Externalizing Problem Behaviour and its Relation to the Self-Regulation of Emotion in Children Prenatally Exposed to Methadone: Outcomes at Age 9.5 Years

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Abstract

The only approved option for treating opiate dependency during pregnancy in New Zealand is Methadone Maintenance Therapy and while the benefits of this treatment for the mother are well established, the long term impact of prenatal methadone exposure for the child remains unclear. The current study is the first of its kind to investigate the relative contribution of prenatal methadone exposure, self-regulation of emotion, poly-substance exposure and socio-environmental risk factors to behavioural adjustment in children at age 9.5 years. As part of a prospective longitudinal study, fifty methadone exposed (ME) children and fifty non-exposed (Non-ME) comparison children were assessed using a range of laboratory based tasks and parent-report measures. Pre and postnatal socio-environmental and drug-use risk factors were measured via a comprehensive developmental interview conducted with each child's caregiver. Behavioural adjustment was assessed using the Behavioural Assessment System for Children – Second Edition (BASC-2), while effortful control (a component of effective self-regulation) was assessed using the Frustrating Puzzle Box and Stop-Signal tasks.

At age 9.5 years, ME children were rated by their caregivers as exhibiting a higher level of externalizing behavioural problems than Non-ME children both in overall score ($p<.001$), and in the proportion of children whose scores classified them as having an at-risk ($p<.001$) or clinically significant ($p=.002$) level of disruptive or maladaptive behaviour. On closer examination, ME children were found to score significantly higher than Non-ME children on the Conduct Problems, Attention Problems and Hyperactivity scales ($p<.001$), as well having a higher rate of co-morbidity between behavioural problems ($p<.001$). In addition to behavioural adjustment difficulties at age 9.5 years, ME children also scored significantly lower on a composite measure of effortful control ($p<.001$), indicating deficits in self-regulatory ability. Following regression analysis, prenatal methadone exposure ($p<.001$) and socio-environmental risk ($p=0.04$) were found to significantly contribute to externalizing problem behaviour scores

over and above the effects of poly-substance exposure during pregnancy and effortful control ability, highlighting the importance of considering multiple risk factors in any research involving ME participants.

The findings of the current study contribute unique information to the limited existing literature on long term developmental outcomes for ME children and support the continued follow-up and assessment of this population. Impaired effortful control ability and high rates of externalizing behavioural problems identify two areas of vulnerability in which ME children and their families may require additional support to manage difficulties associated with these issues. Identifying the areas in which ME children are performing poorly compared to their Non-Exposed peers will allow for more targeted interventions to be implemented and enable ME children to remain on a positive developmental trajectory.

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MMT	Methadone Maintenance Therapy
OST	Opiate Substitution Therapy
ME	Methadone Exposed
Non-ME	Non-Methadone exposed
MM	Methadone Maintained
Non-MM	Non- Methadone Maintained
MEC	Caregivers of ME children
Non-MEC	Caregivers of Non-ME Children
MIPs	Methadone in Pregnancy Study
CCDRG	Canterbury Child Development Research Group
NAS	Neonatal Abstinence Syndrome
ADHD	Attention Deficit Hyperactivity Disorder
CD	Conduct Disorder
ODD	Oppositional Defiance Disorder
SES	Socio-Economic Status
CBCL	Child Behaviour Checklist
BASC-2	Behavioural Assessment System for Children – Second Edition
PRS-C	Parent Rating Scale – Child
SSRT	Stop Signal Reaction Time

Chapter One: An Overview of Opiate Use, Methadone Maintenance Treatment and Externalizing Behaviour Outcomes in Exposed Children.

1.1 Neural Mechanisms of Opiates and Opiate Dependency

With the exception of alcohol, opiates have been used for their psychoactive properties longer than any other drug (Gruber, Silveri, & Yurgelun-Todd, 2007). Opiates, also referred to as narcotics, are a category of drug derived from opium which occurs naturally in the seed pod of the poppy, the most well-known of these being morphine, codeine and heroin. The opiate drug category also includes synthetic opiates (opioids) which behave chemically in the same way as opiates but are manufactured though chemical synthesis rather than the poppy itself (Oxford Concise Medical Dictionary, 2010). Opiates act on three major classes of receptors within the brain – delta, kappa and mu. The majority of opiates that are used in clinical settings such as morphine, methadone and codeine are selective agonists at the mu receptor (Reisine, 1995). Opiates interacting at the mu receptor are powerful analgesics directly inhibiting pain transmitting neurons in both the peripheral and central nervous system (Fields, 2007). Clinically opiates are classed as depressant substances due to the reducing/diminishing effect they have on the central nervous system, heart rate, blood pressure, body temperature and respiratory system (New Zealand Drug Foundation, 2014; Oxford Concise Medical Dictionary, 2010; Reisine, 1995).

Opiate binding to receptors also results in powerful rewarding effects though the inhibition of neurons that are responsible for keeping dopamine levels under control. The physical sensation of the resulting increase in dopamine levels is a temporary 'euphoric' state where the person feels a heightened and intense sense of well-being and pleasure (Dacher & Nugent, 2011; Fields, 2007; New Zealand Drug Foundation, 2014). It is this sense of euphoria that is suggested to contribute to the addictive nature of opiates. While the neuropharmalogical

mechanisms underlying drug tolerance, dependence and addiction are complex and not yet completely understood (Koob & Le Moal, 2001), a common theory of opiate addiction hypothesises a reinforcing cycle that increases in addictiveness. The reinforcing cycle of dependence/addiction to opiates has both biological and psychological components. The intense feelings of well-being and pleasure associated with opiate use, positively reinforces the continuing use of the drug by relieving everyday life stressors such as pain, anxiety, stress, boredom or depression. However when the 'high' associated with opiate use wears off, the user is once again faced with the realities of life they had been able to temporarily escape due to the chemical effect of the opiate (Satel & Lilienfeld, 2014). A physical dependence to opiates is then created when the person continues to use opiates in order to achieve the associated feeling of euphoria. With continued use, opioid receptors in the brain become less responsive to opioid stimulation and increasing amounts of the drug are required in order to achieve the pleasurable effect of the opiate the individual experienced previously. In addition, the withdrawal symptoms associated with opiates such as dysphoria, muscle aches, vomiting, abdominal pain, sweating, insomnia and anxiety, reinforces drug taking by motivating the person to seek out more of the drug to relieve themselves of the withdrawal symptoms. Because of this cycle of reinforcement, once a person has established dependence, long-lasting changes to the brain have occurred making opiate addiction a compulsive, debilitating and chronically relapsing abuse disorder (Dacher & Nugent, 2011; Deering et al., 2008; Koob & Le Moal, 2001; Kosten & George, 2002).

1.2 Prevalence of Opiate Use

Despite opiates being classed as a controlled drug under the Misuse of Drugs act both in New Zealand and worldwide, opiate abuse is prevalent throughout the world with an estimated world-wide prevalence of 0.4% (United Nations Office on Drugs and Crime, 2013). Strict guidelines and protocols exist around the dispensing and administration of

opioid analgesics in clinical settings, and practioners are monitored by medicine control boards (Moriarty, 2014). However, the Centre for Disease Control and Prevention in America has now classified prescription opioid abuse as an epidemic, with opioid pain relievers involved in 16,6000 deaths in the year 2010 (Office of National Drug Control Policy, 2014). In New Zealand the latest data available from the Ministry of Health estimates the prevalence of opiate use in New Zealand (both heroin and prescription opioids) to be 3.6% of the population (approximately 94,000 people), peaking in the 25-34 year age group. Of the 3.6% that reported opiate use, 37.7% reported using opiates on a weekly basis while estimates of clinical opiate dependence in New Zealand sit at approximately 10,000 people (Deering et al., 2008; Mason, Hewitt, & Stefanogiannis, 2010). Prescription opioids (mainly morphine sulphate tablets) are the most commonly abused opiates in New Zealand followed by 'homebake' (morphine/heroin produced from over the counter codeine products) and opium poppies. The city of Christchurch (in which the sample for the current study is drawn) has been estimated to be home to the largest number of opiate users in New Zealand based on the fact that overdose death rates are three times higher than what is found for the rest of the country (Adamson et al., 2012).

The societal cost of opiate use is significant, opiate dependence is associated with high rates of relapse, medical and mental health problems, criminal activity and mortality (Berry et al., 2010; Deering et al., 2008). Common problems associated with opiate use and dependence include medical and physical problems (infection from injection sites, septicaemia , jaundice, blood-borne viruses such as HIV, hepatitis C and B), fatal overdose, mental health problems (opiate dependent users are more likely to have depression, anxiety, antisocial personality disorder and suicidal ideation) and social problems (unemployment, criminal activity and financial problems due to funding drug habit and impaired relationships with family and

friends) all which place pressure on available societal resources (Berry et al., 2010; Deering et al., 2008).

In the US the societal cost of prescription opiate use alone, after taking in to account, workplace costs from premature death, healthcare and criminal justice costs, was estimated to be $55.7 billion (Birnbaum et al., 2011). While the total social cost for opiate use alone in New Zealand has not been calculated, the cost of illicit drug use to society was estimated to be $1.31 billion with the cost of criminal activity from untreated opiate dependent individuals estimated to be in the range of $2 million to $7 million per week (Sellman, Hannifin, & Deering, 1996).

1.2.1 Increasing Opiate Use amongst Women

The prevalence of drug abuse has significantly increased for both males and females worldwide. However women are more likely to misuse narcotic analgesics when compared to men in an American National Household Survey on Drug Abuse (with n=3,185). In addition this survey found that the most commonly misused drug reported by women during their pregnancy were opiates (Ritter, Strickler, & Simoni-Wastila, 2004). Of particular concern from this survey was the finding that 90% of drug-abusing women are of child-bearing age, a figure supported by the New Zealand statistic mentioned previously of opiate use peaking in the 25-34 year age range (Mason et al., 2010; Vucinovic et al., 2008; Yanai et al., 2003).

