41.7 | 21.71 (1) | <.0001 |
| % Regularly visited park, playground or library | 86.7 | 81.7 | 2.34 (1) | .67 |
| % Regularly played with other parent | 66.7 | 98.3 | 10.16 (1) | .001 |
| % Regularly cared for by other parent | 56.7 | 83.3 | 18.03 (1) | <.0001 |
| <i>Television viewing</i> | | | | |
| <i>M(SD)</i> no. of minutes child watched TV/day | 58.37 (51.02) | 47.17 (39.80) | 1.34 (118) | .18 |
| <i>M(SD)</i> hours of background TV | 7.26 (4.83) | 3.86 (3.68) | 4.32 (118) | <.001 |

Home Environment

The Home Observation for the Measurement of the Environment (HOME) was used to assess the quality of the home environment, in which children in the study were

being raised. The results are shown in Table 7.10. The HOME scale was only partially completed for two children, who were asleep during most of the 18-month home visit. For these children, an average of the completed items in the relevant subscales was used to replace the value of the missing items. It was possible to complete the HOME observation for nine children not seen at home at 18 months, since most items rely on observation of parent and child behaviour, rather than the physical home environment. Some supplementary questions were used for these children.

Results revealed significant differences in the home environment of the two groups of children. Subscale scores suggested that the environments of methadone-exposed toddlers were poorer in terms of: parental responsiveness ($p = .008$); parental acceptance of the child ($p = .01$); organisation of the home environment ($p = .03$); parental involvement with the child ($p = < .0001$); and parental stimulation of the child ($p = < .0001$). On the other hand, HOME scores suggested that parents of methadone-exposed and comparison children were equally likely to provide a range of play materials for their children ($p = .38$). The total score, created by summing subscale scores, highlighted the disadvantaged environment experienced by methadone-exposed children with significantly lower scores evident in the methadone-exposed group ($p = < .0001$). Taken as a whole, the results from the HOME scale suggest that parents or caregivers of methadone-maintained children typically provided a home environment for their children, which was less child-centered and less sensitive to the needs of young children, than comparison group parents.

Table 7.10: Observation of the Home Environment in Households of Methadone-Exposed and Comparison Children at Age 18 Months.

| | Households of methadone- exposed children (n=60) | Households of comparison children (n=60) | $\chi^2/t(df^*)$ | <i>p</i> |
|---|--|--|------------------|----------|
| <i>M (SD)</i> Total HOME score | 35.1 (6.0) | 39.4 (4.4) | -4.57 | <.0001 |
| <i>M (SD)</i> Responsivity of Parent | 8.2(2.2) | 9.2(1.8) | -2.71 | .008 |
| <i>M (SD)</i> Acceptance of Child | 6.5 (1.4) | 7.1(0.9) | -2.58 | .01 |
| <i>M (SD)</i> Organisation of Physical & Temporal Environment | 5.4 (0.8) | 5.6 (0.6) | -2.22 | .03 |
| <i>M (SD)</i> Provision of Appropriate Play Materials | 7.7 (1.3) | 7.9 (1.0) | -.88 | .38 |
| <i>M (SD)</i> Parental Involvement with Child | 3.6 (2.0) | 5.1 (1.3) | -4.86 | <.0001 |
| <i>M (SD)</i> Opportunities for Variety in Daily Stimulation | 3.4 (1.1) | 4.4 (0.7) | -4.79 | <.0001 |

**df* = 118

Behaviour Management and Discipline

The Conflict Tactics Scale: Parent-child form (CTS-PC) was used to assess the strategies used by study mothers to manage behaviour problems presented by their toddlers. The CTS-PC surveyed the use by parents of different types of behaviour management including the use of psychological aggression, physical punishment, as well as severe physical punishment or abuse. Table 7.11 shows the frequency with which the different types of discipline were used. Primary caregivers were also questioned about whether they

had concerns about themselves or their partner hurting their children and any contact with CYF. Data were missing for two children in the study; one from each group.

As can be seen in Table 7.11 there were some reported differences in the punitive discipline strategies used. Primary caregivers of methadone-exposed toddlers reported more frequent use of psychological aggression than parents of comparison toddlers ($p = .001$). One example of this differing disciplinary style was in the use of ‘threatening to smack’, which 46% of primary caregivers of methadone-exposed toddlers said was a strategy they practised, whereas only 19% of comparison primary caregivers used similar threats ($p = .002$). Physical punishment, e.g. smacking, was more frequently used by primary caregivers of methadone-exposed toddlers than the comparison group ($p = .03$), but severe and very severe assault were reported rarely, but equally across both groups, with no significant differences.

Nearly all primary caregivers (88%) interviewed said they had no worries about hurting their children, with no between group differences reported ($p = .41$). Equally most primary caregivers (74%) interviewed had no concerns about their partners hurting their children and again there were no between group differences ($p = .39$). However, in the previous 18 months significantly more primary caregivers of methadone-exposed children (58%) had had contact with CYF, compared to 10% of the comparison group caregivers ($p = <.0001$) and 39% of partners of caregivers of methadone-exposed children had had contact with CYF compared to 7% of partners of the comparison group caregivers ($p = <.0001$).

Table 7.11: Discipline Strategies Used by Primary Caregivers of Methadone-Exposed and Comparison Children at Age 18 Months.

| | Primary caregivers of methadone – exposed children (<i>n</i> =59) | Primary caregivers of comparison children (<i>n</i> =59) | χ^2/t (<i>df</i>) | <i>p</i> |
|--|--|---|--------------------------|----------|
| <i>M</i> (<i>SD</i>) frequency of psychological aggression | 16.07 (20.80) | 5.85 (11.55) | 3.30 (116) | .001 |
| <i>M</i> (<i>SD</i>) frequency of physical punishment | 6.17 (10.00) | 2.91 (5.92) | 2.15 (116) | .03 |
| <i>M</i> (<i>SD</i>) frequency of severe assault | .00 (00) | .05 (.29) | -1.35 (116) | .18 |
| <i>M</i> (<i>SD</i>) frequency of very severe assault | .03 (.26) | .05 (.29) | -.34(116) | .74 |

In summary, results from the 18-month assessment confirmed that for children born to mothers enrolled in methadone maintenance, social adversity continued from birth into early childhood. Methadone-exposed children were more likely to have moved from home to live with alternative caregivers or were more likely to be living with single parents in low-income households than comparison children. Their parents were more likely to have mental health difficulties, to be experiencing higher levels of life stress and to have more violence and aggression in their lives than comparison parents. Children born to mothers engaged in methadone maintenance were equally likely to attend out-of-home childcare as comparison children, but their families organised fewer stimulating activities and they were exposed to higher rates of background television than comparison children. Results from the HOME scale suggested that children born to mothers enrolled in methadone maintenance lived in family environments, which were less child-centered and less responsive to children's emotional and learning needs than comparison families. Finally,

the caregivers of methadone-exposed children were more frequent users of aggressive discipline and used more frequent physical punishment than comparison caregivers.

CHAPTER 8: DEVELOPMENTAL OUTCOME AND SOCIO-FAMILIAL CONTEXT

The results of the 2-year assessment outlined in Chapter 6 show pervasive developmental delays in children born to mothers engaged in methadone maintenance treatment. Furthermore, these between group differences persist after controlling for confounding factors. This raises the question of the causal mechanisms that might help explain the elevated levels of cognitive and language delay and communicative difficulty in this group of children. The aim of this final stage of the analysis was to examine the extent to which the differing family environments in which methadone-exposed and comparison children were being raised over their first 2 years may help to explain the poorer early cognitive and communication difficulties experienced by methadone-exposed children.

To address this issue, the regression models described in chapter 6 were further extended to include a range of environmental variables, including: care status; parental mental health and family stress; learning opportunities; parenting behaviours; and partner deviance that were found in Chapter 7 to significantly differentiate the two study groups. In addition, preliminary analyses were conducted to ensure that there were no violations of the assumptions of normality, linearity and multicollinearity. Two highly-skewed variables (the number of illicit drugs used by primary caregivers at 18 months and the total number of caregiver life stressors) were transformed using a logarithm transformation and a square root transformation respectively. Following this,

multiple regression using forwards and backwards variable elimination was used to identify the best fitting and most parsimonious model using the method described by Baron and Kenny (1986).

A number of authors, (Bollen & Stine, 1990; Mallinckrodt, Abraham, Wei, & Russell, 2006; McCartney, Burchinal, & Bub, 2006) have stressed the importance of statistical testing for the size of the mediated effect after regression analysis. They note that research by MacKinnon, Krull and Lockwood (2000) found a lack of power and more frequent Type-II errors, when the causal steps approach of Baron and Kenny (1986) was used alone. McCartney, Burchinal and Bub proposed that bootstrapping, as described by Preacher and Hayes (2008), was the most appropriate method of testing mediator effects in small samples ($N < 400$). Bootstrapping quantifies the indirect effect, rather than inferring the existence of an indirect effect by testing its constituent paths. It estimates the total and direct effects of an independent variable on a dependent variable, as well as an indirect effect through a hypothesized intervening process. Bootstrapped tests of simultaneous multiple indirect effects can establish the unique contribution of each putative intervening process to the total indirect effect on outcome. Unlike the Sobel test, it does not rely on the mediating variables being normally distributed (McCartney, et al., 2006). For this analysis, a macro for SpSS was downloaded from <http://www.comm.ohio-state.edu/ahayes/spss%20programs/indirect.htm>. Five thousand bootstrapping samples were used for the final analysis of each outcome measure and bias-corrected and accelerated (*BCa*) confidence intervals were generated to assess the probability of the indirect effect being different from zero at the 95% confidence level, as recommended

by Hayes (2009). *BCa* confidence intervals include a correction for median bias and skew. If zero is not between the upper and lower bounds of the confidence interval, then the indirect effect is interpreted as significant. Indirect effects can be calculated with covariates added to the model, in which case the total effect is corrected for the effect of the covariates. Only quantitative mediators can be entered in the macro, though dichotomous independent, dependent and covariate variables may be used.

Using this approach, the intervening processes involved in each developmental outcome were analysed in two ways, first using the causal steps approach with multiple regression and then by measuring the change in the effect of the predictor on outcome after controlling for the mediated effect using bootstrapping.

Factors Explaining the Relationship Between Methadone Exposure and Cognitive Outcome

As described in Chapter 6, group status (methadone-exposed or comparison) predicted Bayley Mental Development Index (MDI) results after adjustment for the confounding effects of maternal education, child gender and gestational age at birth. Further linear regression modeling was used to assess the extent to which persisting group differences in MDI scores were explained by intervening factors. A summary of the results is provided in Table 8.1. The unstandardised regression coefficients (*B*) and standard error of *B* (*SE B*) and the standard regression coefficients (β) are reported. As shown, three intervening factors were found to be significant. These were (a) total HOME scale score ($p = .008$), (b) the number of hours of background TV ($p = .02$), and (c) out-of-home care placement ($p = .001$). After the inclusion of these three

factors in the model, the association between being born to a mother enrolled in methadone maintenance treatment and MDI scores was no longer significant.

Table 8.1: Summary of Linear Regression Analysis for Confounding and Intervening Factors Associated with Mental Development Index Scores.

| Variable | <i>B</i> | <i>SE B</i> | β | <i>p</i> |
|---|----------|-------------|---------|----------|
| Step 1-Unadjusted | | | | |
| Group status | 16.35 | 3.18 | .43 | <.0001 |
| $F(1,118) = 26.82, p = <.0001, R^2 = .19, \text{Adjusted } R^2 = .18$ | | | | |
| Step 2-Adjusted for confounding factors | | | | |
| Group status | 9.82 | 3.29 | .26 | .004 |
| Maternal education | 2.82 | .85 | .28 | .001 |
| Gestational age | 2.21 | 1.04 | .16 | .04 |
| Gender | 8.87 | 2.93 | .23 | .003 |
| $F(1,115) = 14.68, p = <.0001, R^2 = .34, \text{Adjusted } R^2 = .32$ | | | | |
| Step 3-Adjusted for confounding and intervening factors | | | | |
| Group status | 2.49 | 3.45 | .07 | .47 |
| HOME score | .84 | .32 | .26 | .008 |
| Background TV | -.01 | .006 | -.19 | .02 |
| Out-of-home care | 18.07 | 5.43 | .26 | .001 |
| $F(1,115) = 12.86, p = <.0001, R^2 = .45, \text{Adjusted } R^2 = .41$ | | | | |

Bootstrapping was also used to assess the model, using 5,000 bootstrap samples. Table 8.2 shows the total and specific indirect effects of the proposed intervening variables in the relationship between group status and MDI score. It can be

seen that it was not possible to enter care status (out-of-home care or living with biological parent/s) as a possible intervening factor, because of its dichotomous nature. Thus, for this bootstrapping analysis, this dichotomous variable could only be entered in the model as a covariate, with maternal education, gender and gestational age. Thus in this analysis, the effects of care status have been controlled for, instead of tested as an intervening factor.

Results from the bootstrapping analysis suggested that hours of TV being left on in the house (point interval =2.47 and a 95% *BCa* bootstrap *CI* of .03 to 6.41, $p <.05$) and total HOME score (point interval = 2.16 and a 95% *BCa* bootstrap *CI* of .53 to 6.16, $p <.05$) were significant specific intervening processes. The combined indirect effect for total HOME score and number of hours of background TV was also significant (point interval = 4.9 and a 95% *BCa* bootstrap *CI* of 1.79 to 9.29, $p <.05$). The total effects pathway between group status and MDI score (coefficient =7.60, $p =.03$) became non-significant (coefficient =2.63, $p =.4$), when controlling for the total indirect effects. These results confirm that, after controlling for significant confounding factors and out-of-home care placement, a model including total HOME scores and hours of background TV as intervening factors explains the relationship between being born to a mother maintained on methadone during pregnancy and poorer MDI scores.

Table 8.2: Intervening Processes in the Association Between Group Status and Mental Development Index Score

| Indirect effects of intervening processes | Point estimate | Bootstrapping | |
|---|----------------|---------------|-------|
| | | BCa 95% CI | |
| | | Lower | Upper |
| Total indirect effect* | 4.91 | 1.79 | 9.29 |
| N. hours TV was on in the house* | 2.62 | .15 | 6.44 |
| Total HOME score* | 2.29 | .53 | 6.16 |

* $p < .05$

Covariates entered – maternal education ($p = .12$), gender ($p = .0004$) gestational age ($p = .24$); care status ($p = .0005$).