A later report from Maeda, Bateman, Clancy, Creanga and Leffert (2014) described a 127% increase in the prevalence of opioid abuse or dependence during pregnancy between the years of 1998 and 2011 (McGlone, Mactier, & Weaver, 2009). This report is consistent with a 2012 review stating that with the prevalence of opiate use in the United States increasing substantially over the last decade, the number of infants born addicted to opiates throughout the country has tripled (Hayes & Brown, 2012). Together these findings identify a need for opiate substitution therapies to be targeted at pregnant women.

1.3 Methadone Maintenance Therapy (MMT) for Opiate Dependency

Several options exist for the treatment of opiate dependence. These include: managed withdrawal, outpatient programs (counselling), therapeutic communities (residential programmes centred around self-help and relapse prevention), self-help groups (narcotics anonymous) and opiate substitution therapies (Berry et al., 2010). While no one treatment works for every individual, opiate substitution therapies (OST) such as methadone, buprenorphine and naltrexone are considered to be one of the most effective types of therapy for opiate dependence. A large body of evidence from controlled trials, longitudinal studies and programme evaluations have found OST to be correlated with significant reductions in illicit opiate use, criminal, antisocial or dangerous behaviours aimed at obtaining opiates to avoid withdrawal (reducing the likelihood of incarceration and prosecution),death from overdose and HIV transmission (WHO, 2004).

The calculation of cost/benefit ratios of opiate substitution therapies in the treatment of opiate dependence is complex and varies between countries. In New Zealand the most current calculation of cost/benefit of opiate substitution therapies estimates that treating an opiate dependent patient would save the tax-payer between $385 and $700 per patient per week compared to leaving them untreated (Berry et al., 2010). The World Health Organisation estimates that for every dollar invested in opiate substitution therapies there is a return of between $4-$7 due to a reduction in drug related crime, criminal justice costs and theft. When savings related to health care are taken into account it is estimated that savings exceeds costs by 12:1 (WHO, 2004). These figures highlight the importance of treatment for opiate dependence to society as a whole.

Methadone Maintenance Therapy (MMT) is considered the ‘gold standard’ treatment for opiate dependency and hence is the most widely used pharmacological treatment (Farid,

Dunlop, Tait, & Hulse, 2008). Methadone is a synthetic, full mu-opioid agonist and chemically behaves in the same way as natural or other synthetic opiates by binding with mu-receptors within the brain, producing similar pharmacological effects minus the induced euphoric state. Once bound to the receptors, methadone acts to block the effects of other opiates and relieves the physiological symptoms of withdrawal and intoxication for 24-36 hours due to its long elimination half-life, allowing blood-concentration levels to stabilise and reducing cravings for other opiates (note opiate substances only, methadone does not directly target chemical pathways involved in non-opiate substance use) (Farid et al., 2008; Jones et al., 2010). Methadone dose during treatment varies according to the quantity, frequency and route of administration in which the patient had previously used opiates along with their liver and kidney functioning. The first dose is not allowed to be higher than 40mg and increases by 5-10mg per day until the right dosage for maintenance is achieved. Maximum methadone dosage for maintenance is generally in the 60-120mg per day range (Ministry of Health, 2001). Methadone Maintenance is currently the only approved and available option for pregnant women requiring OST in New Zealand (Berry, 2014; CADS, 2011).

1.3.1 Methadone Maintenance Therapy during Pregnancy

As previously discussed methadone behaves chemically the same way as other opiates (both natural and synthetic), binding to mu-receptors within the brain and relieving withdrawal symptoms. Combined with a long elimination half-life, methadone effectively restricts the amount of opiates the mother needs to take to avoid the effects of withdrawal (and therefore exposes the foetus to) by stabilizing maternal serum opioid levels (Deering et al., 2008; Farid et al., 2008; Jones et al., 2010; Jones et al., 2008). Stabilizing maternal serum levels helps to avoid the highs and lows associated with opiate intake and withdrawal which in turn stabilizes the uterine environment of the foetus. When the uterine environment is stabilized, the risk of obstetric complications such as abortion, placental abruption, preeclampsia and infection in the

uterus (common complications in pregnancies of heroin addicts) is reduced (Hayford, Epps, & Dahl-Regis, 1988; Vucinovic et al., 2008). In addition, any woman who becomes pregnant while on methadone maintenance is provided with the appropriate antenatal care with clear protocols around communication, advice and management of the pregnant women. By facilitating and supporting access to antenatal services, a more stable prenatal care routine is put in place increasing the chances of the pregnancy being carried to term and decreasing the likelihood of obstetric complications (Berry et al., 2010; Cleary et al., 2012; Jones et al., 2008).

A further benefit of MMT in pregnancy is that the dispensing of methadone must occur in front of staff at a specialist service, a general practioner or pharmacist. This ensures a clean, consistently formulated methadone dose that complies with manufacturing codes of practice and therefore reduces the chances of the mother and foetus being exposed to foreign substances that can occur in illegal and unregulated street manufactured opiates (Berry et al., 2010; Farid et al., 2008; Ministry of Health, 2001). The regular and routine dosing of MMT in combination with reduced cravings also benefits pregnant women by reducing the need for criminal activity. Criminal activity can impact a mother and developing foetus through injury from violent crime, HIV transmission though infected needles and needle sharing (not an issue with prescribed liquid methadone) and sexually transmitted diseases through prostitution potentially leading to infection and increasing the chance of obstetric complications (Daley et al., 2000; Office of National Drug Control Policy, 2012; Schiling, Dornig, & Lungren, 2006).

During pregnancy, methadone is transferred bi-directionally from maternal circulation to foetal circulation through the placenta membrane. Transfer to the foetus can also occur via the amniotic fluid and umbilical cord (Farid et al., 2008; Nekhayeva et al., 2005; Ostrea, Mantaring, & Silvestre, 2004). In New Zealand, the protocol for treating pregnant women on methadone maintenance is to find the lowest optimal dose that maintains stabilisation at each stage of the pregnancy in order to limit foetal exposure. Women are encouraged to not withdraw

from methadone when they become pregnant as withdrawal increases the risk of abortion, premature delivery, decreased foetal oxygen supply and growth retardation as well as increasing the likelihood of relapse to illicit opiates (Berry, 2014) .

It is currently believed that the consequences of prenatal methadone exposure for child development are minimal compared to the impact of exposure to illicit opiate use or withdrawal from methadone (Berry, 2014; Berry et al., 2010). This may in fact be the case, however developmental outcomes for children exposed to methadone during pregnancy have not yet been extensively researched and remain unclear. Considering the increased prevalence of opiate abuse both in New Zealand and worldwide along with the knowledge that in the United States alone the number of infants born addicted to opiates over the last ten years has tripled (Hayes & Brown, 2012), it is becoming increasingly important that research does establish if and where any effects of prenatal methadone exposure occur in developmental trajectories in order to optimise outcomes for these children.

1.4 Neonatal and Infant Outcomes of Methadone Exposed Children

1.4.1 Methadone Exposure and Foetal Development

Opiates transferred during pregnancy are believed to primarily accumulate in the brain and nervous tissues of the foetus (Kandall, Doberczak, Jantunen, & Stein, 1999; Vathy, 2002). Experimental research on the effects of prenatal opiate exposure on the foetal brain using rats and mice suggest that exposure to opiates during pregnancy impacts brain and central nervous system development. More specifically, prenatal methadone exposure has been found to reduce striatal acetylcholine and striatal nerve growth factor, delaying striatal cholinergic neuron development (neurons involved in motor control, plasticity and reward-dependent learning) and potentially contributing to neurobehavioral problems such as impaired task-orientated motor control and rest-activity cycles (Robinson, 2000; Robinson, Guo, Maher, McDowell, & Kunko,

1996). Methadone exposed rat pups have also been found to be in a prolonged state of hyperexcitability, measured via a heightened acoustic startle response and have disrupted rest/activity cycles in comparison to non-exposed control rats (Hutchings, Zmitrovich, Brake, Church, & Malowany, 1993; Zmitrovich, Brake, Liu, Hamowy, & Hutchings, 1994). In addition to disruptions to central nervous system development, the biochemical maturation of the brain has been found to be altered in methadone exposed rat with reductions found in brain weight, cerebellar weight and brain DNA content. It is suggested that these findings parallel clinical findings that human children exposed to methadone during pregnancy have smaller head circumferences compared to non-exposed infants (Zagon & McLaughlin, 1978).

For research on the impact of prenatal methadone exposure on human development, the neurobehaviour of the foetus can help provide insight in to how the nervous system is developing. Ultrasound recordings both before and after an administered methadone dose have shown that foetal breathing movements (which promote lung growth) and rate of breathing decrease after the mother has taken methadone (Wouldes, Roberts, Pryor, Bagnall, & Gunn, 2004). Further, foetal heart rate is slower and less variable after methadone is administered indicating disruption to nervous system development (Lauren M. Jansson, DiPietro, & Elko, 2005; Lauren M. Jansson et al., 2011; Ramirez-Cacho, 2006).

Foetal growth also appears to be impacted by prenatal methadone exposure. Several studies have found infants born to mothers maintained on methadone or exposed to other opiates during pregnancy to have smaller head circumferences and lower birthweights when compared to non-exposed infants (Dryden, Young, & Mactier, 2009; Hulse, Milne, & Holman, 1997; Hunt, Tzioumi, Collins, & Jeffery, 2008). These early differences in foetal growth between methadone-exposed infants and non-exposed comparison infants have been found to remain significant even after controlling for maternal factors, cigarette use, environmental deprivation,

pre-term birth and obstetric health indicating a direct biological effect of methadone exposure during pregnancy (Mactier, Shipton, Dryden, & Tappin, 2013; Wouldes & Woodward, 2010).