Factors Explaining the Relationship Between Methadone Exposure and Communicative Development.

As described in Chapter 6, analysis of the ESCS results revealed that there were no significant confounders for the ESCS variable, total number of IBR behaviours. However, maternal tobacco smoking in pregnancy, explained the second ESCS variable, the ratio of IBR to IJA behaviours and thus no further analysis was undertaken with this second variable.

Further linear regression modeling was used to assess the extent to which persisting group differences in total number of IBR behaviours score were explained by intervening factors. A summary of the results are shown in Table 8.3. Two intervening factors were found to be significant. These were (a) caregiver use of psychological aggression ($p = .01$), and (b) the primary caregiver life stress score ($p =$

.01). A third intervening factor, (c) number of caregiver changes ($p = .07$), showed borderline significance and was retained for further analysis. After the inclusion of these three factors in the model, the association between being born to a mother engaged in methadone maintenance treatment and differences in total number of IBR behaviours scores was no longer significant.

Table 8.3 : Summary of Linear Regression Analysis for Intervening Factors Associated with Total IBR Behaviours Score

| Variable | <i>B</i> | <i>SE B</i> | β | <i>p</i> |
|--|----------|-------------|---------|----------|
| Step 1-Unadjusted | | | | |
| Group status | -3.54 | 1.48 | -.22 | .02 |
| $F(1,112) = 5.32, p = .02, R^2 = .05, \text{Adjusted } R^2 = .04.$ | | | | |
| Step 2-Adjusted for intervening factors | | | | |
| Group status | -2.84 | 1.57 | -.18 | .07 |
| Caregiver use of psych. aggression | .113 | .045 | .24 | .01 |
| N. Caregiver life stress score | -1.21 | .48 | -.24 | .01 |
| N. Caregiver changes | 1.45 | .81 | .16 | .07 |
| $F(4,109) = 5.52, p = .004, R^2 = .17, \text{Adjusted } R^2 = .14$ | | | | |

Further analysis using bootstrapping suggested that a model, including two of the three intervening processes identified above, were significant in the model. This analysis is summarised in Table 8.4. The total effect of the independent variable (methadone-exposed or non-exposed) on the dependent variable total IBR score had a regression coefficient of -3.54 ($p = .02$), which dropped to -2.84 ($p = .07$) when indirect

effects were entered in the model. An examination of the specific indirect effects of each variable indicated that caregiver use of psychological aggression was significantly associated with use of IBR behaviours (point estimate = -1.25 and a 95% *BCa* bootstrap *CI* of -3.10 to -.40, $p < .05$). The caregiver life stress score was also associated with IBR behaviours (point estimate = -1.25 and a 95% *BCa* bootstrap *CI* of -.40 to 3.10, $p < .05$), though more caregiver life stress was associated with fewer IBR behaviours. Both variables made a unique contribution to the indirect effect on total IBR score. The number of caregiver changes, however, did not contribute above and beyond the other two variables to the indirect pathway with point estimate of -.78 (95% *BCa* bootstrap *CI* of -2.75 to .16). Together the total indirect effect on outcome was nonsignificant, with a point estimate of -.77 and a 95% *BCa* bootstrap *CI* of -3.01 to .91. This suggests that both caregiver use of psychological aggression and caregiver life stress were significant intervening influences in the association between group and IBR behaviours, but their effects were in opposite directions. Thus, it does not make sense to consider their combined effect on IBR behaviours (Hayes, 2010).

Table 8.4: Intervening Processes in the Association between Methadone-Exposure or Comparison Group Status and Total Number of IBR Behaviours Used

| Indirect effects of intervening processes | Point estimate | Bootstrapping | |
|---|----------------|---------------|-------|
| | | BCa 95% CI | |
| | | Lower | Upper |
| Total indirect effect | -.77 | -3.01 | .91 |
| N. caregiver changes | -.78 | -2.75 | .16 |
| Caregiver use of psych. aggression * | -1.25 | -3.10 | -.40 |
| N. caregiver life stress score* | 1.2 | .40 | 3.10 |

* $p < .05$.

No covariates significant.

Analysis of the BSID language scale showed that methadone-exposed children had poorer language skills than comparison children. These differences were attenuated after controlling for prenatal benzodiazepine exposure and gender. Further linear regression modeling was used to assess the extent to which persisting group differences in total BSID language items score were explained by intervening factors. A summary of the results are shown in Table 8.5. Based on this analysis, the only intervening factor found to be significant was the total HOME score. After the inclusion of this factor in the model, the association between being born to a mother engaged in methadone maintenance treatment and differences in BSID language score was no longer significant.

Table 8.5: Summary of Linear Regression Analysis for Confounding and Intervening Factors Associated with BSID Language Score

| Variable | <i>B</i> | <i>SE B</i> | β | <i>p</i> |
|---|----------|-------------|---------|----------|
| Step 1-Unadjusted | | | | |
| Group status | 3.28 | .88 | .33 | <.0001 |
| $F(1,114) = 13.96, p = <.0001, R^2 = .11, \text{Adjusted } R^2 = .10$ | | | | |
| Step 2 –Adjusted for confounding factors | | | | |
| Group status | 2.04 | .90 | .21 | .025 |
| Benzodiazepines | -3.02 | 1.2 | -.23 | .014 |
| Gender | 3.55 | .81 | .36 | <.0001 |
| $F(3,112) = 14.34, p = <.0001, R^2 = .26, \text{Adjusted } R^2 = .28$ | | | | |
| Step 3-Adjusted for confounding and intervening factors | | | | |
| Group status | 1.06 | .94 | .11 | .26 |
| Home score | -1.38 | .46 | -.25 | .004 |
| $F(3,111) = 13.74, p = <.0001, R^2 = .33, \text{Adjusted } R^2 = .31$ | | | | |

When the indirect effects of methadone exposure were bootstrapped on BSID language scores, analysis suggested that the total HOME score was a significant intervening process in the relationship between the independent and dependent variables. The total indirect effects point estimate was .99 with 95% BCa bootstrap CI of .21 to 2.26 ($p = .05$).

The results of the parent report CSBS scores showed that parents of methadone-exposed children reported that the language skills of their children were less well developed than comparison children. These differences were partly explained

by controlling for maternal education and gender, however between group differences were still significant. Further analysis using linear regression modeling assessed the extent to which persisting group differences in total CSBS scores were explained by intervening factors. A summary of the results are shown in Table 8.6. Based on this analysis, the only intervening factor found to have borderline significance was the total number of stimulating experiences available to the child. After the inclusion of this variable in the model, the association between being born to a mother engaged in methadone maintenance treatment and CSBS language score was no longer significant.

Table 8.6: Summary of Linear Regression Analysis for Confounding and Intervening Factors Associated with CSBS Score

| Variable | <i>B</i> | <i>SE B</i> | β | <i>p</i> |
|--|----------|-------------|---------|----------|
| Step 1-Unadjusted | | | | |
| Group status | -.62 | .17 | .32 | .0001 |
| $F(1,114) = 13.24, p < .0001, R^2 = .10, \text{Adjusted } R^2 = .10$ | | | | |
| Step 2-Adjusted for confounding factors | | | | |
| Group status | -.39 | .19 | -.20 | .04 |
| Maternal Education | -.12 | .05 | -.23 | .02 |
| Gender | -.35 | .17 | -.18 | .04 |
| $F(3,112) = 8.06, p < .0001, R^2 = .18, \text{Adjusted } R^2 = .16$ | | | | |
| Step 3-Adjusted for confounding and intervening factors | | | | |
| Group status | -.31 | .19 | -.16 | .10 |
| N. stimulating experiences | -.03 | .02 | -.17 | .06 |
| $F(4,111) = 7.07, p < .0001, R^2 = .20, \text{Adjusted } R^2 = .17$ | | | | |

When the indirect effects of methadone exposure were bootstrapped on CSBS scores, analysis suggested that the number of experiences available to the child was a significant intervening factor in the relationship between the independent and dependent variables. The total indirect effects point estimate was $-.08$ with 95% *BCa* bootstrap *CI* of $-.24$ to $-.004$ ($p = .05$).

Conclusions

These results indicate that after the inclusion of intervening family and contextual processes in the model, the association between being born to a mother engaged in methadone maintenance treatment and differences in cognitive and communication development was no longer significant. The key intervening variables included total HOME score, use of background TV, frequency of stimulating experiences, caregiver disruption and foster care, caregiver use of psychological aggression and caregiver life stress score.

Further analysis suggested that the significant intervening effects of low HOME scores contributed to poor cognitive and language assessment outcomes. Poor cognitive outcomes were also significantly associated with increased use of background TV in the home and out-of-home care placement. Lower CSBS language scores were associated with less frequent stimulating experiences.

On the other hand, the between group differences seen in the number of requesting behaviours (IBR) of the ESCS showed a somewhat different association with other parenting and family variables to the cognitive and language measures. Analysis of the IBR results suggest that more frequent caregiver use of psychological

aggression was associated with increased use of requesting behaviours. Again, a disrupted family history was associated with poorer outcomes, with more changes of caregiver showing an association with increased use of requesting behaviours. A relationship between caregiver report of life stressors and fewer requesting behaviours was also shown, though this was an inverse relationship, showing more stress was associated with fewer IBR behaviours. These intervening influences are discussed further in chapter 9.

CHAPTER 9: DISCUSSION

Overview of Study Findings

The use of illicit drugs in pregnancy is a serious health and welfare problem with respect to a small, but significant number of women in New Zealand and beyond. Of additional concern is the health and well-being of their infants. Evidence suggests that the long-term outlook for children of drug-dependent mothers is poor, with many children needing later intervention from health, education, justice and social service systems (Advisory Council for the Misuse of Drugs, 2003; Australian National Council on Drugs, 2007; Hogan & Higgins, 2001). Regrettably, studies have been unable to disentangle the multiple influences of pre- and post-natal disadvantage. Thus, there is a critical need to study the progress of these children from conception through their early years, to identify those risk and protective factors that shape their later life course. This is of crucial importance both to these children and their families, but also to society, since the remediation of health, education and social problems, once they occur, entails substantial funding from multiple public budgets.

This study sought to shed light on the early developmental needs of these children by describing the cognitive and communication skills of a group of 60 Canterbury children born to mothers enrolled in methadone maintenance treatment alongside a regionally-representative comparison group of 60 children whose mothers were not engaged in methadone maintenance treatment. By measuring child outcomes at age 2, as well as infant clinical variables at term and the psychosocial environments in which children were growing up, this study has sought to examine the way in which

neonatal, social background, parent and family factors combined to put children at more or less risk during the important toddler years.

The Early Development of Children Born to Mothers Engaged in Methadone-Maintenance Treatment

Cognitive Development

A primary focus of this study was the cognitive, communication and language skills of these two groups at age 2 years. First, with respect to cognitive development, clear differences emerged between methadone-exposed and the comparison group. Children of mothers enrolled in methadone maintenance scored on average around 1SD lower and had higher rates of cognitive delay than children in the comparison group. It is also worth noting that the mean MDI score of the comparison group ($M = 92.35 \pm 16.99$) was somewhat below the standardised mean of 100 (± 15) for the BSID II. This highlights the importance of including a regionally-representative comparison group and basing delay classifications on this group, rather than population norms. The reason for the low comparison-group mean score is unclear, but it is consistent with a previous finding by this team with another group of randomly-selected Canterbury children (Woodward, et al., 2006).

In the last twenty years, five studies have also used the BSID to assess opiate- or methadone-exposed children as toddlers. Only one of these used the second edition of the BSID. The Maternal Lifestyle Study used the BSID-II to assess a group of 80 opiate-exposed children at age 2 and a much larger sociodemographically-matched, comparison group. They reported no between group differences, with both groups

obtaining mean MDI scores of 82 (Messinger, et al., 2004). Using the original BSID, two research groups found no significant between group differences in mean MDI scores between opiate- or methadone-exposed toddlers and sociodemographically-matched comparison children (Hans & Jeremy, 2001; Ornoy, et al., 1996). A fourth study by Hunt et al (2008) used the BSID to examine progress in methadone-exposed children at 18 months. The comparison group in this study was matched only for maternal age and ethnicity. They reported significantly lower mean MDI scores in the methadone-exposed group compared to the comparison group. The fifth study by van Baar and de Graaff (1994) examined the development of 35 methadone-exposed children and 35 randomly-selected comparison children and also found that methadone-exposed infants showed significantly poorer scores on the BSID at age 2, in comparison to the reference group.

To summarise these mixed findings from these five studies, it would appear that methadone-exposed and opiate-exposed children score poorly on the MDI of the Bayley Scales at age 2, but perhaps not significantly less well than comparison children, matched for social risk. Nevertheless, some of these studies have methodological concerns, including: sample attrition (Hans & Jeremy, 2001; Hunt, et al., 2008); small sample size (Hans & Jeremy, 2001) and retrospective research design (Ornoy, et al., 1996). Our study suggests that children born to mothers maintained on methadone during pregnancy show significant cognitive delay compared to their peers, which in itself is important, since most children were not receiving any early intervention services. However, this study did not use a comparison group matched for social risk.

Communication and language Development

A second important domain of development investigated by this study was communication and language. It was hypothesised that difficulties in this area might contribute to later learning and behavioural problems. The Early Social Communication Scales (ESCS) were used to assess children's non-verbal, communicative behaviours. In particular, two aspects of their communicative style were measured: first the frequency with which they engaged the examiner in joint attention (IJA): and secondly the frequency with which they communicated to the examiner a request for an object (IBR). Methadone-exposed children were found to use proportionately more requesting behaviours than comparison children, whilst comparison children used proportionately more joint attention behaviours. This disparity was also reflected in the mean numbers of IJA and IBR behaviours, though only between group differences in IBR behaviours reached statistical significance.

Bruner (1981) argues that toddlers have four, basic communicative intentions, which serve a crucial function in their interactions with others and in the development of language; of these, he highlights two – joint attention and requesting – for particular examination. Bruner's description of these two behaviours is similar to those identified in this study, through the framework of the ESCS, as IJA and IBR behaviours. These two behaviours were also examined by Wetherby, Cain, Yonclas and Walker (1988) in a sample of 15 typically-developing children at ages 13, 17 and 25 months, as well as a third category of communication bids, which were socially affiliative in function. The study used an assessment regime similar to the ESCS. They reported that nearly all children engaged in these three types of communicative bids. However, the proportions

of bids for each purpose changed as children grew older. At 25 months, 44% of bids were requesting (compared to 36% at 13 months), 46% were joint attention bids (compared to 49% at 13 months) and 10% were affiliative (compared to 16% at 13 months). Flanagan et al (1994) extended the research by Wetherby et al (1988) and examined the joint attention, requesting and affiliative communicative bids of 13 children of teenage mothers. As a group, these children made significantly more requesting bids than the typically-developing children of the same age, studied by Wetherby et al (1988). Flanagan et al (1994) also reported that children of mothers with less sensitive parenting styles made more requesting bids, than children with mothers who were more sensitive. Research using the ESCS with typically-developing children has found that more frequent joint attention bids were associated with more optimal social and behavioural competence at 30 months (Vaughan Van Hecke, et al., 2007) and accelerated language skills at 24 months (Mundy, et al., 2007). In addition, Vaughan Van Hecke et al (2007) have more recently suggested that IJA behaviours may also serve as a critical indicator of emotional development, reflecting the infant's growing capacity for socially-motivated, sharing of emotions between themselves and another social partner.

As noted in the introduction, there have been very few studies published, which have measured the early social communication behaviours of prenatally drug-exposed children. None has examined joint attention in methadone-exposed children.

Nevertheless with respect to drug exposure in general, Sheinkopf et al (2004) assessed a group of 30 cocaine-exposed children using the ESCS at ages 12, 15, and 18 months and then followed them up at age 36 months using teacher-reported measures of

behavioural adjustment. There was no comparison group. They found that joint attention behaviours (averaged across the three time points) negatively predicted behaviour problems at 36 months and average requesting behaviours positively predicted disruptive behaviours. Another study of 56 cocaine-exposed children by Claussen, Mundy, Mallik and Willoughby (2002), cocaine-exposed children, who also had disorganised attachments ($n=28$), used fewer joint attention behaviours at 18 months than other cocaine-exposed children with attachments that were not disorganised. Though evidence is scant, these few studies seem to suggest that when the communicative style of toddlers is assessed, high rates of joint attention bids are associated with positive outcomes, whereas frequent requesting bids, on the other hand, tend to predict poorer long-term outcomes. This pattern of low joint attention /high requesting behaviours and its association with greater developmental risk seems to be consistent with the findings of our study, where this pattern is more typical of children in the methadone-exposed group, than the comparison group.

In the context of the ESCS, the proportions of behaviours, which are joint attention and requesting, do not clearly replicate those reported by Wetherby et al (1988) – requesting behaviours were much more common in our study even in the comparison group. However, this may be a function of the assessment procedure used. Alternatively, this may be related to sample selection, the group described by Wetherby et al were volunteers who responded to an advert. No social background data is reported and there were only 15 children. Nonetheless, the results of this part of the assessment suggest that children born to mothers enrolled in methadone maintenance during pregnancy may be at risk of developing a style of communicating,

which may be perceived by others as demanding and disruptive. There is also some suggestion that they may also have more difficulty in expressing an affective response to their environment, which could also have longer-term negative consequences for a child's emotional and language development.

Measures of language, specifically the BSID language measure and the parent-reported Communication and Symbolic Behaviour Scale, were included to set in context the results from the ESCS and to establish whether the ESCS was measuring skills, other than language or cognitive skills. Statistical analysis showed that the ESCS results did not correlate with BSID language or CSBS scores, suggesting that at age 2, the ESCS scores possibly reflect more behavioural or emotional competence than vocabulary and other forms of language development. With regard to language, methadone-exposed children showed significantly poorer language development than comparison children on both the composite BSID language measure and the CSBS questionnaire. However, it is important to exercise some caution in the interpretation of the parent-report CSBS results, since Seagull, Mowery, Simpson, Robinson, Martier, Sokol et al (1996) noted that parents with drug or alcohol problems were significantly more likely than parents with no substance use problems to overestimate their child's ability at age 12 months. So whilst, there was a significant difference in language development, as reported by parents of methadone-exposed and comparison children using the CSBS, this may in fact underestimate the full extent of the language delay in methadone-exposed children.

This finding is largely consistent with other studies examining the language development of methadone-exposed children. Similarly to this study, Johnson, Diano

and Rosen (1984) compared the performance of methadone-exposed and comparison children on language items of the BSID and found methadone-exposed children acquired language skills later than demographically-matched, comparison children, when tested at 12 and 24 months, though this was not tested statistically. Van Baar (1990) also reported poorer language skills in 35 methadone-exposed children at age 2 years, compared to 35 randomly-selected comparison children. The effects of prenatal cocaine exposure on children's language development have been more frequently and recently examined than that of methadone, but the results of this research are mixed. Thus, three longitudinal studies found small, but significant differences in language performance in pre-school cocaine-exposed children, after controlling for social risk (Bandstra, Vogel, Morrow, Xue, & Anthony, 2004; Beeghly, et al., 2006; Lewis, et al., 2007), whilst two other studies reported no differences between matched-comparison and cocaine-exposed groups (Delaney-Black, Covington, Templin, Kershaw, Nordstrom-Klee, Ager et al., 2000; Kilbride, Castor, & Fuger, 2006). Thus further research is still required to examine the longer term progress of cocaine- and methadone-exposed children with regard to language development, especially in order to understand the pathways of influence.

Infant Clinical and Socio-familial Context at Term Age

Collectively the above findings suggest the presence of pervasive cognitive, language and communication difficulties in this group. However, the high-risk nature of this group of children and their families has been evident throughout this study. Thus, further investigation of the infant clinical characteristics at term, as well as the social and family environments into which children were born was important to

understand the role of these factors, in addition to prenatal methadone exposure, in determining the developmental outcomes of this group. This study used the infants' hospital records at delivery, as well as maternal interview data from the third trimester to identify factors that discriminated between the two groups and which might in turn influence developmental progress.

Infant Clinical Data

Study findings showed that infants born to women enrolled in methadone maintenance treatment during pregnancy were significantly smaller at birth than comparison group infants. Specifically as a group, they weighed less, were shorter and had smaller head circumferences. Similar results have been reported by other studies of methadone-exposed infants in New Zealand (Wouldes & Woodward, 2010) and internationally (Dryden, et al., 2009). In our study, there was no significant difference in gestational age between the methadone-exposed and comparison groups, although the methadone-exposed group were born on average slightly earlier at just under 38 weeks compared the non-exposed group, who were born at just over 38 weeks. The absence of any significant difference is perhaps not surprising since all children born \leq 32 weeks were excluded from the study as part of the initial selection criteria. Finally, the number of infants requiring treatment for NAS in this Christchurch sample was relatively high (84%), which presumably reflects a lower threshold for treatment in Christchurch than some other centres. However, rates of children treated are still within the 30-91% reported range for methadone-exposed infants requiring treatment described by Kuschel (2007).

Maternal Social Background and Family Characteristics

The data collected at term age also investigated the social context into which study children were born. Findings from the maternal interview in the third trimester suggested that infants of mothers enrolled in methadone maintenance treatment were born into family environments that were significantly disadvantaged. More methadone-maintained mothers were single, poorly educated, living on benefits and in rented accommodation than comparison mothers. This socio-demographic profile of mothers engaged in methadone maintenance treatment would appear to be similar to those reported elsewhere (Dryden, et al., 2009; Suchman, et al., 2006)

Years of maternal education was chosen as the key measure of socioeconomic risk for further analysis. Seventy nine percent of women enrolled in methadone maintenance treatment had no qualifications (equating to fewer than 11 years of education), compared to 27% of comparison mothers. This extremely high rate of academic failure amongst these women suggests that their learning and/or behavioural difficulties date from their own adolescence or earlier. Low levels of education have been commonly noted amongst drug-dependent women with several studies reporting that mothers enrolled in methadone maintenance treatment or drug-dependent women typically average around 11 years of education (Hans & Jeremy, 2001; Messinger, et al., 2004; Tyler, Howard, Espinosa, & Simpson Doakes, 1997).

Maternal Mental Health and Substance Use

Maternal interview data from late pregnancy revealed that women enrolled in methadone maintenance treatment were much more likely to be experiencing

depressive symptoms, as well as receiving treatment for other psychiatric problems, than women in the comparison group. Co-morbid affective disorders, particularly depression, have been found to be common in substance-dependent adults (Adamson, et al., 2006; Marsden, et al., 2000; Oei, et al., 2009; Peles, et al., 2007), with rates of co-morbidity being higher in women (Marsden, et al., 2000; Peles, et al., 2007). The prevalence of depression amongst comparison-group women was similar to other community samples (Pajulo, et al., 2001).

The maternal interview also revealed that many women, particularly those enrolled in methadone maintenance, were users of other substances in pregnancy, including other prescribed psychoactive medication. Mothers enrolled in methadone maintenance were prescribed significantly fewer anti-depressants, but more benzodiazepines, in pregnancy than comparison-group women. Lower use of prescribed anti-depressant medication (3%) seems out-of-line with measured rates of depression in this group (43%) and suggests perhaps that depression is under-diagnosed amongst these women.

With respect to non-prescribed but licit substances, tobacco use was highly prevalent in mothers engaged in methadone maintenance treatment with rates of tobacco smoking being similar to those commonly reported amongst women enrolled in methadone maintenance treatment (Choo, et al., 2004; Svikis, et al., 1997). This group of mothers also frequently used other illicit drugs, with 30% of women saying they had used an illicit substance in the previous month. Continued illicit drug use has also been frequently documented amongst pregnant methadone-maintained women, with studies reporting from 22% to 62% of these women using illicit drugs in addition

to methadone (Berghella, Lim, Hill, Cherpes, Chennat, & Kaltenbach, 2003; Crandall, et al., 2004; Jones, et al., 2008; McCarthy, et al., 2005). Only use of alcohol in the present study showed no differences across the two groups, with around 1 in 5 women from both groups reporting they had drunk some alcohol during their pregnancy.

Thus in summary, results from the term phase of this study confirmed previous research suggesting that at birth, infants born to mothers enrolled in methadone maintenance treatment during pregnancy are significantly disadvantaged compared to their peers whose mothers are not enrolled in methadone maintenance treatment. This raises the issue of the extent to which between group differences in cognitive and language outcomes might reflect either in part or in full the confounding effects of infant clinical and socio-familial factors correlated with methadone maintenance in pregnancy.

The Role of Confounding Factors in Explaining Between Group Differences and Developmental Outcome

Covariate analysis was undertaken with variables known to be, or hypothesised to be, associated with methadone exposure and cognitive and communication outcomes. Significant covariates seemed to fall into two groups. Four variables were significant confounders factors of the association between being born to a mother engaged in methadone maintenance treatment and cognitive and language scores. These included gestational age, gender, maternal education and exposure to benzodiazepines. On the other hand, prenatal exposure to tobacco was the only

significant confounder in the association between methadone exposure and joint attention outcomes. These findings will be discussed in turn.

First, the data suggested a significant confounding effect of gestational age on the relationship between being born to a mother maintained on methadone and MDI score. It is perhaps surprising that there was any effect of gestational age in our study since by excluding children born ≤ 32 weeks, the effects of early delivery were largely controlled for by the research design. However, gestational age was included as a variable in the regression analysis in order to make a thorough assessment of confounding effects, since there is clear evidence to suggest an association between early delivery and developmental difficulties (Bhutta, Cleves, Casey, Cradock, & Anand, 2002; Woodward, et al., 2006).

A second infant characteristic, which was associated with cognitive and language outcomes at age 2, was infant gender. In our study, boys scored less well than girls on the MDI, and on BSID language items and the CSBS. Studies of early cognitive and language development have commonly found an effect of gender, with boys doing less well than girls (Bornstein & Haynes, 1998; Locke, Ginsborg, & Peers, 2002). Studies of drug-exposed children have also in general found gender effects with boys underperforming in comparison to girls (Behnke, Eyler, et al., 2006; Lewis, et al., 2007). Some studies have reported an interaction effect between gender and drug exposure, suggesting that boys may be particularly susceptible to prenatal insult from drug-exposure (Bennett, Bendersky, & Lewis, 2002, 2008; Moe & Slinning, 2001). However, our data did not support this hypothesis.

A third confounder, which in part explained the association between being born to a mother maintained on methadone and MDI and CSBS language scores at age 2 was maternal education. The importance of maternal educational achievement in relation to children's cognitive development has recently been highlighted by data from the large-scale U.S. Comprehensive Child Development Program (Perry & Fantuzzo, 2010). It showed that the relationship between maternal educational achievement and pre-school cognitive development accounted for more variance than any other maternal or child characteristic examined.

Fourth, benzodiazepine use was a significant confounder of between group differences in BSID language scores. Other substances consumed in pregnancy have been independently associated with negative outcomes for infants, including low birth weight (Kashiwagi, et al., 2005; Kennare, et al., 2005; Laken, et al., 1997; Winklbaaur, et al., 2009), later cognitive and behavioural problems (Fried, et al., 1998; Huizink, 2009) and language delay (Lewis, et al., 2007; Lewis, Singer, Short, Minnes, Arendt, Weishampel et al., 2004). However, the effects of benzodiazepine use in pregnancy either in isolation or together with other drugs have not been widely examined. However, Berghella et al (2003) reported that women enrolled in methadone maintenance treatment, who also took benzodiazepines in pregnancy, had infants who tended to experience more NAS symptoms, as well as requiring longer NAS treatment.

In summary, there were significant confounders in the relationship between being born to a mother enrolled in methadone maintenance and cognitive and language outcomes at age 2. In all instances, these covariates, which included gestational age,

gender, maternal education and exposure to benzodiazepines attenuated the relationship between group and outcome, but significant between group differences remained. This suggests that infant clinical and family background factors in part explained the association between being born to a mother engaged in methadone maintenance treatment and cognitive and language development, nevertheless significant between group differences remained.