1.4.2 Methadone Exposure and Neonatal Abstinence Syndrome

Neonatal Abstinence Syndrome (NAS) refers to a group of withdrawal symptoms occurring in infants prenatally exposed to addictive illicit or prescription opiate drugs. The drugs pass through the placenta to the foetus as described previously, and can potentially result in a physical dependence on that drug. When the drug supply is suddenly removed at birth, the infant may experience withdrawal symptoms including excessive crying and sucking, hyperactive reflexes, irritability, high-pitched cry, tremors, rapid breathing, sweating, sleep problems, seizures, uncoordinated and frantic sucking reflex when feeding, vomiting and weight loss (Hayford et al., 1988; L.M. Jansson & Velez, 2012). The symptoms of NAS can last a few days or for over eight weeks, with the type of symptoms the infant experiences depending on several factors such as: type of drug used, quantity of drug taken, length of time the foetus was exposed to the drug and gestational age of the infant. (Hayford et al., 1988; NLM, 2012).

The prevalence of NAS in opiate exposed infants is variable, although research has shown that infants exposed to methadone during pregnancy are at an increased risk of NAS and experience more severe NAS symptoms compared to infants exposed to heroin during pregnancy (K. Johnson, Gerada, & Greenhough, 2003; Kenner & D'Apolito, 1997). US data reports 48% to 94% of infants will show clinical signs of withdrawal (Gawronski et al., 2014; Lauren M. Jansson, DiPietro, Elko, & Velez, 2010; Osborn, Jeffery, & Cole, 2010). Pharmacological intervention using morphine or phenobarbital to manage withdrawal symptoms is required in around 30-91% of NAS samples (Berghella et al., 2003; Dryden,

Young, Hepburn, & Mactier, 2009; Ebner et al., 2007; Gawronski et al., 2014; Kruschel, 2007; Sleigman et al., 2010; Wouldes & Woodward, 2010).

Infants with NAS are characterized as having poor self-regulatory ability as they are often difficult to settle and are quickly and easily overstimulated (Velez & Jansson, 2008). The symptoms of NAS are suggestive of a dysfunction in the regulation of the central and autonomic nervous systems and because of this, the basic functions of the infant such as feeding, sleeping, alertness and ability to communicate cues to caregivers can be impaired (Lagasse et al., 2003; Quick, Robb, & Woodward, 2009; Velez & Jansson, 2008). Non-pharmacological treatments designed to support neurobehavioural functioning during the postnatal period involve reducing exposure to light, noise and handling, and also swaddling which has been found to reduce startle response, arousal and allow the infant to sleep for longer periods of time (Dow et al., 2012; Kruschel, 2007; Velez & Jansson, 2008).

Parent interaction is also very important during the post-natal period in aiding the infant to self-regulate, however efforts by the infant to communicate distress or over-arousal can be difficult to interpret in an infant with NAS due to their dysregulated state. Parents of babies experiencing NAS need training by professionals to help them in understanding their infants' behavioural cues and assist them in learning to self-regulate. This aspect of the infant's non-pharmacological care however can be impaired due to the stigma surrounding opiate drug use, staff attitudes towards the mother's lifestyle choices, continued parental opiate use, parents fearing the involvement of child protection agencies, maternal mood disorders and the mother's own feelings of guilt over their baby having to undergo treatment. These factors can all impact on a mother's willingness to learn effective strategies in which to manage their infant's dysregulation, their tolerance for their infants challenging behaviours, their responses to their infant's behavioural cues and their motivation to engage with their infant. Facilitating quality interaction between the mother and child in cases of NAS can help to decrease the likelihood

of developmental problems in the infant and also reduces the risk of abuse or neglect when the mother and baby return home (Dow et al., 2012; Kruschel, 2007; Velez & Jansson, 2008).

1.5 Developmental Outcomes for Preschool Age Children Prenatally Exposed to Methadone – The Importance of Continued Follow-Up

Research suggests an early biological effect of exposure to methadone during pregnancy. However, children prenatally exposed to methadone and/or other opiates are considered to be a double jeopardy population due to both the potential teratogenic effects of prenatal methadone exposure and the environmental risks of being raised in a household where one or both parents are dependent on opiates. Environmental factors can exacerbate or buffer the effects of neurobehavioral vulnerabilities associated with drug exposure (B. M. Lester & Tronick, 1994). Children in opiate-dependant households are more likely to be raised in environments characterized as being high-risk due to factors such as poverty, poly-substance abuse, caregiver instability, low parental education, violence, and high rates of maternal depression (Davie-Gray, Moor, Spencer, & Woodward, 2013; Lean, Pritchard, & Woodward, 2013; Vucinovic et al., 2008).

Recent research by Konijnenberg et al. (2015) assessed whether a teratogenic risk model (prenatal drug exposure directly influences child outcomes), maternal risk model (maternal mental health problems) or a combination model (including both teratogenic and maternal risk factors) best accounted for behavioural outcomes in pre-school children prenatally exposed to methadone or buprenorphine. Their research established that developmental outcomes in children born to mothers in opiate substitution treatment was best understood by a combination model that considered both prenatal and postnatal factors (Konijnenberg, Lund, & Melinder, 2015). Given the dual hazards of both the biological and environmental risk factors methadone exposed children are exposed to, continued follow-up of

this population is important, as some developmental deficits may become more apparent as the child becomes older and encounters adverse postnatal risk factors (B. M. Lester, 1998; B. M. Lester & Tronick, 1994).

The limited available longitudinal research on children exposed to methadone during pregnancy has produced mixed findings, but suggests that difficulties in several domains of functioning may become apparent during the preschool years. Preschool age children prenatally exposed to methadone and/or other opiates have been found to score significantly lower than non-exposed children on measures of motor ability (Hans, 1989; Messinger et al., 2004; Wilson, Desmond, & Wait, 1981), particularly in regards to fine and gross motor coordination (Hunt et al., 2008; Sundelin Wahlsten & Sarman, 2013). In addition, opiate-exposed pre-schoolers have also been found to score lower on measures of social competence (Hunt et al., 2008; Rodning, Beckworth, & Howard, 1989). Cognitive ability has also been found to be impacted in opiate exposed children (Hans & Jeremy, 2001; Hunt et al., 2008; Rosen & Johnson, 1982; Steinhausen, Blattmann, & Pfund, 2007), although several studies have contradicted this by reporting that the opiate-exposed pre-schoolers in their samples scored similarly to non-exposed comparison children on measures of cognitive ability (Burns, O'Driscoll, & Wason, 1996; Hans, 1989; H. L. Johnson, Diano, & Rosen, 1984).

Behavioural adjustment- particularly externalizing behaviour, is a domain of development that previous studies have consistently identified methadone and/or other opiate exposed children as having difficulties in. Children raised in households where one or more parent struggles with substance abuse are found to have high rates of behavioural problems (Dawe, Harnett, Staiger, & Dadds, 2000). Slinning (2004) assessed behavioural development in children aged 2 and 4.5 years who had been prenatally exposed to heroin (among other substances). Results of the study showed that when compared with a non-exposed, low risk control group, children in the drug exposed group scored significantly more poorly on attention

problems and impulsivity measures and twelve percent exhibited symptoms of major attention deficits. These findings are consistent with an earlier study by Barth and Needell (1996) who found four year old adopted children who had been prenatally exposed to opiate drugs exhibited more hyperactive behaviours than a non-exposed control group.

Wilson, Desmond and Wait (1981) also reported externalizing behavioural problems in infants exposed to methadone or heroin during pregnancy, who were rated by their caregivers as being more difficult to care for and having poorer attention at age one year than non-exposed control children. A prospective study conducted in Amsterdam by van Baar, Soepatmi, Gunning and Akkerhuis (1994) later supported these findings by reporting difficulties in caring for children prenatally exposed to cocaine, heroin and methadone from birth to age five and a half. They found the drug exposed children were rated by their caregivers on several measures as having more behaviour problems, being more aggressive, more easily out of control and had more difficulties with social interaction than non-exposed comparison children at four and five years of age.

A more recent study by Sarfi, Sundet and Waal (2013) examining behavioural adaptation in 2.5 year old children who had been exposed to methadone or buprenorphine during pregnancy found that toddlers in the opiate exposed group had significantly higher problem behaviour scores than toddlers in a non-exposed comparison group. However when maternal symptoms of anxiety and depression were taken into account they were found to be predictive of problem behaviour scores over and above the effect of the prenatal opiate exposure highlighting the dual hazard nature of this population. This finding was supported by a later study of children who had been prenatally exposed to methadone or buprenorphine discussed previously, which found that it was a combination of teratogenic and maternal risk factors that best predicted externalizing behavioural outcomes at age four years (Konijnenberg et al., 2015).

1.6 Externalizing Behavioural Problems in School-Aged Children Prenatally Exposed to Methadone

On the basis that problems with externalizing behaviour are the most consistently reported outcome within the limited available literature on preschool development in methadone exposed children, this is an area clearly warranting further research. Children exposed to methadone during pregnancy face the double jeopardy issue of being exposed to multiple risk factors for poor developmental outcomes. Previous research has argued that early biological and environmental effects on developmental outcomes in substance exposed children may be subtle in the beginning, but that they place the child at a cumulative disadvantage which over time as the child faces increasing demands on their functioning, will begin to reveal more noticeable differences in developmental outcomes (Bellinger, Matthews-Bellinger, & Kordas, 2016; Crea, Barth, Guo, & Brooks, 2008; Barry M. Lester, LaGasse, & Seifer, 1998; Savage, Brodsky, Malmud, Giannetta, & Hurt, 2005).