In contrast, the only covariate found to significantly contribute to the relationship between methadone-exposure and any of the joint attention measures was prenatal exposure to tobacco. Analysis revealed that differences between methadone-exposed and comparison children in the ratio of IBR to IJA use were explained by tobacco use. Research examining non-verbal communication, and more specifically joint attention, and the confounding effects of other prenatal exposure is lacking. Typically, studies of children's joint attention ability have not included an analysis of confounding factors. One exception to this was a study by Vaughan Van Hecke et al (2007), which examined the associations between joint attention at 12 months and later social competence, after adjustment for the confounding effects of maternal education and gender. They noted that maternal education did not play a 'substantial role' in the predictive association between joint attention and social competence in typically-developing children. Our data suggested that maternal education had no confounding effect on the relationship between prenatal methadone exposure and ESCS measures and this result, therefore, appears to support the findings of Vaughan Van Hecke et al.

Most studies, which have used the ESCS to measure joint attention have found no significant gender differences in outcomes (Mundy, Delgado, Block, Venezia,

Hogan, & Seibert, 2003; Mundy & Gomes, 1998). In an exception to this, Vaughan Van Hecke et al (2007) and Mundy et al (2007) reported some differences, with boys displaying fewer IBR bids and girls displaying somewhat more IJA eye contact at 9 months. However, our study found no significant gender differences in any of the ESCS scores and thus seems to confirm the more frequent finding of research using this measure.

In summary, analysis of confounding factors suggested that with regard to one ESCS outcome measure, the ratio of IBR to IJA behaviours, between group differences were explained by the covariate effects of prenatal tobacco use. Otherwise control for confounding factors did not appear to have an impact on between group differences in joint attention measures.

To conclude, covariate analysis of outcome measures at age 2 proved largely to be robust to control for the confounding effects of infant characteristics and family context at birth. Gestational age, gender, maternal education and exposure to benzodiazepines explained in part the association between being born to a mother enrolled in methadone maintenance and outcome measures at age 2 years, but nevertheless significant differences between methadone-exposed and comparison children remained. However, the differing family environments in which children were raised over the following 18 months would also have an important intervening influence on children's progress. The subsequent phase of the research was to identify the important differences in family environment which might affect children's progress and lead in due course to diverging developmental trajectories.

Family Environment and Parenting Practices at Age 18-months

Data, regarding the family context and parenting practices to which children in the study were exposed, were gathered by interview and observation at home at age 18 months. Results included detail of children's family placement, caregiver mental health and substance use, family functioning and parenting practices. These will be discussed briefly in turn.

Family Placement

In our study, 18% of methadone-exposed and no comparison children were living with other caregivers by age 18 months. Internationally, studies of substance-exposed children vary widely in terms of numbers of study participants who are raised by their biological parents, as opposed to being moved to an out-of-home placement. This likely reflects variability in national policies with regard to assessments of risk and use of out-of-home care. Thus, at one extreme, a Norwegian study noted that 85% of a group of 78 substance-exposed children were moved into foster care by age 3 (Moe & Slinning, 2001). In contrast, an Australian study followed up 119 prenatally opiate and/or amphetamine-exposed children and a demographically-matched group of non-exposed infants (McGlade, Ware, & Crawford, 2009). At a mean age of 49 months, 24% of drug-exposed infants had entered foster care compared to 2% of the comparison group. Data from our research suggest that NZ practice is more in line with Australian child protection services, rather than those in Norway.

Despite the relatively high proportion of methadone-exposed children growing up in out-of-home care, this group of children as a whole were on average still living in

socio-economic adversity, with a welfare-dependent, single parent. Similar family circumstances amongst methadone-maintained or opiate-using mothers are described by Suchman et al (2006) and Powis et al (2000).

Continuing Substance Use

As observed at the term interview, smoking was still very common amongst parents of methadone-exposed children. Alcohol use had increased from pregnancy levels in both groups, but was significantly more common amongst comparison-group parents. Nearly half the parents of methadone-exposed children continued to use other illicit substances, mostly cannabis, whilst less than 1 in 10 parents from the comparison group were illicit substance users. Continued illicit drug use by 36% of mothers receiving prescribed methadone was reported by Powis et al (2000). Barnard and McKeganey (2004) noted that during periods of relative stability parental drug use may have a minimal impact on children, but that escalating and uncontrolled drug use can quickly undermine household stability, suggesting that continued illicit drug use can quickly escalate, suggesting parental drug use is always an indicator of risk, if not a major problem for children all the time.

Parent Stress

Interview results revealed that women engaged in methadone maintenance treatment reported more frequent major problems in their lives than caregivers of comparison-group children. These were most often related to economic stressors and to relationship difficulties. Drug-dependent mothers have been shown to experience high levels of stress, compared to non-drug-dependent mothers (Kelley, 1992, 1998).

Suchman and Luthar (2001) proposed that socio-economic risk and psychological maladjustment function as 'distal' stressors, which attenuate the ability of methadone-maintained women to tolerate stress. Results from the Edinburgh Depression Scale indicated that depression continued to be a problem for many parents of methadone-exposed toddlers, which as noted earlier is common amongst substance-dependent adults (page 9-162). Thus, these findings suggested that more mothers of methadone-exposed children were parenting their toddlers whilst themselves managing symptoms of depression and stress, than comparison parents. As noted above, more women from this group were also single, so had less support coping with the needs of a toddler and as shall be seen, those who had partners were more likely to be in a relationship with a partner who himself engaged in deviant or drug-using behaviour.

Partner Relationships

Married or cohabiting mothers of methadone-exposed toddlers reported that their partners were more frequently engaged in undesirable behaviours which included criminality and illicit drug use, than partners of comparison-group women. High rates of partner involvement in drug use have been reported elsewhere amongst drug-dependent women (Tuten, et al., 2004; Whitaker, et al., 2006). Nevertheless in our study, partner-perpetrated violence was not more common amongst caregivers of methadone-exposed children compared to non-exposed children. Minnes et al (2008) reported around 66% of cocaine-dependent women described moderate to severe violence from partners, though it is not clear whether this occurred in the previous year or at any point in the relationship. In our sample, 14% of married or cohabiting mothers of methadone-exposed toddlers reported any partner violence over the last 12

months. It could be that in our sample, women were more reluctant to be open about domestic violence. However, when asked about all adult relationships, nearly half the parents of methadone-maintained toddlers were the victims of some violence in the preceding year, as opposed to comparison parents of whom less than 1 in 10 reported any violence from any adult towards them. Anecdotally, women reported having been in violent conflicts with siblings, ex-partners and neighbours. Verbal abuse was also reported by nearly all the parents of methadone-maintained toddlers, compared to three quarters of comparison parents. This suggests that verbal abuse and violence are frequent occurrences in the households of toddlers born to mothers enrolled in methadone maintenance.

Child Care Contexts

At age 18 months, children born to mothers enrolled in methadone maintenance treatment were as likely to be attending a paid-for childcare service as children from the comparison group. At home however, methadone-exposed children were involved in fewer stimulating activities than their comparison peers. To some extent, this could be explained by economic factors, with more expensive activities being engaged in significantly less often by families of methadone-exposed toddlers. Nevertheless, the fact that around 10% of parents of methadone-exposed toddlers reported playing or reading with their child less than once a month, compared to 2% of comparison parents, suggests that these parents were either unaware of their children's needs or unable to meet them for some reason. Better-educated parents have been shown to be more likely to engage their children in more stimulating experiences than less well-educated parents (Bianchi & Robinson, 1997; Kiernan & Huerta, 2008; Silva

& Fergusson, 1976). Thus in our study, one possible explanation is that as a less well-educated group, parents of methadone-exposed children would be less likely to involve their children in as many stimulating activities as comparison parents.

Parents of children born to mothers enrolled in methadone maintenance also reported that the TV was switched on in their houses for more hours per day than comparison parents. About 40% of the homes of methadone-exposed children and 10% the homes of comparison children had the TV on for more than 10 hours a day. On the other hand, there was no between group difference in the number of hours children were reported as watching TV. In this study, the children watched around 45-60 minutes of TV per day. These levels were somewhat lower than U.S. children, who were reported to watch around 2 hours of TV per day at 20 months (Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004).

Chapter 7 outlined the results of the HOME scale (Caldwell & Bradley, 1984), which suggested that, in many respects, the home environments of children born to mothers enrolled in methadone maintenance treatment were less child-centred and were less likely to be promoting child well-being, compared to the home environments of comparison children. Parents of methadone-exposed children were characterised by being less responsive and less involved with their children. They were also less accepting of their children's needs. In addition, they were less able to structure family time around them.

The HOME scale has been widely used to measure the early home environments of drug-exposed children, though not with the families of methadone-exposed children. It was used by the Maternal Lifestyles Study (MLS) to measure the

family environments of children prenatally exposed to opiates, when they were age 10 months (Messinger, et al., 2004). The MLS study found 98 households of opiate-exposed children scored higher on the HOME scale, than 1129 households of children not exposed to opiates, though the mean total score of the opiate-exposed children was the same as our study (35 points). It should be noted that 522 of the comparison group children in the MLS were born to mothers using cocaine in pregnancy, so clearly the comparison children were also from highly disadvantaged households. Similarly, Singer et al (2002) did not find that the HOME distinguished between 218 homes of cocaine-exposed children and 197 matched high-risk comparison homes (mean scores for both groups were <29). However, other studies have found significant differences between the homes of drug-dependent parents and non-drug-dependent parents. Brown et al (2004) compared 34 homes of cocaine-exposed children, with 49 foster homes of cocaine-exposed children and 63 comparison homes when the children were aged 18 months. They found a significant difference between the caregiving environments of cocaine-exposed children raised by their biological parents, compared to the environments of cocaine-exposed children raised by foster parents. The households of foster parents achieved higher HOME scores than biological parents.

The implications from the studies above are somewhat difficult to relate to findings from this study, since data regarding families of methadone-maintained mothers is lacking. It could be hypothesised that children of mothers in drug treatment (i.e. methadone maintenance) might be somewhat less at risk than children of cocaine- or opiate-dependent parents who are not engaged in treatment. However, it would appear from the MLS study and from Singer et al that drug-using parents raise their

children in environments which are not dissimilar from other non-drug-using, but disadvantaged families with often no clear differences on the HOME scale detectable. However, evidence suggests that children from less deprived backgrounds score significantly better on the HOME scale. Data from our study would support these findings.

Discipline

In terms of the use of discipline and physical punishment, results from the Conflict Tactics Scales: Parent-Child Form suggested that caregivers of methadone-exposed children reported using significantly more psychologically aggressive tactics when disciplining their children. They more often shouted and yelled, or threatened their children with punishments which they failed to carry out. Drug-dependent parents in other studies have been identified as being at risk for communicating with their children in ways which are less optimal. For example, in a small study, Salo, Politi, Tupola, Biringen, Kalland, Halmesmäki et al (2010) found that opiate-dependent mothers were significantly more intrusive and less structuring and sensitive, than mothers from either depressed or comparison group mothers. Das Eiden (2001) reported that cocaine-using mothers and their infants at age 2-months were more likely to display higher dyadic conflict. The cocaine-using mothers used more negative remarks and criticisms and the infants, in turn, appeared more distressed and angry. Johnson et al (2002) also reported that cocaine-using mothers were more hostile and intrusive in interaction with their cocaine-exposed preschoolers at age 3 years.

Study findings also revealed that parents of methadone-exposed toddlers reported that they were also more likely to smack their children than comparison parents, but rates of more severe physical punishment were similar across both groups. Hien and Honeyman (2000) also found that drug-using (mostly cocaine-using) mothers used more aggressive and physical discipline with their children, than low-income comparison parents. In this way, the results of our study, with mothers of methadone-exposed children also characterising their own parenting as being more aggressive, seem to corroborate existing research.

In summary, results from the caregiver interview and home observation at 18 months largely confirm existing research which has described the family functioning and parenting practices of drug-dependent parents. As can be seen however, the parents of *methadone-exposed* children have not often been followed up specifically as a group and therefore these findings extend the existing literature with regard to this population. In general, results suggest that early adversity continued for these children and their families, with more frequent caregiver disruption, economic disadvantage, higher rates of parental depression and continued parental drug use. Families of methadone-exposed children were more often stressed and had higher rates of conflict and aggression than comparison families. Caregivers of methadone-exposed children also engaged their toddlers in fewer stimulating experiences, were less child-centred and used more aggressive discipline than comparison-group caregivers.

The Role of Parenting and Family Factors in Explaining Between Group Differences and Developmental Outcomes at Age 2 Years.

In light of the above results which suggest that children born to mothers enrolled in methadone maintenance treatment were raised in circumstances of more disadvantage than comparison children, this raises the possibility that some of the observed differences in children's outcomes at age 2 years, may well reflect these different child-rearing contexts. Examination of these data suggested that family context and the quality of parenting significantly influenced children's cognitive and communicative development. Collectively, these variables suggested that methadone-exposed children were less likely to have a stable relationship with their primary caregivers and their emotional and learning needs as toddlers were less likely to be met. They were growing up in home environments, which were more often violent, noisy, distracting and lacking in appropriate stimulation for young children and where their needs were either poorly understood and/or not prioritised. Furthermore the parents of methadone-exposed children were more likely to use an aggressive parenting style and be themselves experiencing greater stress. Across all the developmental outcomes studied, findings suggested that family context and the quality of the home environment wholly or partly explained between group differences. These intervening influences will be examined in more detail in turn.

Home Environments

First, the HOME scale scores showed a strong relationship with MDI scores and the BSID language items scores. This suggests that home environments which, on

many levels, were less optimal for young children – environments were less responsive, less sensitive, less stimulating and indeed less safe – had a significant negative influence on cognitive and language performance at age 2 years and in part accounted for the poorer scores obtained by methadone-exposed children. This is consistent with previous research which has found that higher HOME scores were associated with higher MDI scores at age 2 (Brown, et al., 2004; Singer, Arendt, Minnes, Farkas, Salvator, Kirchner et al., 2002) and better WISC III results at age 7 (Arendt, Short, Singer, Minnes, Hewitt, Flynn et al., 2004), though not BSID scores at 6 months (Howard, et al., 1995) amongst families of children prenatally-exposed to cocaine.

Whilst total HOME scores correlated with measures of social risk, social risk did not significantly predict MDI scores. This would suggest that the HOME scale measures more than social risk and implies that more involved, child-centred and responsive parenting is associated with higher MDI scores. Further investigation is required to identify more closely which aspects of the home environment account for these developmental differences.

Caregiver Changes

The second important pathway between being born to a mother enrolled in methadone maintenance treatment and MDI scores was the care status of the child. Methadone-exposure was associated with an increased risk of an out-of-home placement by age 18-months, which in turn was associated with poorer MDI score. Developmental delay in children in foster care is common (Leslie, Gordon, Ganger, &

Gist, 2002; Reams, 1999). Moe and Slinning (2002) examined the developmental progress of 57 Norwegian substance-exposed children, most of whom were in foster care and 47 non-exposed children at ages 1, 2 and 3 years using the BSID-II. Moe and Slinning found that at all three ages substance-exposed children did significantly less well on the MDI than non-exposed children. There was also evidence of a developmental 'catch-up' over the three years for the substance-exposed children, who were living with specially-trained and supported foster parents. It would seem reasonable to hypothesise that the disruption for children of having to make a new relationship with another caregiver in their first 18 months, as well as the presumably inadequate quality of caregiving they were exposed to in their families of origin, may well have an early adverse effect on development. This may, over time, be attenuated by an optimised caregiving environment in foster placement.

Similarly, more frequent changes in caregiver explained in part the association between children born to mothers engaged in methadone maintenance treatment and increased use of requesting behaviours. Bada et al (2008) reported that unpredictability in living circumstances contributed to more behaviour problems in cocaine- and/or opiate-exposed children at age 3 years. It may be that changes in communicative style is one pathway through which caregiver instability affects longer term changes in children's behaviour, shaping it towards being more demanding and as a consequence, towards poorer adaptive functioning.

The Role of Television

A third significant intervening influence in the relationship between being methadone-exposed or non-exposed and MDI scores, was the number of hours that TV was on in the home. This variable was the least significant in the regression model. However, children who were exposed to more hours of TV at home, scored less well on the MDI, though no such relationship existed between parent reports of time spent *watching* TV and developmental outcome.

Recent research has investigated this issue under experimental conditions. Kirkorian, Pempek, Murphy, Schmidt and Anderson (2009) and Schmidt, Pempek, Kirkorian, Lund and Anderson (2008) reported that children at 12, 24 and 36 months showed disrupted and shorter play episodes, whilst playing in a room with a TV running in the background. In addition, they found that the quality and quantity of parent interactions were also compromised under the same conditions. Parents were less verbally interactive with their children in the presence of TV and their utterances were more passive and less attentive or responsive.

It may be then that chronic exposure to background TV for very young children may have a disruptive influence on the development of sustained attention. Visual or auditory changes occur every approximately every six seconds in TV programming (Schmitt, Anderson, & Collins, 1999). These frequently occurring novel auditory and visual stimuli may initiate repeated orienting reactions, constantly disrupting children's play. Further qualifying these findings, Barr, Lauricella, Zack and Calvert (2010) found no adverse effects for young children when watching appropriate

programmes designed for their age group, but on the other hand, heavy exposure to adult-directed programming was linked to cognitive deficits.

Furthermore, as well as direct effects on children, as Kirkorian et al (2009) suggest, background TV may have an indirect effect on children via changes in parental behaviour. Evidence suggests that parent contingent responsiveness and verbal stimulation promotes social, cognitive and language development (Tamis-LeMonda, Bornstein, Baumwell, & Damast, 1996). Thus, background TV may have a long-term adverse effect on parent-child engagement and thus a deleterious effect on learning.

Opportunities for Learning

The fourth factor, which explained in part the relationship between being born to a mother engaged in methadone maintenance treatment and language development specifically, was the frequency with which parents reported that children were involved in stimulating experiences. Children in the methadone-exposed group were involved in significantly fewer experiences, than their comparison peers. This in part explained the between group difference in scores on the Communication and Symbolic Behaviour Scale parent report measure. As Hsin (2009) pointed out, joint activities offer parents the opportunity to engage with children in verbal interaction which may promote their language development. It may be that children with parents who understand the need to stimulate them by offering them varied experiences, also appreciate the need to engage them in verbal interaction.

Aggressive Discipline

Specifically with regard to the development of children's joint attention behaviours, the pathway between being born to a mother engaged in methadone maintenance treatment and children's use of more requesting behaviours seemed to be influenced by elevated rates of aggressive parenting and parent stress levels. As described earlier, the lower IJA/higher IBR profile seen in the methadone-exposed cohort would appear to be associated with some longer-term developmental risk (Vaughan Van Hecke, et al., 2007). Thus, the developmental pathways underlying these behavioural differences are of interest.

As noted earlier, results from the Conflict Tactics Scales: Parent-Child Form suggested that caregivers of methadone-exposed children reported using significantly more psychologically-aggressive disciplinary tactics. Analysis revealed that this use of psychological aggression intervened in the relationship between group status and children's use of requesting behaviours. As Sheinkopf et al (2004) point out, frequent requesting (IBR) behaviours in this context may reflect in children an impulsive, reward-seeking or demanding behavioural style, which as they found, may later be associated with more behaviour problems. Our results suggest that the tendency of methadone-exposed children to use more requesting or demand-type communications with an examiner during the ESCS was explained in part by the increased use of frequent verbally-aggressive communications by caregivers towards them. A causal pathway, which links being born to a mother maintained on methadone with more aggressive parenting, that is in turn associated with children's use of more requests or demands, is interesting.

There appear to be no published studies, which investigate the association between an aggressive parenting style and increased request or demand-type communications in young children. As noted previously, Flanagan et al (1994) reported that teenage mothers, who scored less well on measures of maternal sensitivity, were more likely to have infants who made more requesting or demanding communications at 9-12 months of age. Claussen et al (2002) reported fewer requesting and joint attention behaviours in cocaine-exposed children with disorganised attachments compared to securely-attached, cocaine-exposed infants, but they noted requesting behaviours increased from 12 to 18 months, whereas joint attention behaviours decreased over the same period in the disorganised group. They concluded that less optimal parenting is associated with a decline in joint attention behaviours in the second year of life. Mundy and Acra (2006) proposed further that the infant's sharing of affective experiences through joint attention is rewarded through contingent responding, which if compromised, results in less frequent joint attention behaviours. It may be that if children's needs for affective engagement are not met by responsive parenting, some children, as an alternative way of satisfying their needs, resort to greater use of requests and demands. This then sets them on a path towards patterns of behaviour, which become less socially acceptable, as they get older.

The Influence of Parent Stress

One of the unexpected findings of this study was that infants of women who reported greater levels of stress at 18 months demonstrated fewer requesting communications during the ESCS. This was a surprise since women engaged in methadone maintenance treatment reported high caregiver stress more frequently and

methadone-exposed children typically used more requesting behaviours, as has been described. The association between parent report of more stress and fewer requesting behaviours is somewhat difficult to interpret, but may suggest that children of parents who are more stressed initiate fewer bids altogether, whether those bids are joint attention or requesting bids. There is some evidence in the data also for a trend towards children who have more stressed parents, making fewer IJA bids, though the correlation was not significant ($r=-.13$).

One possible explanation of this behaviour could be that parents who were very stressed were less able to respond at all to their children and thus both IJA and IBR bids declined and these children communicated less in general. On the other hand, the relationship between maternal mental states and parenting is not always predictable. Henderson and Donahue Jennings (2003), for example, compared the ability of 69 depressed and 63 comparison mothers to engage in joint attention during a playroom snack task with their toddlers. Results showed a trend towards women with depression engaging in less joint attention with their toddlers, but the differences were not significant. Moreover, they reported that women with depression and a comorbid anxiety disorder, were as able as the non-depressed comparison group to engage in joint attention: despite the women in the comorbid group reporting more psychological distress than the depression-only group. Henderson and Jennings hypothesised that women with a comorbid diagnosis showed a different interpersonal style to those with depression only. They reported that expression of affect partially mediated the relationship between diagnostic status and joint attention. Mothers in the comorbid group showed relatively higher levels of positive affect than women in the depression-

only group. They note that joint attention requires not only the ability to co-ordinate attention, but also the capacity to share affective experience. It may be that the expression of affect has a protective effect on parental ability to engage in joint attention, even when parents are depressed. This may help to explain the results of our study. Women, who were prepared to acknowledge greater stress, possibly were able to express affect more openly, and be more responsive to the affective communications of their children. Children's greater ability to communicate joint attention bids may reduce children's tendencies to make as many requesting-type communications.

Thus, the analysis suggested that intervening factors explained the observed association between being born to a mother maintained on methadone during pregnancy and cognitive and communicative development at age 2 years. The analysis suggests that elevated rates of cognitive and language delay and differences in joint attention behaviours appear to reflect a less optimal family background and child-rearing environment which is more common among families where mothers are in treatment for opiate-dependency during pregnancy. These results are generally consistent with previous research in this field, which suggests that the psychosocial environment of drug-exposed children is often highly disadvantaged and that this in turn is associated with later developmental problems.

Theoretical implications

This study aimed to compare the development of cognition and communication in a group of toddlers born to mothers maintained on methadone during pregnancy with the development of a group of typically-developing children from the same

region. Results showed clear delay in cognitive and language development and significant behavioural differences in the communicative style of methadone-exposed children. On closer examination, it was shown that the association between being born to a mother engaged in methadone maintenance and cognitive, language and early social communication outcomes may arise by pathways which include family stability; family functioning and parenting practices. This further raises the question for this field of research, as to how these factors combine to perpetuate on-going difficulties for methadone-exposed children. Suchman et al suggest the challenge for this field is to:-

‘move beyond the simple identification of psychosocial correlates of maladaptive parenting, (for example, drug use or psychopathology) applying more complex developmental frameworks to understanding the underlying mechanisms linking psychosocial factors with maladaptive parenting’
(Suchman, et al., 2005, pg. 440).

Indeed, beyond this, there is also a need to understand more closely the mechanisms linking aspects of non-optimal parenting to negative outcomes in children. The findings of this study may contribute to developmental theory, by adding detail to a transactional model of development (Sameroff, 1975).

As a number of authors have pointed out, the development of language, cognition and emotion have in the past been examined separately, but increasingly the boundaries between these areas of interest are weakening, as the interrelatedness of these developmental domains becomes apparent (Bloom & Tinker, 2001; Greenspan & Shanker, 2007). In order for infants to be able to process new stimuli, their first task is

to moderate their arousal and achieve state regulation. This begins with learning to stabilise physiological functioning, but progresses through the early years, as the infant also gradually learns to sustain attentional and affective regulation. This on-going process provides the foundation on which the infant can build cognitive and communicative development.

This model conceptualises self-regulation in infancy as a feature of the dyadic relationship between infant and mother; in which patterns of reciprocal affect-signalling play a fundamental role (Barwick, Cohen, Horodezky, & Lojkasek, 2004; NICHD Early Child Care Research Network, 2004). For a number of reasons, the negotiation of these early co-regulated tasks may be less smooth for children born to mothers enrolled in methadone maintenance treatment.

First, drug-dependent women may be more likely to experience difficulties regulating affect themselves. Drug use has been conceptualised, as an attempt by users to manage their own dysregulated affect, through 'self-medication' with illicit substances (Khantzian, 1997). Opiate dependence has also been found to be highly comorbid with other mental health problems, particularly depression and personality disorder (Adamson, et al., 2006; Marsden, et al., 2000). These psychopathologies in themselves are also associated with problems in managing affect and emotional regulation (Kornør & Nordvik, 2007). Thus as parents, it is likely that drug-dependent adults will have difficulty dealing with their own affect, and as a consequence that of their children. In addition, the physiological effects of prescribed methadone and continued illicit drug use on the brain will also be to diminish the concurrent ability of parents to accurately observe and be responsive to their infants (Dawe, et al., 2000).

Furthermore, the result of multiple environment stressors, including – as this research has found – poverty, poor housing, low educational attainment, lack of family support, poor health, dysfunctional relationships all serve to compound the challenge for mothers maintained on methadone to be emotionally available to their infants. Thus as a partner in the important process of establishing emotional synchrony with an infant, mothers enrolled in methadone maintenance treatment face a huge task for which they are often ill-equipped.

However, it is not only the mothers who face difficulties here. Infants exposed to the physiological effects of opiates in utero are at risk for: autonomic over-reactivity and cerebral irritation (Oei & Lui, 2007); gastro-intestinal disturbance (Kuschel, 2007); and altered sleep patterns (Hanft, Burnham, Goodlin-Jones, & Anders, 2006). In our study, 84% of methadone-exposed infants required treatment for NAS, pointing to high levels of observed clinical symptoms in this Christchurch group. Infants were being treated with morphine for NAS for an average of 10½ weeks, with 25% of methadone-exposed children being treated for more than 14 weeks. For the first few months then, infants suffer from both the effects of the symptoms of NAS and the effects of the treatment. Face-to-face interactions emerge between mother and child as early as 8 weeks and begin to facilitate the transformation from mutual- to self-regulation for the infant (Feldman, Greenbaum, & Yirmiya, 1999; Trevarthen & Aitken, 2001). Thus, the short-term effects of neonatal abstinence syndrome may additionally hinder the process of establishing reciprocity in the dyad over the first weeks, predisposing the mother and infant pair to greater risk of longer-term negative consequences.

As infants grow up, a lack of reciprocity in affect signalling with their mother may have implications for the attachment relationship. Goodman et al (2005) proposed that mothers enrolled in methadone maintenance were less attentive to their infants, which led to an avoidant attachment, which in turn resulted in the mother feeling rejected by the infant and so on, reinforcing the cycle of communication difficulties. A transactional pattern of this kind may well give rise to increased hostility, which has been identified by a number of authors as being of significance in the early interactions between at risk mother and child dyads and predictive of later negative outcomes, (Hien & Honeyman, 2000; Lyons-Ruth, Yellin, Melnick, & Atwood, 2005; Sokolowski, et al., 2007). The mothers in our study reported that they interacted with their children with greater anger and aggression. Aber, Belsky, Slade, and Crnic (1999) reported that maternal levels of anger typically increase when children are aged between 15 and 28 months and peak at around 21 months, which is the point at which mothers in our study were interviewed. Suchman et al (2005) noted that 87% of mothers maintained on methadone in their study felt no cohesion or closeness with their children.