Childhood externalizing behaviour problems place the child in conflict with their environment and increases the risk of the child having difficulty with social, academic and occupational functioning as adolescents and adults, along with exhibiting more serious antisocial behaviours such as crime and violence (American Psychiatric Association, 2013; Jianghong, 2004). Early behavioural problems can also indicate a predisposition for more serious clinical childhood disorders such as Attention Deficit Hyperactivity Disorder (ADHD), Conduct Disorder (CD) and Oppositional Defiance Disorder (ODD) that emerge in middle childhood (American Psychiatric Association, 2013). It is therefore very important that behavioural adjustment problems and associated risk factors are identified early on to reduce the risk of negative developmental outcomes.

1.6.1 Defining Externalizing Problem Behaviour

The definition of what constitutes 'problem' behaviour changes within the context of the child's developmental stage i.e. what constitutes problem behaviour at age four is unlikely to be the same at age eighteen (Keenan & Shaw, 1997). Externalizing problems in school aged children focus on behaviours defined as 'undercontrolled' which involve the child exhibiting negative outward behaviour on their external environment (Jianghong, 2004). Examples of undercontrolled behaviours include aggression (e.g. arguing, name-calling, threatening, breaking others objects, hitting), defiance/ delinquency (e.g. rule-breaking, cheating, truancy), inattention and disruptive behaviours (e.g. interrupting, can't wait turn) (Hinshaw, 1992; Jianghong, 2004; Phelps, Brown, & Power, 2002; Reynolds & Kamphaus, 2004).

Several studies have attempted to map the normative development of externalizing behavioural problems in the general population. A longitudinal study by Bongers, Koot, van der Ende and Verhulst (2003) used growth curve analyses on The Child Behaviour Checklist (CBCL) subscales to track externalizing behavioural development in 2,076 children born in Holland between the ages of four and eighteen years. They found that boys and girls tended to differ in their trajectories with boys having higher externalizing problem scores at all time points, but that scores decreased with age for both genders. This finding supported earlier studies which also found declining trajectories for externalizing problems in their study samples, coinciding with the development of cognitive and socio-emotional processes (Keenan & Shaw, 1997; Stanger, Achenbach, & Verhulst, 1997). Research on developmental trajectories for externalizing behaviour is limited by the issue of how generalizable developmental trajectories are between cultures (where definition of what is considered a problem behaviour can differ) and specific behaviours, i.e. trajectories may not look the same for attention problems compared to delinquent behaviours (Bongers, Koot, van der Ende, & Verhulst, 2003;

Keenan & Shaw, 1997). Therefore continued tracking within particular populations is needed in order to gain insight into typical behavioural development.

1.6.2 Externalizing Behaviour Problems in Opiate Exposed Children: Review of the Literature

Research on the early outcomes of children exposed to opiates during pregnancy have identified significant behavioural adjustment problems in preschool age children (Konijnenberg et al., 2015; Sarfi, Sundet, & Waal, 2013; Slinning, 2004; van Baar, Soepatmi, Gunning, & Akkerhuis, 1994; Wilson et al., 1981), but few have conducted initial assessments or followed longitudinally to school age to see if these problems persist and if so how and why they have progressed. Due to the limited longitudinal research available for children exposed to methadone exclusively, the literature search was widened to include prenatal exposure to opiates in general with the type of drug exposure specified for each study reviewed. The following review consists of the available published data to date on the presence of externalizing problem behaviours in school-age children exposed to opiates during pregnancy which meet the selection criteria of a) prenatal opiate exposure, b) follow-up to, or initial assessment at school age c) inclusion of a non-exposed comparison or reference group and d) contained measures of childhood behaviour. Table 1 presents a summary of the available literature in chronological order.

Table 1

Summary of Studies Examining Externalizing Problem Behaviour in Opiate Exposed Children

Reference	Study Design	Sample	Research Question	Behavioural Measure	Findings	Strengths	Limitations
Wilson et al. (1979)	Cross-sectional	**Ages:** 3-6 years **G1**- heroin exposed (n=22) **G2**- drug environment only (n=20) **G3**- non-exposed high risk (n=15) **G4** – non-exposed comparison	Effect of opiate exposure on neuroanatomical variables and the relation to selected behavioural variables	The Child Behaviour Checklist (CBCL)	Significant group differences on items of uncontrollable temper, impulsiveness, poor self-confidence, aggressiveness and difficulty making and keeping friends (p<0.05)	Use of multiple comparison groups to separate out environmental risk factors. Reported poly-substance abuse.	No verification of drug use. Small sample size. Did not consider poly-substance abuse in statistical analyses. Reliance on retrospective maternal self-report of drug use.
Davis et al. (1988)	Cross-sectional	**Ages:** 6-15 **G1** – Prenatal exposure to narcotics (n=28) **G2**-environmental exposure to narcotics use (n=28)	To assess neuropsychological functioning and behavioural status in children exposed to narcotics during pregnancy	Burks Behaviour Rating Scales	Greater attention (p<.001), Impulse control (p<.01), Anger (p<.001) and Aggressiveness (p<.001) in narcotic group Greater behavioural problems in children exposed to methadone than heroin	Considered methadone exposure and heroin exposure separately Use of MMT records to confirm methadone use.	Parent and teacher reports of behaviour not considered separately Narcotic exposed group significantly younger than control group No reporting of methadone dose No consideration of socio-environmental factors between the two groups.

deCubas et al. (1993)	Between groups Cross sectional	**Ages:** 6-13 years **G1** – methadone exposed (n=20) **G2** – non exposed (n=20)	Effects of prenatal exposure to methadone on IQ, school achievement and social-emotional development	The Child Behaviour Checklist (CBCL)	Significant group differences in externalizing problems, aggression, hyperactivity and delinquency (p<0.001)	Measure of SES, maternal education, birth complications, alcohol and nicotine use Attempt to match comparison group on demographic variables	No measure of methadone dose. Small sample size. No measure of other drug use outside alcohol and cigarette use. No consideration of developmental differences/influences that can occur with large age range.
Soeptami (1994)	Longitudinal	**Ages**: 4-12 years **G1**- heroin and/or methadone exposed (n=91) **G2**- non-exposed reference group (n = not reported)	Effects of heroin and/or methadone exposure on IQ, behaviour, school problems and social competence	The Child Behaviour Checklist (CBCL)	Proportion of children in exposed group with significant total behaviour problem scores larger than found in non-exposed reference group (p<0.001) Higher total behaviour problem score in the exposed group (p<0.001)	Large exposed sample Good reporting of maternal confounds (social support, prenatal care)	No strict control group – results compared to other large scale Dutch studies No measure of methadone dose. Problems with selective attrition Did not consider maternal confounds or poly-substance use in statistical analyses Information on how drug-use data was collected not included.

Seuss et al (1997)	Between groups Cross-sectional	**Ages**: 7-12 years **G1**- prenatal exposure to heroin/methadone or alcohol (n=15) **G2**- no prenatal exposure but living with substance depending mother (n=13) **G3**- Non exposed (n=15)	Effects of incentive on sustained attention and autonomic regulation in boys prenatally exposed to opiates	The Gordon Diagnostic System Distractibility Task	Fewer correct responses and higher error rate in exposed group (p<0.05)	Use of multiple comparison groups to assess impact of environmental factors. Considered impact of incentive to perform task on attentional performance Frequency of poly-substance use reported.	Small sample size. Methadone dose not reported. Study sample only included male participants. Incomplete hospital record data to verify drug maternal reports of drug use.
Ornoy et al. (2001)	Between groups Cross-sectional	**Age**: 5-12 years **G1**-Maternal use of Heroin (n=65) **G2** – Paternal use of Heroin (n=33) **G3**-non exposed low SES (n=32) **G4**- non exposed, Average SES (n=30)	The effect of post-natal environmental factors in comparison to prenatal heroin exposure on development.	The Child Behaviour Checklist (CBCL) The Pollack Taper test (inattention/hyperactivity) The Parental Conners Questionnaire	Highest rate of ADHD, delinquency and aggression found in G1 (p=0.01) High rates of ADHD also found in G2,G3 & G4	The use of multiple comparison groups separating environment from pre-natal exposure Included measurement of maternal rates of ADHD	Measure of poly-substance abuse taken but not included in statistical analyses Incomplete clinical data for exposed group. Reliance on retrospective maternal self-report of drug use.

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Walhovd et al. (2007)	Case-control Longitudinal	**Ages:** 9-11 **G1-** poly-substance exposed children (n=14). **G2-** non exposed control children (n= 14).	Effect of prenatal poly-substance exposure on volumetric cerebral characteristics.	The Child Behaviour Checklist	Significant differences for attention problems (*p*=.003), social problems (*p*=.001) and total problems subscales (*p*=0.02) Thinner right lateral orbito-frontal cortex correlated with attention, social and total problems CBCL subscales (*p*<.05)	Strict inclusion criteria. Consideration of selective participation. Separated opiate exposure from other substance exposure in statistical analyses.	Small sample size. Age difference between exposed group (M=11.3 years) and control group (M=9.8 years) No reliable measure of drug use.
Nygaard et al. (2016)	Between groups Longitudinal	**Age**: 8.5 years **G1** – exposed to heroin and other drug substances (n=72) **G2** – non-exposed comparison children (n=58)	Whether behaviour and attention problems were more prominent than cognitive deficits in the drug exposed group and whether any problems increased or decreased over time.	The Child Behaviour Checklist ADHD Rating Scale	Significant differences on CBCL externalizing (p=.05) and attention (*p*=.005) subscales More ADHD related problems in drug exposed group (*p*=.004) Tendency for externalizing behaviours to increase over time.	Use of multiple informants (parent and teacher) Inclusion of non-exposed comparison group Included medical records of drug use where possible	Under-reporting of heroin use by mothers due to facing an evaluation by authorities over custody of their children Comparison group not examined for how representative of the region it was.