Further elaborating this model of non-optimal patterns of affect signalling in substance-use-affected dyads, Söderström & Skårderud, (2009) proposed that the parenting problems experienced by substance-dependent mothers can be conceptualised as difficulties with mentalising, that is envisioning the mental state of their infants. If parents lack the skills to understand and empathise with their children's emotions then, they are less likely to be able to respond appropriately. This would affect the relationship at both a micro level in the subtleties of affective exchanges, as

well as more broadly, in terms of what the mother provides for her child. For example, it may explain the lower scores of families of methadone-exposed children seen in our study on the HOME scale and in differences in parents' preparedness to provide children with stimulating experiences. Most seriously, this inability to understand the child's perspective has been linked to an elevated risk of child maltreatment (de Paúl, Pérez-Albéniz, Guibert, Asla, & Ormaechea, 2008).

It may be then, that problems with parent mindfulness, reciprocal affect signalling, resultant difficulty in maintaining state regulation may to some extent underlie the developmental delay that has been seen in methadone-exposed children in our study. Progress in cognitive and communication skills takes place within a social context for young children and if reciprocity is maladaptive, the effects on development will be far-reaching. On the other hand, Feldman (1999) noted that highly-arousing, affective interactions are laden with social and cognitive information. Language learning begins through "acts of expression", as children use first glances, gestures and then words, to articulate what they have in mind. As they communicate with others, they begin to learn self/other differentiation, the foundations of cause and effect and the building blocks of cognitive processing (Greenspan & Shanker, 2007). Thus, mismatched patterns of communication may result in the cognitive and language delay seen in methadone-exposed children in his study. By the end of the first year, joint attention too plays a key role in building social competence and children's understanding of their own and others' mental states (Charman, Baron-Cohen, Swettenham, Baird, Cox, & Drew, 2000). Aureli and Presaghi (2010) described the complex patterning of first mother-regulated, affect-sharing joint attention that unfolds

into more symmetrical patterning of shared affect over the infant's second year. If early bids for joint attention are not understood or attended to, then arguably the frequency of joint attention bids may decline, and, it would appear from our research, that requesting bids may increase. These requesting bids are less emotionally laden and could be easier for parents to interpret (Mundy, et al., 1996; Vaughan Van Hecke, et al., 2007). As requests are more successfully responded to than affect sharing bids, they become reinforced and may be shaped into demands, contributing in due course to higher risk of behaviour problems.

Thus, the findings of this research contribute to the understanding of early developmental pathways of at risk children. It can also be argued that these results lend support a transactional model of development, where the reciprocity of mother-child interaction is key. Further coding and examination of the interactional observation of these mother-child dyads at 18 months will be important in building on these results, allowing for a better understanding of this process.

Limitations

The issue of whether being born to a mother engaged in methadone maintenance in pregnancy contributes to children's later developmental vulnerability raises a set of very complex and difficult to test questions (Glantz & Chambers, 2006; Jacobson & Jacobson, 2005). This study has attempted to address some of the methodological problems inherent in this research field. The strengths of this research are in its prospective, longitudinal design, excellent recruitment and retention and wide-ranging measures of environmental and contextual variables. Nevertheless, the

study has a number of limitations, which should be noted. Some of these have already been reported in the text, but there are more general issues with regard to the design and completion of the study, which will be discussed in turn. These caveats relate to recruitment, measurement, and possible inadequate control for confounders.

Recruitment

As this thesis has shown, mothers engaged in methadone maintenance live in acutely compromised circumstances. The research nurse charged with recruitment of methadone-maintained women to this study successfully engaged 84% of all eligible women. Given the hard-to-reach nature of this group of women, this is an extremely high percentage of the total population and increases the confidence with which we can generalise from the results. Nevertheless, it is possible, that the 16% of women who were not recruited, were even more disadvantaged than those who were recruited, thus developmental outcomes reported might have been worse, if their children had also been included.

Before this PhD study had begun, consideration had been given to the choice of appropriate comparison group for this study. The strategy adopted was to use a comparison group which reflected a cross-section of randomly-selected children from the same city and surrounding rural area from which the methadone group was also drawn. By contrast, some international studies of opiate-exposed children have used a comparison group matched for socio-economic status (Hans & Jeremy, 2001; Messinger, et al., 2004; Ornoy, et al., 1996). The option to recruit a cross-sectional comparison group was favoured here, since it was possible to statistically control for

social class and other confounders. Such is the extent of the adversity faced by the group of women engaged in methadone maintenance treatment, it would not have been possible to match a comparison group for all possible confounders, e.g. other substance use, other mental health problems etc.

Finally, with respect to recruitment, it should also be noted that both groups of women were recruited from a Christchurch hospital and results may not be generalisable to other parts of New Zealand or indeed other parts of the world. The women recruited from the group engaged in methadone maintenance treatment were receiving good quality, multi-disciplinary care, involving specialists in drug dependency, as well as midwifery and obstetric care. This level of support is not available to all pregnant women maintained on methadone in all parts of New Zealand. Thus again, developmental outcomes should be considered in light of this.

Measurement

First, much of the parenting data included in this analysis from the 18-month interview were gathered by self-report. It could be argued that some measures may have been more affected by biased reporting than others. Data may have been compromised by parental concerns about being reported to child protection services or welfare benefit agencies.

With regard to maternal drug use in pregnancy, Ford Tappin, Schluter and Wild (1997) showed that maternal report of tobacco smoking can be unreliable in pregnancy. In a Canterbury study, Ford et al found that 22% of pregnant women reported not smoking, when biochemical analysis confirmed that they had been.

Arguably, there would be even more reason to underreport use of illicit drugs, especially during pregnancy. Bauer et al (2002) reported that meconium testing increased the rate of concurrent drug use in pregnancy by 28% over that reported by women at interview. In our study, there was some cross-checking in pregnancy of women engaged in the methadone programme by urine analysis for other illicit drug use. However, there is no mandatory reporting of maternal drug use in New Zealand and this together with interviewing by experienced and sympathetic practitioners and reassurance about the confidential treatment of interview information may have helped minimise under-reporting.

In addition to the possible reporting bias of the self-report measures, a further issue surrounding measurement was in maintaining 'blindness' to group status amongst the research staff. The risks associated with observer bias in the assessment of cocaine-exposed infants were shown in a study by Woods et al (1998) of observational coding of infants. Examiners were, under one condition told the infants were cocaine-exposed and under a second condition, were blind to group status. The behaviour of cocaine-exposed infants was coded as significantly worse, when examiners thought the infants had been exposed to cocaine. In our study, the author could not remain blind to group status, having completed the interview at age 18-months. The results of the HOME scale should be interpreted with caution as a result. However, the outcome measures were scored or coded by masked researchers. The author administered the ESCS, but it was coded by research assistants, who were blind to group status. The research assistant who administered the BSID II was also blind to group status.

In addition, possible limitations in this research with regard to the measures chosen should be considered. First, there were challenges associated with the use of the Early Social Communication Scales. Whilst the scales were not difficult to administer and were appealing to children, some difficulties with interpreting the coding instructions from the manual and training tapes. For this reason, the inter-rater reliability was lower than hoped, despite a time-consuming learning and training process. The task was also made more difficult by the age group of the children in this study. The scales are described as suitable for children up to 30 months, but the published research and reliability data from the authors was limited to children under 18 months. At 24 months, children use significantly more language than they would at 18 months. As a result, the manual instructions were at times difficult to interpret when children simultaneously communicated in a number of different ways, for example, speaking as well as using non-verbal gestures. The decision was made to code both separately, but differences in this regard may potentially limit the degree to which these results may be compared with other studies.

Finally, the size of the population studied here is relatively modest. It is possible that some small effects may not have been apparent with a group of this size and a larger sample would increase the precision with which effects could have been determined. To some extent, this limitation will be addressed by the larger sample from which this group of 120 children is drawn.

Confounding Factors

In a discussion of the adequacy of confounder analysis in this field, Neuspiel (1994) highlighted the complexity of the problem. He noted that some infant clinical variables, for example, gestational age and birth weight may be analysed as confounders, but may, in fact, be intervening variables caused by drug exposure. In our study, children born ≤ 32 weeks were excluded in order to remove the possible confounding effects of prematurity. Further, Neuspiel addressed the issue of tobacco smoking and noted that, if tobacco exposure is not adequately measured, then it may have residual confounding effects. The use of a dichotomous measure, i.e. smoking or not smoking as was used here, may under-control for the effects of tobacco smoking. Unfortunately due to problems associated with collinearity, we were unable to include continuous measures of other prenatal exposure in the models. As Neuspiel pointed out, full control for the social differences between smokers and non-smokers is probably not possible and it is an area that has not been well considered by research.

Finally, this study was not able to consider genetic risk as a confounding factor. It is possible that genetic risk of substance dependency may be passed down to the child of a mother engaged in methadone maintenance treatment and this in turn, might account for between group differences in child outcome measures. A genetic association between attentional deficits, for example, may explain drug use in the parent and developmental delay in the infant. Alternatively, genetic susceptibility in a subgroup of children may place them at greater risk for the effects of drug exposure than the majority of the population (Taylor & Rogers, 2005). Lester (2009) has also more recently proposed that prenatal drug exposure might act as an intrauterine

stressor, altering foetal programming contributing to risk of longer-term negative outcomes.

Implications for Intervention and Practice

Coles & Black (2006) noted that the field of infant teratology has given little attention to the implications of research for education and intervention. The Canterbury Methadone in Pregnancy Research Project has the potential to make a difference to the quality of service provision for children and families affected by parental substance use. There are a number of implications for practice. First, children born to mothers engaged in the methadone programme are clearly at significant risk of developmental delay in the first 2 years of life, in comparison to a cross-section of typical Christchurch children. This study suggests that these differences are not just cognitive and academic, but also social and behavioural. If this group of methadone-exposed children were to continue on a similar trajectory, 26% would begin school at age 5 with the cognitive and language skills typical of a 4 year old, thus starting on a school career already at considerable disadvantage to their peers. Evidence suggests that as children of drug-dependent parents grow up, their eventual costs to society from long-term health, mental health, education, child protection and youth justice intervention will be considerable (Bromberg, Backman, Krow, & Frankel, 2010; Kalotra, 2002). This suggests that children growing up in families affected by problem drug (and alcohol) use require dedicated service provision from agencies responsible for the care and welfare of children.

Second, the study demonstrates the severe and complex nature of the needs of some of these children and their families. It is clear that any intervention service for this group of children would require multi-disciplinary expertise and inter-agency collaboration. McMahon and Luthar (1998) noted there are often gaps in existing service delivery, since substance abuse treatment services are often experienced in working with adults on dependency problems, but may be less familiar with the needs of children; whereas family-based services understand children, but are less familiar with substance abuse. The latest report from the Advisory Council for the Misuse of Drugs (2007) suggests that, in the UK at least, there is still an urgent need for 'joined-up' services with a shared strategic approach to the needs of problem drug users and their children. The Advisory Council for the Misuse of Drugs suggests that adult treatment services should be required to record the numbers of children cared for by drug-dependent adults, so that services for children could be planned more effectively. There is a continuing need for further training of professionals working in adult addiction services about the complex relationship between parental drug dependence and child welfare.

Evidence of significant early learning difficulties amongst methadone-exposed children in this study suggests that routine monitoring and screening from birth is essential for children born to mothers who are drug dependent. In this way, intervention could be planned and implemented for those children, assessed as being at most risk. The group of children born to mothers enrolled in methadone maintenance treatment was heterogeneous with some children doing well, so experienced practitioners need to be able to target on-going intervention for those families with

greatest need. For families with the most severe problems, residential services, which imbed infant mental health interventions within an addiction-treatment environment are available in some parts of the world (Bromberg, et al., 2010; Salo, et al., 2010; Steinhausen, et al., 2007). In Christchurch, similar residential mother and baby services are available for women with other severe mental health problems, but women with a primary substance dependency are not currently eligible.

Third, such are the challenges that some drug-dependent parents face, some of their children will undoubtedly need out-of-home-care placement. In our study, foster care and frequent caregiver changes were associated with greater risk. Bada et al (2008) also showed that an increased number of caregiver changes was related to poorer outcomes at age 3 in prenatally drug-exposed children. In their view, services need to work towards improved decision-making, so that stability is enhanced for at-risk children. Furthermore, foster carers need support and training, if they are to meet the needs of this group of children. Moe and Slinning (2002) have described the extensive training and follow-up services provided for Norwegian foster parents of drug-exposed infants and toddlers, but this would not appear to be available in New Zealand.

In summary, this study has highlighted the negative trajectories that may be beginning for some children in this group of toddlers born to mothers enrolled in methadone maintenance treatment. Appleyard, Egeland, van Dulmen, & Sroufe (2005) concluded that children exposed to the greatest numbers of risks are most likely to suffer the most negative consequences. They proposed that every risk that can be reduced matters. Findings suggest that early monitoring for all infants is essential, with

integrated, multi-disciplinary, early intervention available to those that need it.

Intensive intervention with some home-based support services are required for mother and infant dyads, with oversight and links to alternative foster care provision for those who cannot provide adequate parenting. Foster parents need to be appropriately supported and trained.

Further Research Directions

Despite the limitations described above, this research adds considerably to national and international understanding of the early development of children born to mothers engaged in methadone maintenance treatment during pregnancy. Only a handful of studies, over the last few decades, have examined the early cognitive, language and communication development of children born to mothers engaged in methadone maintenance treatment during pregnancy. In addition, the study is the first to examine non-verbal communication behaviours, in combination with other cognitive and language processes, in this group of toddlers.

Further examination of the communicative intentions of young children, especially those in at risk groups, would be useful in strengthening our understanding of similarities and differences across different clinical groups in patterns of these early communication behaviours. The present study suggests that differences in toddler communication behaviours are influenced by child-rearing styles, but further research would help clarify this. Longer term follow-up would be useful in determining the consequences for these early differences, extending the work of Sheinkopf et al (2004). Thus, an examination of the relationships between early communication behaviours,

parent-child interaction patterns and children's later social competence would enable researchers to evaluate the part these behaviours play in the overall context of early child development.

As discussed earlier, one limitation of this PhD research was the reliance largely on self-report measures of parenting. Observational data of parent-child interaction would further clarify the parenting behaviours which are most critically associated with the development of children's early social communication. This absence of observational data will be addressed by the larger study from which these children were drawn. It will examine parent-child interaction recorded at the 18-month home visit. This will be useful in assessing the relationships between cognitive, language and communication outcomes in children and observed parenting behaviour. In addition, the larger study will examine in greater depth children's emotional and self-regulatory behaviour, complementing the results presented here of cognitive and communication abilities. Furthermore the study, which has begun to assess these children at age 4½ years, will provide useful data about the relationship between children's performance at 2 years and their later skills and behaviour. Following-up these children to school age would further enhance the research by enabling us to draw firmer conclusions about the predicative value of early measures of development and family environment for children's later capacity for learning and establishing relationships outside the home.

Conclusions

Understanding the nature and extent of the problems faced by children born to mothers engaged in methadone maintenance treatment in pregnancy is an essential first step to meeting their needs. The aim of this study was to identify early differences in development between methadone-exposed children and their non-exposed peers and examine the role of infant, parenting and family factors in their developmental progress. Findings indicated that developmental delay in both cognitive and language ability was much more common amongst children born to mothers engaged in methadone-maintenance treatment. In addition, methadone-exposed children showed a different profile of communication behaviours, engaging in more requesting behaviours and fewer joint attention behaviours than comparison children.

Control for confounding factors, including gestational age, gender, other substance use in pregnancy and maternal education attenuated differences, but significant effects of prenatal methadone exposure persisted. Comparison of the child-rearing and home environments of methadone-exposed children with comparison children showed pervasive differences. Indeed, as Glantz and Chambers (2006) noted, many drug-exposed children live in “highly, chronically, multiply stressful home environments”. Numerous indicator measures reflected these adverse circumstances, including single parenthood, financial stress, depression, poor parental health, deviant partners, family stress, conflict and violence, less stimulating environments, aggressive child management strategies and family environments, which were less child-centered. Further analysis showed that across all outcome measures, the intervening influences

of family and parenting factors explained the association between being born to a mother enrolled in methadone maintenance and developmental difficulties.

This research highlights the extreme vulnerability of substance-exposed children and their families and emphasises the need to develop seamless, coordinated intervention services, which incorporate expertise in working with children and young families, as well as skills in the management of parental drug dependency. Good quality services of this kind can begin to reverse the current trends for these children towards educational failure, family breakdown and continuing cycles of disadvantage.

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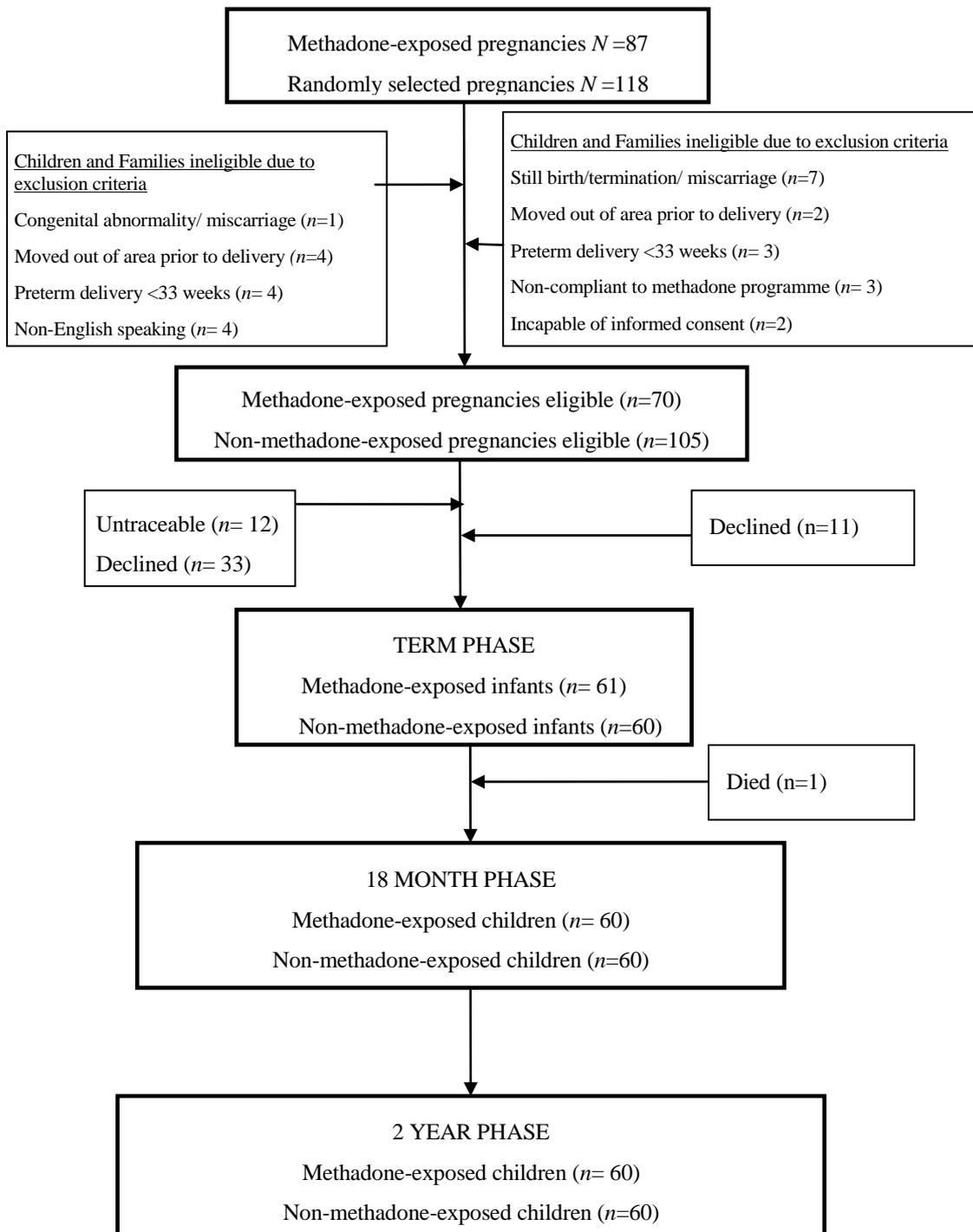
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APPENDIX A: CONSORT STATEMENT

Comparison Group

Methadone-Exposed Group



APPENDIX B: CONSENT FORMS

Consent form: 18 month study

- I have been invited to participate with my child in a study that is comparing the development of children who were and were not born to mothers on methadone maintenance during their pregnancy. I have heard and understood an explanation of the study, and have been given an opportunity to discuss the study and ask questions. I am satisfied with the answers I have been given.
- I have had enough time to consider whether we will take part in the study, and to discuss my decision with the researcher or a person of my choice.
- I know who to contact if I have any questions about the study.
- I understand that our participation in this research is **confidential** and that no material which could identify me will be used in any study reports, or made available to anyone else without my approval in writing.
- I also understand that my child and I can withdraw from the study at any time.
- I understand the compensation provisions for the study.
- I agree to members of the research team having access to medical information about my child for cross checking the number and dates of any major or minor illnesses that I have recorded on the study forms. **YES/NO**
- I agree to members of the research team contacting other workers involved in my child's care to obtain information on child development. Name of worker/s..... **YES/NO**
.....
- I wish to receive a summary of the results of this study. **YES/NO**

I consent to my child taking part in this study.

Parent/s Name: _____ Child's name _____

Signature of Parent/s: _____ **Date:** _____

I consent to take part in this study.

Parent/s Name: _____

Signature of Parent/s: _____ **Date:** _____

In my opinion, consent was given freely and the participant understands what is involved in this study.

Researcher's Name: _____

Signature of Researcher: _____ **Date:** _____

Consent form: 2 year study

- I have been invited to participate with my child in a study that is comparing the development of children who were and were not born to mothers on methadone maintenance during their pregnancy. I have heard and understood an explanation of the study, and have been given an opportunity to discuss the study and ask questions. I am satisfied with the answers I have been given.
- I have had enough time to consider whether we will take part in the study, and to discuss my decision with the researcher or a person of my choice.
- I know who to contact if I have any questions about the study.
- I understand that our participation in this research is **confidential** and that no material which could identify me will be used in any study reports, or made available to anyone else without my approval in writing.
- I also understand that my child and I can withdraw from the study at any time.
- I understand the compensation provisions for the study.
- I agree to members of the research team having access to medical information about my child for cross checking the number and dates of any major or minor illnesses that I have recorded on the study forms. **YES/NO**
- I agree to members of the research team contacting other workers involved in my child's care to obtain information on child development . Name of worker/s..... **YES/NO**
.....
- I wish to receive a summary of the results of this study. **YES/NO**

I consent to my child taking part in this study.

Parent/s Name: _____ Child's name _____

Signature of Parent/s: _____ **Date:** _____

I consent to take part in this study.

Parent/s Name: _____

Signature of Parent/s: _____ **Date:** _____

In my opinion, consent was given freely and the participant understands what is involved in this study.

Researcher's Name: _____

Signature of Researcher: _____ **Date:** _____

APPENDIX C: EDINBURGH DEPRESSION SCALE

| | Never | Hardly Ever | Some times | Often |
|--|-------|-------------|------------|-------|
| I have been able to laugh and see the funny side of things | 1 | 2 | 3 | 4 |
| I have looked forward with enjoyment to things | 1 | 2 | 3 | 4 |
| I have blamed myself unnecessarily when things went wrong | 1 | 2 | 3 | 4 |
| I have been anxious or worried for no good reason | 1 | 2 | 3 | 4 |
| I have felt scared or panicky for no very good reason | 1 | 2 | 3 | 4 |
| Things have been getting on top of me | 1 | 2 | 3 | 4 |
| I have been so unhappy that I have had difficulty sleeping | 1 | 2 | 3 | 4 |
| I have felt sad or miserable | 1 | 2 | 3 | 4 |
| I have been so unhappy that I have been crying | 1 | 2 | 3 | 4 |
| The thought of harming myself has occurred to me. | 1 | 2 | 3 | 4 |

APPENDIX D: DRUG USE QUESTIONNAIRE

1 Did you smoke cigarettes before or during your pregnancy?

| | No. of cigs per day | |
|--------------------------|---------------------|--|
| Before pregnancy | | |
| 1 st 3 months | | |
| 2 nd 3 months | | |
| 3 rd 3 months | | |

2 Did you smoke dope/cannabis before or during your pregnancy?

| | No. of joints per week | |
|--------------------------|------------------------|--|
| Before pregnancy | | |
| 1 st 3 months | | |
| 2 nd 3 months | | |
| 3 rd 3 months | | |

3 Did you drink alcohol before or during your pregnancy?

| | No. of drinks per week | |
|--------------------------|------------------------|--|
| Before pregnancy | | |
| 1 st 3 months | | |
| 2 nd 3 months | | |
| 3 rd 3 months | | |

4. Did you use benzodiazepines before or during your pregnancy?

| | No. of times per week | |
|--------------------------|--------------------------|--|
| Before pregnancy | | |
| 1 st 3 months | | |
| 2 nd 3 months | | |
| 3 rd 3 months | | |

5. Do you use heroin or other opioids (excluding methadone) before or during your pregnancy?

| | No. of times per week | |
|--------------------------|--------------------------|--|
| Before pregnancy | | |
| 1 st 3 months | | |
| 2 nd 3 months | | |
| 3 rd 3 months | | |

6. Did you use stimulants (eg amphetamines, speed, cocaine) before or during your pregnancy?

| | | |
|--------------------------|--|--|
| Before pregnancy | | |
| 1 st 3 months | | |
| 2 nd 3 months | | |
| 3 rd 3 months | | |

APPENDIX E: LIFE STRESS QUESTIONNAIRE

There are many things about being a parent that people find stressful or difficult. Can you tell me to what extent the following things are a problem for you at present?

| | N/A | No Problem | Some Problem | Major Problem |
|--|-----|------------|--------------|---------------|
| Not having enough money for your family's needs | 9 | 1 | 2 | 3 |
| Not having enough time to yourself | 9 | 1 | 2 | 3 |
| Not having enough time to spend with your partner | 9 | 1 | 2 | 3 |
| Transport difficulties | 9 | 1 | 2 | 3 |
| Inadequate accommodation | 9 | 1 | 2 | 3 |
| Never having enough sleep | 9 | 1 | 2 | 3 |
| Not being able to get out of the house | 9 | 1 | 2 | 3 |
| Never having another adult to talk to | 9 | 1 | 2 | 3 |
| Not having anyone you could call on for assistance with the children | 9 | 1 | 2 | 3 |
| Your relationship with your ex-partner/non-resident parent | 9 | 1 | 2 | 3 |
| Your relationship with your parents | 9 | 1 | 2 | 3 |
| Your relationship with your partner's parents | 9 | 1 | 2 | 3 |
| Other people telling you how to bring up your children | 9 | 1 | 2 | 3 |
| Not having enough time to see your friends | 9 | 1 | 2 | 3 |
| Managing my child's behaviour | 9 | 1 | 2 | 3 |
| Anything else. Specify: | 9 | 1 | 2 | 3 |

APPENDIX F: PARTNER DEVIANCE SCALE

| To what extent would you say your partner.... | No | Applies somewhat | Definitely applies | No partner |
|--|----|------------------|--------------------|------------|
| Is a good citizen | 1 | 2 | 3 | 9 |
| Has a lot of personal problems | 1 | 2 | 3 | 9 |
| Does things that are against the law | 1 | 2 | 3 | 9 |
| Smokes cigarettes | 1 | 2 | 3 | 9 |
| Drinks alcohol | 1 | 2 | 3 | 9 |
| Has problems due to alcohol | 1 | 2 | 3 | 9 |
| Uses marijuana/hashish | 1 | 2 | 3 | 9 |
| Has problems related to marijuana or other drugs | 1 | 2 | 3 | 9 |
| Has problems with aggression such as fighting or controlling anger | 1 | 2 | 3 | 9 |
| Has been in trouble with the law | 1 | 2 | 3 | 9 |
| Uses heroin/methadone | 1 | 2 | 3 | 9 |
| Uses Opiates | 1 | 2 | 3 | 9 |
| Uses benzodiazepines/ tranquillizers | 1 | 2 | 3 | 9 |
| Uses barbiturates/ sedatives | 1 | 2 | 3 | 9 |
| Uses Cocaine/ crack | 1 | 2 | 3 | 9 |
| Uses Methamphetamine | 1 | 2 | 3 | 9 |
| Uses Hallucinogens/ LSD | 1 | 2 | 3 | 9 |