The first study reviewed was by Wilson, McCreary, Kean and Baxter (1979) who examined behavioural development in 3-6 year old children prenatally exposed to heroin. The study sample consisted of four groups – one with prenatal heroin exposure and three comparison. The heroin-exposed group (n=22) was made up of children whose mothers reported heroin as being the predominant drug used during pregnancy, although no recruitment information was provided. The second group was the drug environment comparison group (n=20) consisting of children born to mothers who reported being drug free during pregnancy but were involved in drug culture either through living with a narcotic addict or becoming addicted to heroin following the birth of the infant. Participants in this group were recruited from local methadone maintenance programs. The third comparison group was made up of children born at Houston city-country hospital identified as being high risk due to medical complications such as foetal distress, intrauterine growth retardation and prematurity (n=15). The final comparison group consisted of children selected from school readiness programs in the geographical area of the Houston hospital's location who had uncomplicated births and no reported prenatal or postnatal drug exposure (n=20). Behavioural adjustment was assessed using the Child Behaviour Checklist (CBCL) and the results presented in Table 1 show that the children who had been prenatally exposed to heroin had significantly greater problems with uncontrollable temper, impulsiveness, poor self-confidence, aggressiveness and difficulty making and keeping friends in comparison to the drug environment, high-risk and matched SES groups (Wilson, McCreary, Kean, & Baxter, 1979). The authors acknowledged that maternal reports of quantity and type of drug use during pregnancy were not verified and that there was a poor correlation between reported drug histories and severity of withdrawal symptoms in the infant at birth, meaning any significant results could not be connected directly to the impact of prenatal heroin exposure. Despite this, considerable effort was made by the authors to determine the effect of environment on behavioural development. While the drug environment and high-

risk comparison groups performed poorly in relation to the matched SES comparison group, these variables were not able to fully account for the behavioural problems reported for the children in the heroin exposed group.

Seuss, Newlin and Porges (1997) also used multiple comparison groups to compare sustained attention and autonomic regulation in a sample of 7-12 year old boys who had been prenatally exposed to either alcohol, methadone and/or heroin. The drug exposed group (n= 15), was recruited through methadone clinics, flyers and newspaper ads with maternal drug use confirmed by hospital records. The first comparison group consisted of children who were not exposed to opiates during pregnancy but were living with a mother who reported using heroin and/or methadone within the first five years of the child's life (n=13), while the second comparison group consisted of non-exposed children matched by socio-economic status to the first two groups (n=15). All three groups were tested using the Gordon Diagnostic System Distractibility Task. Boys in the prenatal exposure group were found to be more impulsive on the task, making a greater number of commission errors and having fewer correct responses than the two control groups (Suess, Newlin, & Porges, 1997). When poly-exposure to alcohol and heroin or methadone was considered in analyses, it was found that boys who had been exposed to alcohol and opiates during pregnancy had performed the poorest on the task, although it was not possible with the available data to tell whether this was attributable to the alcohol or opiate exposure. Despite the small sample size of the groups and the inclusion of only male participants, the study provides some additional support for poor attentional functioning and increased impulsivity in heroin and/or methadone exposed school-age children.

Similar results to the two previous studies were found by Ornoy, Segal, Bar-Hamburger and Greenbaum (2001), who included multiple comparison groups to examine the effect of post-natal environment on the development of behavioural problems in children prenatally exposed to heroin. Children aged between 5-12 years (M=8 years) referred to the Institute of

Child Development by social services in Jerusalem, were separated into those that had been prenatally exposed to heroin (maternal use only, n=65) and those that had been exposed to opiates via the post-natal environment (paternal use only, n=33). Two non-exposed comparison groups were also formed, the first consisting of non-exposed children referred to the institute because of environmental deprivation and neglect (n=32), while the second group was made up of non-exposed children recruited from mainstream schools in Jerusalem who met the criteria of >31 weeks gestation age, IQ>70 and without significant neurological impairment (n=30). All study groups were assessed using the CBCL, The Parental Conners Questionnaire and the Pollock Taper test. Results presented in Table 1 show that the highest rates of ADHD, delinquency and aggression were found in children prenatally exposed to heroin in comparison to all other study groups, although significantly high rates of inattention and/or hyperactivity were also found in children who had heroin-dependent fathers and those with environmental deprivation (Ornoy, Segal, Bar-Hamburger, & Greenbaum, 2001). Despite methodological limitations such as a lack of consideration of poly-substance exposure in analyses, reliance on maternal self-report of drug use and incomplete clinical outcome data for some children, the use of multiple groups to consider the effect of environmental and family factors helps to further isolate the relationship between prenatal opiate exposure and externalizing problems. The findings of this study suggest that exposure to opiates during pregnancy may have an impact on the development of the foetal brain leading to problems with attention and behaviour in exposed children, while also highlighting the importance of the environment in which the child is raised.

Unlike the previous study which drew on a heroin exposed sample, deCubas and Field (1993) used the CBCL to investigate behavioural outcomes in children exposed to methadone during pregnancy. The methadone exposed group consisted of 20 children ranging in age from 6-13 years (M=8.5 years old) whose mothers were enrolled in the local methadone maintenance

treatment program. Information on drug use was obtained via maternal report with all study mothers reporting the use of alcohol and cigarettes during their pregnancy but not heroin. The comparison group was made up of 20 children also between the ages of 6-13 years (M=7.8) recruited from a developmental evaluation clinic (which they attended for routine immunisations and well-child checks) who matched the methadone exposed group on demographic variables and cigarette/alcohol use during pregnancy. Significant group differences were found on several scales of the CBCL including hyperactivity, aggression, delinquency and the externalizing behaviour composite with children in the methadone exposed group being rated as having greater behaviour problems than children in the comparison group (de Cubas & Field, 1993). Although these findings are based on a small sample size, they suggest that children born to mothers maintained on methadone during pregnancy are more likely to display problem behaviours at school-age than their non-exposed peers.

Soeptami (1994) also used the CBCL to assess for behaviour problems, this time with a mixed heroin and/or methadone exposed sample. The study sample consisted of 91 children from the same neonatal unit who had been prenatally exposed to heroin or a combination of heroin and methadone. Participants were recruited at 12 months old and then followed to the ages of 4-12 years depending on when they had been recruited. No strict control group was used by the researcher; instead the results of the study were referenced against the results found for non-exposed control groups on the same measures in separate, large-scale Dutch studies. Results of the study presented in Table 1 show that children in the opiate exposed group scored higher on the total behaviour problem composite of the CBCL, and that an overall higher proportion of children in the exposed study sample had significant behavioural problems than what was found for the reference group (Soepatmi, 1994). The actual numerical proportions of children with significant behavioural problems along with sample selection criteria for both the exposed group and non-exposed reference group were not reported by the author. The findings

were further limited by poor consideration of poly-substance abuse and confounding contextual variables, particularly given that participants in the exposed group were reported to have more 'favourable' characteristics (greater parental employment and a higher proportion of Caucasian/Dutch children) than those who had refused to participate at the follow-up. While the results of this study are suggestive of greater behavioural problems in opiate exposed children, they were not able to establish a clear link between opiate exposure and the development of problem behaviours.

Davis and Templer (1988) also recruited a mixed heroin/methadone sample when investigating the neuropsychological functioning and behavioural status of children exposed to narcotics in utero. The first group included in the study sample consisted of 28 children, 6-15 years of age (mean age = 8.50) who were born to mothers currently enrolled in a methadone maintenance program in California. The second group consisted of 28 children, also 6-15 years of age (mean age = 11.21) recruited from the same methadone maintenance clinic who were not exposed to methadone or heroin during pregnancy, but did live in a household where their mothers were living with a narcotic addicted man. Information on maternal drug use, pregnancy complications and parental care was collected at the time of recruitment but not reported or considered in any analyses. Behaviour was assessed using the Burk's Behaviour Rating Scale, with children in the drug exposed group rated higher on the Attention Problems, Impulse Control, Anger Control, and Aggressiveness subscales than children in the narcotic-environment only group. When the authors repeated the analyses with the drug exposed group separated into those that had been exposed to methadone only (n=9) compared to those who had been prenatally exposed to heroin only (n=12), results showed that children in the methadone exposure only group were rated as having greater impulse control problems and anger control problems than children in the heroin exposure only group (Davis & Templer, 1988). Despite these findings being limited by a number of methodological issues such as

having an older comparison group, small sample sizes and no explanation of the home environments or polysubstance exposure of the sample, the results suggest that children exposed to opiates during pregnancy (particularly methadone) have a tendency for poorer behavioural outcomes as they reach school-age.

Within the opiate exposure literature, developmental outcomes often have to be drawn from studies which consider the effect of multiple drug substances in their work. This is true for Walhovd et al. (2007) who recruited 9-11 year old children that were a part of a larger Norwegian longitudinal study examining illicit drug use in pregnancy and child development. The first group of participants consisted of children whose mothers reported the use of illicit drugs during pregnancy (n=14). Mothers of children in the drug exposed group had been referred to the study by medical or social staff at the Municipal health service during their second or third trimester. Of the 14 children in the exposed group, 10 were reported to have been predominantly exposed to opiates (heroin), one predominantly exposed to cocaine, one to alcohol and two had been predominantly exposed to psychopharmacological substances. Thirteen of the mothers also reported using benzodiazepines, neuroleptics, cannabis and amphetamines in addition to their main drug of choice during pregnancy. Drug reports were checked against medical and social records. The second group consisted of non-exposed control children who had also been enrolled in the study at infancy (n=14), although it was unclear how these children had been recruited. Using the CBCL as the behavioural measure, children in the exposed group were found to have significantly higher scores than children in the non-exposed group on the attention problems, social problems and total behavioural problems subscales. Magnetic Resonance Imaging (MRI) of all study children also showed that the thickness of the right lateral orbito-frontal cortex (which was found to be reduced in the drug exposed group) was negatively correlated with scores on the CBCL indicating a biological drug effect (Walhovd et al., 2007). The study was able to control for children being raised in a non-optimal

environment due to the children in the exposed group all living with adoptive families from an early age and matched to the control group on factors such as socioeconomic status. Despite the issues of small sample size, poly-substance exposure and correlational data preventing reliable conclusions, the study results do potentially suggest a relationship between prenatal opiate exposure and subsequent brain and behaviour development.

The final reviewed study by Nygaard, Slinning, Moe and Walhovd (2016) examined behaviour and attention problems in 8.5 year old children exposed to heroin and other drug substances during pregnancy. The drug exposed group consisted of 72 children prenatally exposed to heroin, recruited at birth from an in-patient clinic for high-risk infants or families in Oslo, Norway. The comparison group consisted of fifty-eight non-exposed children recruited at birth from local maternal and child health centres in the Oslo area. Drug exposure information was collected via maternal self-report alongside medical and social records. The behavioural outcome measures included at the 8.5 year assessment were the CBCL and the ADHD Rating Scale. Results for these measures revealed that after controlling for age, gender, socioeconomic status, gestational age and birthweight, children in the drug exposed group scored significantly higher than non-exposed children on the parent and teacher reported externalizing problems and attention problems CBCL subscales. Children in the drug exposed group were also rated as having more ADHD related problems on the ADHD Rating Scale by both their parents and teachers When these findings were compared with behaviour data from the 4.5 year follow-up of the study, the authors state that there was a tendency for behavioural problems in the drug exposed group to increase over time (Nygaard, Slinning, Moe, & Walhovd, 2016). Most of the children included in the drug exposed group (72%) for this study were moved to permanent foster homes or adopted before the age of one year with only five children remaining with their biological parents at the 8.5 year assessment. The authors were not able to determine in this study the impact of caregiver changes on behavioural outcomes, or any potential protective

aspects of moving from a drug using household to a more stable caregiving environment due to sample size. Despite this, the results of this study provide more robust support than previous literature for the continued follow-up of opiate exposed children to school aged in order to identify how behavioural outcomes in this population develop over time.

1.7 Methodological Issues in Opiate Exposure Behavioural Outcome Research

The studies included for review identify a relationship between prenatal opiate exposure and the development of externalizing problem behaviours in school-age children. An issue with many of the studies reviewed however is that they contain a number of methodological problems, limiting the conclusions that can be drawn from the findings. Of the eight studies that met selection criteria for review, three had sample sizes of twenty or less (de Cubas & Field, 1993; Suess et al., 1997; Walhovd et al., 2007) potentially reducing the statistical power and generalizability of the results. Recruiting and retaining larger sample sizes of a specific drug-dependant group can be difficult to achieve and often poly-substance users are recruited in order to achieve larger group sizes. Studies on the effect of methadone are often analysed in conjunction with heroin and other substances (Soepatmi, 1994; Suess et al., 1997; Walhovd et al., 2007), making it harder to conclusively link methadone exposure to child outcome. While inferences made from exposure to other opiates is reasonable given that drugs within the opiate category behave chemically similarly within the brain, it cannot always be assumed that outcomes will be the same. Research on differences between opiate maintenance treatment options such as methadone and buprenorphine as well as in comparison to uncontrolled opiates, have revealed differences in the neurodevelopmental outcomes of exposed infants (Bunikowski et al., 1998; Coyle et al., 2012; Whelan & Remski, 2012; Ziegler, Poustka, von Loewenich, & Englert, 2000).

Further limiting conclusions made between prenatal methadone exposure and child outcome is poor consideration of poly-substance use during pregnancy. The use of multiple licit and illicit drugs during pregnancy such as alcohol, tobacco, cannabis, amphetamines, other opiates and benzodiazepines in methadone maintained women is common (Delano, Gareri, & Koren, 2013; Kashiwagi, Arlettaz, Lauper, Zimmermann, & Hebisch, 2005), but in order to isolate the effects of methadone, careful consideration needs to be made of other drugs the infants were exposed to during pregnancy. Several of the reviewed studies (de Cubas & Field, 1993; Ornoy et al., 2001; Soepatmi, 1994; Wilson, McCreary, Kean, & Baxter, 1979), reported that other drug use occurred during pregnancy but did not control for this confound in their analyses. Seuss et al. (1997) excluded participants who reported drug use other than heroin or methadone during pregnancy but did not report which drugs they had asked about and if their exclusion criteria included cigarette use.

Three of the eight reviewed studies relied primarily on retrospective maternal report of drug use during pregnancy (de Cubas & Field, 1993; Ornoy et al., 2001; Wilson et al., 1979). The accuracy of drug-use data based on retrospective recollections can be limited by either the mother being reluctant to reveal the true extent of drug use during her pregnancy through fear of the social stigma or child protective services associated with prenatal drug use, or by length of time between pregnancy and being asked to record drug use. Mothers in the three studies that relied on maternal report alone had a child age range between six and thirteen years, meaning that mothers had a large length of time between their pregnancy and having to recall quantity and type of drugs they used, increasing the potential for underestimating their drug use. Records of urine toxicology results or infant meconium testing are believed to be more reliable in determining type and quantity of drug use during pregnancy (Araojo, McCune, & Feibus, 2008; Lester, 2001). Seuss et al. (1997) and Walhovd (2007) attempted to verify maternal drug use via medical records but admitted that their efforts were limited by poor availability of regular

toxicological results. Prospective studies combined with urine or meconium testing to verify maternal reports are methodologically more capable of producing valid results for child outcomes in this area.

Consideration of postnatal effects that occur as a result of the environment the infant is raised in are critical when studying children exposed to methadone during pregnancy. Substance exposed children are more likely to experience poverty, poor attachment, disruptive caregiving placements and maternal psychopathology (Hans, 2001; Walhovd et al., 2007) and it is important to determine what relationship these risk factors have with child outcomes. It may be that environmental risk factors explain child outcome over and above that of prenatal exposure, or they may behave as mechanisms through with methadone exposure indirectly effects child development. Prenatal exposure to other substances such as tobacco and socio-environmental risk variables such as low SES, maternal age and education have been found to also impact behavioural outcomes in children (Brooks-Gun & Duncan, 1997; Fried, Watkinson, & Gray, 1992). The reviewed studies ranged in the extent to which they measured and accounted for environmental covariates. Several of the studies made use of multiple comparison groups comparing children with prenatal drug exposure to children with postnatal drug exposure only and non-exposed children (Davis & Templer, 1988; Ornoy et al., 2001; Suess et al., 1997; Wilson et al., 1979) in order to separate out prenatal and postnatal drug effects, while others matched comparison groups on socioeconomic status only (de Cubas & Field, 1993; Walhovd et al., 2007). As discussed previously, methadone exposed children are considered to be a double jeopardy population because of their exposure to both the teratogenic effects of prenatal methadone exposure and the environmental risks of being raised in a household where one or both parents are opiate dependent. The double jeopardy nature of this population increases the complexity of any study within this area highlighting the need for appropriate

measurement and statistical analysis of covariates in order to more conclusively determine the true impact of prenatal methadone exposure.

Lack of methadone dose reporting in the literature is also a common issue. Including methadone dose information for a research sample is critical for interpreting and comparing the results of child developmental outcomes in methadone exposed populations. The four reviewed studies that included children prenatally exposed to methadone in their sample (Davis & Templer, 1988; de Cubas & Field, 1993; Soepatmi, 1994; Suess et al., 1997) did not report the dose of methadone that children were exposed to during pregnancy. The daily administered methadone dose given to mothers during pregnancy has been gradually increasing over the years in response to the need for management of withdrawal symptoms (Wouldes & Woodward, 2010). As the four reviewed studies that included methadone exposed children are now seventeen plus years old it is likely that they have been reporting results for children exposed to lower levels of methadone than would be seen more recently. Given that the potential teratogenic effects of methadone on child developmental outcomes may be more perceptible at increased doses (Jacobson & Jacobson, 2005), it is important that new research with adequate reporting of methadone dose is conducted in order to account for the increased methadone dose that infants are being exposed to and allow comparisons across populations.

Chapter Two: The Self-Regulation of Emotion and its Association with Externalizing Behaviour Outcomes

Research on methadone exposed children's capacity to self-regulate as they get older is non-existent, although studies that have focused on other areas of development in methadone/ opiate exposed children routinely describe the children in their sample as being hyperactive, impulsive or having an 'uncontrollable temper'(Barth & Needell, 1996; Slinning, 2004; Wilson et al., 1979). Deficits in areas of self-regulation ability (purposive processes i.e. self-corrective adjustments in order to override an impulse or persist with a course of action that originate within the person) have been consistently found to contribute to problem externalizing behaviour in children and adolescents, particularly in the area of self-regulation of emotion (Eiden, Edwards, & Leonard, 2007; Eisenberg et al., 1996; Eisenberg, Spinrad, & Eggum, 2010; Gross, 2014; Heleniak, Jenness, Vander Stoep, McCauley, & McLaughlin, 2016; Nigg, 2006; Rodriguez, Tucker, & Palmer, 2016; Rydell, Berlin, & Bohlin, 2003; Vohs & Baumeister, 2013). The contribution of possible deficits in the self-regulation of emotion contributing to behavioural outcomes in methadone-exposed children has not been considered in the empirical literature. Therefore one of the main aims of this thesis is to address this gap in the literature and assess a component of self-regulation required for effective emotion regulation development in methadone exposed children at 9.5 years of age.