APPENDIX G: CONFLICT TACTICS SCALES (CTS-2)

| In the past 12 months has anyone (including your partner) ever:..... Coding: 0 = never; 1 = once only; 2 = twice only; 3 = 3-5 times; 4 = 6-10 times; 5 = 11-20 times, 6 = 21+ times; 9 = NA/no partner. | Other, (no. of times) | Partner, (no, of times) |
|---|-----------------------|-------------------------|
| Cursed or sworn at you | | |
| Shouted or yelled at you | | |
| Stomped off during a disagreement | | |
| Deliberately said something to hurt you | | |
| Called you fat or ugly or unattractive | | |
| Deliberately destroyed something belonging to you | | |
| Accused you of being a lousy lover | | |
| Threatened to hit or throw something at you | | |
| Physically twisted your arm or hair | | |
| Pushed or shoved you | | |
| Slapped you | | |
| Physically forced sex on you | | |
| Used threats to make you have sex | | |
| Grabbed or shaken you | | |
| Thrown or tried to throw you bodily | | |
| Thrown an object at you | | |
| Choked or strangled you | | |
| Kicked you | | |
| Punched or hit you with something | | |
| Slammed you into a wall | | |
| Burned or scalded you on purpose | | |
| Beaten you up | | |
| Threatened you with a knife or gun | | |
| Used a knife or gun on you | | |

APPENDIX H: EXPERIENCES CHECKLIST

| On average, how often would your child | Never/ NA | Daily | Week ly | Monthly | 1-3 mont hs |
|--|--------------|-------|------------|---------|-------------------|
| Have a friend to play | 9 | 4 | 3 | 2 | 1 |
| Go to a friend's house | 9 | 4 | 3 | 2 | 1 |
| Be cared for by other parent alone | 9 | 4 | 3 | 2 | 1 |
| Spend time playing with other parent | 9 | 4 | 3 | 2 | 1 |
| Go to the park, playground or library | 9 | 4 | 3 | 2 | 1 |
| Be read a story | 9 | 4 | 3 | 2 | 1 |
| Go shopping or to the supermarket | 9 | 4 | 3 | 2 | 1 |
| Share a family meal (ie, mum, dad, kids) | 9 | 4 | 3 | 2 | 1 |
| Visit relatives or friends, who have children | 9 | 4 | 3 | 2 | 1 |
| Play and learn with you , e.g., how to stack blocks, kick ball | 9 | 4 | 3 | 2 | 1 |
| Use the toy library | 9 | 4 | 3 | 2 | 1 |
| Help with something you are doing e.g. baking, cleaning | 9 | 4 | 3 | 2 | 1 |
| Get out of the house (with parent or older person) | 9 | 4 | 3 | 2 | 1 |
| Go to beach or pool | 9 | 4 | 3 | 2 | 1 |
| Visit animal park, zoo or farm | 9 | 4 | 3 | 2 | 1 |
| Get book from library | 9 | 4 | 3 | 2 | 1 |
| Stay overnight with friends or relatives (without parents) | 9 | 4 | 3 | 2 | 1 |
| Go on a family outing e.g., movies, picnic, sport | 9 | 4 | 3 | 2 | 1 |
| Go to doctors or clinic | 9 | 4 | 3 | 2 | 1 |

APPENDIX I: HOME OBSERVATION FOR MEASUREMENT
OF THE ENVIRONMENT

| HOME SCALES | | |
|--|------------|-----------|
| I. EMOTIONAL AND VERBAL RESPONSIVITY OF PARENT | | |
| | Yes | No |
| Parent spontaneously vocalises to child at least twice during visit | 1 | 2 |
| Parent responds verbally to child's vocalisations or verbalisations | 1 | 2 |
| Parent tells child names of object or person during the visit | 1 | 2 |
| Parent's speech is distinct, clear and audible | 1 | 2 |
| Parent initiates verbal exchange with visitor - asks questions, makes spontaneous comments | 1 | 2 |
| Parent converses freely and easily (eg. gives more than brief answers) | 1 | 2 |
| Parent permits child to engage in messy play | 1 | 2 |
| Parent spontaneously praises child at least twice | 1 | 2 |
| Parent's voice conveys positive feelings towards child | 1 | 2 |
| Parent kisses or caresses child at least once | 1 | 2 |
| Parent responds positively to praise of child offered by visitor | 1 | 2 |
| II. ACCEPTANCE | | |
| | Yes | No |
| Parent does not shout at child | 1 | 2 |
| Parent does not express overt annoyance with or hostility to child | 1 | 2 |
| Parent neither slaps nor spanks child during visit | 1 | 2 |
| No more than one instance of physical punishment during last week | 1 | 2 |
| Parent does not scold or criticise child during visit | 1 | 2 |
| Parent does not interfere with or restrict child more than 3 times during visit | 1 | 2 |

| | | |
|---|------------|-----------|
| HOME SCALES | | |
| At least 10 books are present and visible | 1 | 2 |
| Family has a pet | 1 | 2 |
| III. ORGANISATION OF PHYSICAL AND TEMPORAL ENVIRONMENT | | |
| | Yes | No |
| Child care, when used, is provided by one of three regular substitutes | 1 | 2 |
| Child is taken to grocery store at least once a week on average | 1 | 2 |
| Child gets out of house at least four times a week | 1 | 2 |
| Child is taken regularly to doctor's office or clinic for check-ups and preventative health | 1 | 2 |
| Child has special place for toys and treasures | 1 | 2 |
| Child's play environment is safe | 1 | 2 |
| | | |
| | | |
| IV. PROVISION OF APPROPRIATE PLAY MATERIALS | | |
| | Yes | No |
| Muscle activity toys or equipment | 1 | 2 |
| Push or pull toy | 1 | 2 |
| Stroller or walker, kiddie car, scooter, or tricycle | 1 | 2 |
| Parent provides toys or interesting activities for child during interview | 1 | 2 |
| Learning equipment appropriate to age - cuddly toy or role playing toy | 1 | 2 |
| Learning facilitators - mobile, table and chair | 1 | 2 |
| Provides simple eye-hand coordination toys. Items to go in and out of receptacle, fit together, toys, beads | 1 | 2 |
| Provides complex eye-hand coordination toys that permit combinations -4 stacking or nesting toys, blocks or building toys | 1 | 2 |
| Toys for literature and music | 1 | 2 |
| | | |
| V.PARENTAL INVOLVEMENT WITH CHILD | | |

| HOME SCALES | | |
|--|------------|-----------|
| | Yes | No |
| Parent keeps child within visual range and looks at often | 1 | 2 |
| Parent talks to child while doing housework | 1 | 2 |
| Parent consciously encourages developmental advance | 1 | 2 |
| Parent invests "maturing" toys with value via his or her attention | 1 | 2 |
| Parent structures child's play periods | 1 | 2 |
| Parent provides toys that challenge child to develop new skills | 1 | 2 |
| | | |
| | | |
| VI.OPPORTUNITIES FOR VARIETY IN DAILY STIMULATION | | |
| | Yes | No |
| Other parent provides some daily care | 1 | 2 |
| Parent reads stories to child at least three times a week | 1 | 2 |
| Child eats at least one meal a day with mother and father | 1 | 2 |
| Family visits relatives or receives visits at least once a month or so | 1 | 2 |
| Child has three or more books of his or her own | 1 | 2 |

APPENDIX J: CONFLICT TACTIC SCALE–PARENT-CHILD

I am going to read a list of things that you might have done in the past year when your child did something wrong or made you angry. I would like you to tell me how often you have done each of these things with your child in the past year.

Coding: 0 = Never; 1 = Once; 2 = Twice only; 3 = 3-5 times; 4 = 6-10 times; 5 = 11-20 times; 6 = 21+ times

| | |
|--|--|
| Explained why something was wrong | |
| Put your child in “time out” (or sent to his/her room) | |
| Gave your child something else to do instead of what he/she was doing wrong | |
| Smacked your child on the bottom with your bare hand | |
| Shaken your child | |
| Hit your child on the bottom with something like a belt, hairbrush, a stick or some other hard object | |
| Shouted, yelled, or screamed at your child | |
| Hit your child with a fist or kicked her/him hard | |
| Told your child off | |
| Grabbed your child around the neck and choked her/him | |
| Swore or cursed at your child | |
| Hit your child over and over as hard as you could | |
| Burned or scalded your child on purpose | |
| Talked to your child about how they could have behaved differently | |
| Threatened to smack or hit your child but did not actually do it | |
| Threatened to punish your child in some other way, but did not actually do it | |
| Hit your child on part of the body besides the bottom with something like a belt, hairbrush, a stick or some other hard object | |
| Slapped your child on the hand, arm or leg | |
| Deliberately ignored naughty behaviour | |

FORM (CTS-PC)

| | |
|--|--|
| CTS-PC (CONT) | |
| Took away privileges or a toy | |
| Punched your child | |
| Gave your child something just to end the conflict or stress | |
| Threw or knocked your child down | |
| Called your child dumb or lazy or some other name like that | |
| Slapped your child on the face, head or ears | |
| | |

APPENDIX K: EARLY SOCIAL COMMUNICATION SCALES –
 INITIATING JOINT ATTENTION & INITIATING
 BEHAVIOURAL REQUEST BEHAVIOURS

| <i>Initiating Joint Attention (IJA) behaviours</i> | <i>Example items</i> |
|--|---|
| Eye contact | Made while touching or manipulating an inactive toy |
| Alternating (referencing) | Child alternates a look between an active toy and tester's eyes |
| Point | Child points to an active toy (with or without eye contact) |
| Show | Child raises toy toward testers face (typically |
| <i>Initiating Behavioural Request (IBR) behaviours</i> | <i>Example items</i> |
| Eye contact | Made after toy has ceased or tester has removed the object from the child |
| Reach | Child reaches towards toy, but does not obtain it |
| Appeal | Child combines eye contact with reaching |
| Give | Child pushes object towards tester |
| Point | Child points to an inactive toy (with or without eye contact) |

APPENDIX L: THE COMMUNICATION AND SYMBOLIC BEHAVIOUR SCALES



CSBS DP Infant-Toddler Checklist

Child's name: _____ Date of birth: _____ Date filled out: _____

Was birth premature? _____ If yes, how many weeks premature? _____

Filled out by: _____ Relationship to child: _____

Instructions for caregivers: This Checklist is designed to identify different aspects of development in infants and toddlers. Many behaviors that develop before children talk may indicate whether or not a child will have difficulty learning to talk. This Checklist should be completed by a caregiver when the child is between **6 and 24 months of age** to determine whether a referral for an evaluation is needed. The caregiver may be either a parent or another person who nurtures the child daily. Please check all the choices that best describe your child's behavior. If you are not sure, please choose the closest response based on your experience. **Children at your child's age are not necessarily expected to use all the behaviors listed.**

Emotion and Eye Gaze

1. Do you know when your child is happy and when your child is upset? Not Yet Sometimes Often
2. When your child plays with toys, does he/she look at you to see if you are watching? Not Yet Sometimes Often
3. Does your child smile or laugh while looking at you? Not Yet Sometimes Often
4. When you look at and point to a toy across the room, does your child look at it? Not Yet Sometimes Often

Communication

5. Does your child let you know that he/she needs help or wants an object out of reach? Not Yet Sometimes Often
6. When you are not paying attention to your child, does he/she try to get your attention? Not Yet Sometimes Often
7. Does your child do things just to get you to laugh? Not Yet Sometimes Often
8. Does your child try to get you to notice interesting objects—just to get you to look at the objects, not to get you to do anything with them? Not Yet Sometimes Often

Gestures

9. Does your child pick up objects and give them to you? Not Yet Sometimes Often
10. Does your child show objects to you without giving you the object? Not Yet Sometimes Often
11. Does your child wave to greet people? Not Yet Sometimes Often
12. Does your child point to objects? Not Yet Sometimes Often
13. Does your child nod his/her head to indicate yes? Not Yet Sometimes Often

Sounds

14. Does your child use sounds or words to get attention or help? Not Yet Sometimes Often
15. Does your child string sounds together, such as *uh oh, mama, gaga, bye bye, bada*? Not Yet Sometimes Often
16. About how many of the following consonant sounds does your child use:
ma, na, ba, da, ga, wa, la, ya, sa, sha? None 1-2 3-4 5-8 over 8

Words

17. About how many different words does your child use meaningfully that you recognize (such as *baba* for bottle; *gaggie* for doggie)? None 1-3 4-10 11-30 over 30
18. Does your child put two words together (for example, *more cookie, bye bye Daddy*)? Not Yet Sometimes Often

Understanding

19. When you call your child's name, does he/she respond by looking or turning toward you? Not Yet Sometimes Often
20. About how many different words or phrases does your child understand without gestures? For example, if you say "where's your tummy," "where's Daddy," "give me the ball," or "come here," without showing or pointing, your child will respond appropriately. None 1-3 4-10 11-30 over 30

Object Use

21. Does your child show interest in playing with a variety of objects? Not Yet Sometimes Often
22. About how many of the following objects does your child use appropriately: *
cup, bottle, bowl, spoon, comb or brush, toothbrush, washcloth, ball, toy vehicle, toy telephone? None 1-2 3-4 5-8 over 8
23. About how many blocks (or rings) does your child stack? **Stacks** None 2 blocks 3-4 blocks 5 or more
24. Does your child pretend to play with toys (for example, feed a stuffed animal, put a doll to sleep, put an animal figure in a vehicle)? Not Yet Sometimes Often

Do you have any concerns about your child's development? yes no If yes, please describe on back.