2.1 Defining Emotion Regulation

Emotion regulation is a broad area of interest that has been inconsistently defined in the literature. Eisenberg, Spinrad and Eggum (2010) define emotion regulation as processes used to manage and change if, when, and how (e.g. how intensely) one experiences emotions and emotion-related motivational and physiological states, as well as how emotions are expressed behaviourally. In contrast to research on how people express or understand emotions, emotion

regulation research assists in providing insight into how and why emotions are able to facilitate or disrupt other psychological processes, such as attention or problem solving, and how this contributes to child development. The construct of emotion regulation is multifaceted, requiring the integration of many behavioural and biological processes which in turn have their own complex and multifaceted systems and developmental processes (Thompson, Lewis, & Calkins, 2008). There is disagreement within the field of emotion regulation research as to what neurological, behavioural or biological systems and processes are actually involved in the regulation of emotion (and the extent to which they are involved); however the work of Gross and colleagues has attempted to provide an overall explanatory model of emotion regulation by converging the key ideas of emotion regulation researchers (Gross, 2007, 2014)

Gross's model of emotion regulation outlines five families of processes which can be employed to regulate a generated emotion. These processes are Situation Selection (processes included in this group act to increase or decrease the chance that the individual will find themselves in a situation they expect to lead to desirable or undesirable emotions; Situation Modification (changing the impact of an emotion by externally modifying the situation the individual finds themselves in); Attentional Deployment (redirection of an individual's attention in order to influence an emotion); Cognitive Change (modifying an appraisal of a situation by changing either the thinking around the situation itself or the capacity to manage the situation, in order to alter the significance of the emotion) and Response Modulation (processes act to influence the experiential, behavioural or physiological aspects of the generated emotional response) (Gross, 2014)

While the process model outlines the many processes that can be employed in regulating emotion, in practice determining when an emotion has been regulated is very difficult. The neural systems involved in generating an emotional response and regulating an emotion response are highly intertwined and for many situations determining when an emotion is present

in the absence of emotion regulation is not clearly distinguishable (Campos, Frankel, & Camras, 2004; Lewis & Stieben, 2004; Ochsner et al., 2009; Thompson et al., 2008). For example a teacher rating a child as being visibly low in anger could lead to concluding that the child has good regulatory abilities, when it could be instead that the child just does not feel angry that often and is not actually in the process of regulating that particular emotion. For this reason many researchers choose to focus on the efficiency or frequency of the processes involved in the model in order to ascertain a person's regulatory ability rather than emotional expression alone.

The ability to engage in the emotion regulatory processes outlined in Gross's model is believed to follow a developmental trajectory where there is a shift from the use of extrinsic control (the child is assisted in engaging in the regulatory processes through the help of another person e.g. a parent helping with a frustrating task) to intrinsic control (the child is able to engage in the regulatory process themselves i.e. self-regulation of emotion) (Eisenberg & Sulik, 2012; Gross, 2007, 2014). Extrinsic control is especially important during infancy when we are reliant on caregivers to help in regulating emotions. Newborns early self-regulatory abilities are believed to be the result of pre-programmed neurophysiological mechanisms and reflexes designed to protect the infant from intense stimulation such as turning their head or closing their eyes when faced with situations that are overly stimulating, non-nutritive sucking or increased fussing. However an infant's arousal level can quickly reach a point that overwhelms their own self- regulatory abilities and an adult caregiver is required to help soothe (C.B. Kopp, 1982; Stifter & Braungart, 1995; Vohs & Baumeister, 2013). Caregivers play a significant role in aiding a child to develop effective self-regulation of emotion. Caregiver behaviour such as establishing routines, engaging in reciprocal social interactions with their child, being sensitive to their child's cues of over stimulation and guiding them in the appropriate behaviours or responses for a given situation, support and guide the child in engaging in increasingly intrinsic

emotion regulation processes (C.B. Kopp, 1982; Claire B. Kopp, 1989). Within the context of Gross's process model of emotion regulation, the caregiver assists the infant in engaging in emotional regulation (extrinsic control) for example by waving a novel object or favourite toy at them (engages attentional deployment processes) or by leaving the child with a familiar relative to babysit (situation modification).

The shift to the more effective use of intrinsic self-regulation processes to regulate emotion begins to develop from infancy and is aided by the development of the executive functions, language, cognition, motor, memory and numerous other domains of functioning. For example Stifter and Braungart (1995) found that thumb sucking and grabbing of their feet reduced negativity during a frustrating situation where the arm of the infant was restrained at five and ten months of age. The researchers also reported that the ability to orientate attention away from a distressing situation to another object was beginning to emerge at five months of age, although in this particular study five month old infants were less likely to use this method when highly distressed, indicating external help in engaging in this process was still required (Stifter & Braungart, 1995). While developing effective intrinsic emotion regulation requires input from multiple domains of functioning, there is one developmental component that plays a critical and central role in aiding the self-regulation of emotion – the concept of effortful control (Vohs & Baumeister, 2013).

2.2 Defining Effortful Control

Effortful control is the regulatory component of temperament (relatively stable, physiologically based individual differences in reactivity and regulation) and is defined as the 'efficiency of executive attention' i.e. cognitive processes that control and regulate other abilities and behaviours (Eisenberg et al., 2010; Lengua & Long, 2002; M.K. Rothbart, 1989). The process of effortful control is believed to primarily function within the anterior cingulate

gyrus and prefrontal cortex located in the midfrontal lobe of the brain (Bush, Luu, & Posner, 2000; Eisenberg et al., 2010; Eisenberg et al., 2009; Gross, 2014; Posner & Rothbart, 2000).

Effortful control is a latent construct that consists of multiple capacities (Sulik et al., 2009; Zhou et al., 2007) and refers to internal self-regulatory processes which are flexible and capable of being brought under voluntary control. These processes include the ability to shift and focus attention, inhibitory control (voluntarily inhibiting an inappropriate behaviour), activational control (activating or performing an action despite there being a strong tendency to avoid it) and executive functioning skills that are involved in integrating information and planning (Eisenberg et al., 2010; Vohs & Baumeister, 2013). Effortful control processes align with the Gross (2014) process model of emotion regulation which includes situation selection, situation modification, attentional deployment, cognitive change and response modulation.

The capacity and tendency to engage in effortful control has been linked to numerous outcomes in children such as greater empathetic skills, compliance, resiliency and social competence, less aggressiveness and greater adherence to social standards (Calkins, 1999; Spinrad et al., 2007; Vohs & Baumeister, 2013). In addition, effortful control has also been found to impact academic performance through the ability to focus attention and flexibly manage emotional and behavioural responses according to the changing demands of a classroom setting. Research shows that children low in effortful control are more likely to have poor grades and academic skills at both the primary and secondary school level (Checa, Rodríguez-Bailón, & Rueda, 2008; Liew, McTigue, Barrois, & Hughes, 2008; Zorza, Marino, de Lemus, & Acosta Mesas, 2013), while pre-school children low in effortful control were found to have lower levels of early maths and literacy ability, indicating poor school readiness (Blair & Razza, 2007; Vohs & Baumeister, 2013).

Studies are also beginning to consider the impact of individual differences in effortful control ability on adult psychopathology. Research by Panfilis, Meehan, Cain and Clarkin (2013) examined the relationship between effortful control, current psychopathology and interpersonal difficulties in adulthood in 247 university students. Results of the study showed that low effortful control ability was associated with an increased risk of having psychopathological symptoms and poor interpersonal functioning (De Panfilis, Meehan, Cain, & Clarkin, 2013) indicating that poor effortful control development in childhood may have far reaching effects.

2.2.1 Development of Effortful Control

Effortful control is considered an important developmental milestone for establishing effective self-regulation of emotion across the lifespan given its role in aiding the transition from extrinsic control to intrinsic control (Eisenberg & Sulik, 2012; Gross, 2007, 2014; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005). The developmental shift that occurs in children's ability to regulate is evident in research examining the functions reflective of effortful control ability across early childhood. The capacity for effortful control begins to emerge between 6-12 months of age alongside the maturation of anterior attentional control mechanisms (G. Kochanska, Murray, & Harlan, 2000; M K. Rothbart, Derryberry, & Posner, 1994). Infants as young as 8-10 months old have been found to demonstrate the ability to focus their attention (Eisenberg et al., 2010), while a longitudinal study by Kochanska, Murray and Harlan (2000) found that an infant's ability to focus their attention was related to their ability to effortfully control their behaviour at 22 months of age, supporting the link between the maturation of the anterior attention network and effortful control ability. Ruff and Capozzoli (2003) provided further support for developmental change in their research which demonstrated that although children's ability to engage in focused attention from 10 and 26 months was low at both time points, there was a substantial increase between 26 and 42 months of age. The authors believed

this indicated a shift from attention focusing that is controlled by stimulus factors, to attention governed by cognitive factors and aided by effortful control processes such as inhibitory control (Ruff & Capozzoli, 2003). The inhibitory control component of effortful control has also been found to follow an age-related developmental trajectory with the length of time a child is able to wait on delay of gratification tasks (a well validated measure of behavioural inhibitory control) increasing between 24 months and 4 years of age (Eisenberg et al., 2010; G. Kochanska et al., 2000).

There is some evidence to suggest that effortful control abilities continue to develop from preschool age through to middle childhood. One study that examined inhibitory control on a tapping task where the child was required to perform the opposite action to the researcher, found that correct responses on the task increased between the ages of three and seven (Diamond & Taylor, 1996). Children between the ages of seven and ten show age-related changes in executive attention on the attention network test and inhibitory control on a mistaken gift paradigm (Simonds, Kieras, Rueda, & Rothbart, 2007), while a life span study on inhibitory control development found age-related changes in speed and accuracy of inhibition on a stop-signal task in children aged between six and twelve years of age (Williams, Ponesse, Schachar, Logan, & Tannock, 1999). These findings are further supported by studies examining developmental change in attentional control and planning between the ages of seven and seventeen (P. Anderson, 2002; V. A. Anderson, 2001) and perseverance and attention focusing in children aged between eight and eighteen years (Crone, Somsen, Zanolie, & Van der Molen, 2006) indicating effortful control ability continues to develop throughout middle childhood and into adolescence.

2.2.2 Effortful Control in Methadone Exposed Children

There are currently no research findings available that assess effortful control ability in methadone-exposed children or opiate exposed children in general. However, research is available for children prenatally exposed to cocaine. While cocaine behaves differently within the brain to opiates, children exposed to cocaine during pregnancy experience many of the same postnatal outcomes as methadone exposed children including premature birth, low birth weight, decreased birth length and smaller head circumference (Minnes, Lang, & Singer, 2011). In addition cocaine-exposed children also experience many of the same maternal and environmental risk factors such as poly-substance abuse, low SES and single parent families (Lagasse, Seifer, & Lester, 1999). While it cannot be assumed that cocaine and methadone exposed children will be affected in the exact same way, it can be useful in this case to extrapolate some of the findings available in the cocaine literature. In addition, abnormalities in the central nervous system (considered possible early warning signs of later regulatory problems) are believed to be greater in children prenatally exposed to opiates than cocaine (Das, Poole, & Bada, 2004; Minnes et al., 2011), so it is likely that any differences in regulatory ability found for cocaine children would be significant in methadone exposed sample also.

Savage, Brodsky, Malmud, Giannetta and Hurt (2005) examined attentional functioning and impulse control in 101 ten-year old children who had been prenatally exposed to cocaine using the Gordon Diagnostic System. In comparison to a low SES, non-exposed control group, cocaine-exposed children had a greater number of commission errors on the distractibility subtest of the system indicating poorer sustained attention and greater impulsivity. An interesting finding of the study was that although a significant group difference for commission errors was found, overall both the cocaine exposed and non-exposed control groups were found to be performing below normal on the tasks suggesting poverty may be obscuring any other group difference (Savage et al., 2005). In addition, the majority of children in both groups were

reported as having behavioural problems by the teachers but not attentional or inhibitory control problems. This suggests that group differences in impulsivity and attention may be subtle and that instead any deficits in these areas of effortful control may not be noticeable until they present as behavioural problems.

Sustained attention problems were also found in a longitudinal study by Bandstra, Morrow, Anthony, Accornero and Fried (2001) that followed 235 cocaine exposed children from three to seven years of age. Using several standardized measures of attention at three different time points (three, five and seven years old), the study found performance decrements across the three time points in cocaine exposed children when compared with a non-exposed control group. Group differences remained significant after controlling for confounders such as poly-substance abuse and social-environmental factors (Bandstra, Morrow, Anthony, Accornero, & Fried, 2001). This finding built on the work of a previous study which found that children prenatally exposed to cocaine had sustained attention deficits at six years of age (Richardson, Conroy, & Day, 1996).

Inhibitory control has also been examined in cocaine exposed children. Bendersky, Gambini, Lastella, Bennett and Lewis (2003) used a Contrary Tapping Task which requires the child to tap once every time the examiner taps twice and vice versa, to measure inhibitory control in 92 cocaine exposed five year olds. When compared with a non-exposed control group, children in the cocaine exposed group had greater difficulty inhibiting the prepotent response to imitate the experimenter resulting in a larger error rate (Bendersky, Gambini, Lastella, Bennett, & Lewis, 2003). These findings are supported by later studies which found that cocaine exposed children between the ages of five and eleven had a higher error rates and slower reaction times on measures tapping inhibitory control when compared with the performance of a non-exposed control group (Accornero et al., 2007; Bridgett & Mayes, 2011),

although one study found a relationship between cocaine exposure and inhibitory control in male participants only (Carmody, Bennett, & Lewis, 2011).

A study of 174 cocaine exposed 4.5 year olds used a frustrating problem solving task to assess both reactivity and regulation. Reactivity was defined as latency to first evidence of frustration, oppositionality and aggression, while regulation was defined as latency to first attempt the task and effectively solving the problem (despite the frustration it evoked). When compared with a non-exposed control group, cocaine exposed pre-schoolers were quicker to express frustration, were more disruptive, took longer to attempt the task and used fewer instrumental actions to attempt to solve the problem. These findings suggest greater reactivity and poorer regulatory abilities amongst cocaine exposed children (Dennis, Bendersky, Ramsay, & Lewis, 2006). Research by Eiden et al. (2014) builds on this previous research by implicating effortful control ability in the development of behavioural outcomes within cocaine exposed populations. The reported indirect relationship between prenatal cocaine exposure and externalizing problems at school via maternal harshness and low effortful control ability in pre-school aged children prenatally exposed to cocaine (Eiden, Coles, Schuetze, & Colder, 2014) highlights the importance of effective effortful control in substance-exposed children.

2.2.3 Effortful Control and Behavioural Outcomes

The most extensively researched childhood outcome associated with effortful control is the relationship between low effortful control ability and behavioural adjustment. Effortful control is proposed to contribute to the development of problem behaviours in children via control of attention and behaviour. Attention control involves shifting and focusing attention and allows a child to modulate emotional arousal, process and integrate information about a situation and gives them the time to effectively plan. (Eisenberg, Spinrad, Fabes, Reiser, Cumberland, Shepard, Valiente, Losoya, Guthrie, & Thompson, 2004; Eisenberg et al., 2009;

Gartstein, Bridgett, Young, Panksepp, & Power, 2013). Control of behaviour allows for curbing/preventing impulses that are inappropriate for a given situation, or wilfully activating certain behaviours despite a strong tendency to avoid them in order to meet caregiver/societal demands (Eisenberg, Spinrad, Fabes, Reiser, Cumberland, Shepard, Valiente, Losoya, Guthrie, & Thompson, 2004; Eisenberg et al., 2009).

During the preschool years, children found to be low in effortful control abilities such as inhibitory control and shifting attention (measured via parental report or laboratory behavioural tasks) as infants or toddlers, were more likely to have parent reported behavioural problems such as hyperactivity, aggression and inattention when measured at three to five years of age (Rina D. Eiden, Craig Colder, Ellen P. Edwards, & Kenneth E. Leonard, 2009; Eiden et al., 2007; Hill, Degnan, Calkins, & Keane, 2006; G. Kochanska, Barry, Aksan, & Boldt, 2008; Olson et al., 2005; Spinrad et al., 2007). Similar results have also been found in longitudinal research aimed at assessing components of effortful control and behavioural adjustment problems in school aged children (Eisenberg, Spinrad, Fabes, Reiser, Cumberland, Shepard, Valiente, Losoya, Guthrie, & Thompson, 2004) and adolescents (Caspi, 2000). Supporting these findings is a longitudinal study that tracked the developmental trajectories of effortful control and externalizing behaviour in 356 children between the ages of five to ten years. The overall finding from this study was that children who had lower and less stable effortful control trajectories were more likely to have an elevated and fluctuating externalizing problem behaviour trajectory (Zhou et al., 2007).

Several studies have focused on the protective nature of effective effortful control against other risk factors for behavioural adjustment problems. Gardner, Dishion and Connell (2008) found that effortful control moderated the relationship between peer deviance and antisocial behaviour in 17-19 year olds. A high level of effortful control ability acted as a protective buffer against the effect of a deviant peer group and lowered the risk of the adolescent

engaging in antisocial behaviours. (Gardner, Dishion, & Connell, 2008; G. A. Kochanska, 2003). Similar results have also been found in research examining effortful control, environmental adversity, parenting and antisocial behaviour (Bakker, Ormel, Verhulst, & Oldehinkel, 2011; Lengua, 2008; Valiente et al., 2006) supporting the notion that the development of effortful control is crucial for lowering the risk of behavioural maladjustment throughout childhood.

2.3 Research Aims and Hypotheses

The current study aims to build on previous research by evaluating externalizing problem behaviour in methadone exposed children using a large sample with the inclusion of a randomly selected non-exposed comparison group representative of the Canterbury region. In addition, this study aims to examine for the first time the effortful control abilities of 9.5 year old children who were prenatally exposed to methadone and the relationship between this component of effective self-regulation and behaviour outcomes at age 9.5 years.

The specific aims and hypotheses of the study are:

1) *Aim:* To describe the behavioural adjustment of 9.5 year old children prenatally exposed to methadone in comparison to a non-exposed control group using a composite measure of externalizing behaviour.

   Hypothesis: Children exposed to methadone during pregnancy will be rated by their parents as having greater problems on the Externalizing Behaviour Composite from the Behavioural Assessment System for Children-Second Edition which encompasses conduct problems, hyperactivity and attention problems in middle-school aged children. In addition more methadone exposed children than non-exposed children are expected to be identified as having externalizing behaviour problems which meet the criteria for an 'at-risk' or 'clinically significant' level of problem behaviour.

2) *Aim:* To evaluate effortful control ability in 9.5 year old children exposed to methadone during pregnancy in comparison to a non-exposed control group.

Hypothesis: Children exposed to methadone during pregnancy will have poorer effortful control abilities (inhibitory control and attention control) as indicated by a shorter persistence time on a frustrating puzzle box task and slower reaction times on a stop-signal task. When performance on the two tasks is combined to give an overall composite measure of effortful control ability, ME children are expected to score significantly lower on this measure when compared to the effortful control ability of the non-exposed control group.

3) Aim: To identify the relative contribution of regulation, drug exposure and socio-environmental risk factors to externalizing problem behaviour in children aged 9.5 years.

Hypothesis: Low levels of effortful control ability and prenatal methadone exposure will significantly predict externalizing behaviour scores over and above the potential effects of early socio-environmental risk factors and poly-substance exposure during pregnancy on behavioural development.

Chapter Three: Research Design and Methodology

3.1 Research Design

Data for this study is drawn from the Canterbury Methadone in Pregnancy (MIP) study which is a prospective, longitudinal study conducted by the Canterbury Child Development Research Group (CCDRG) at the University of Canterbury. The MIP study aimed to assess the neurodevelopmental effects of prenatal exposure to methadone and have previously assessed two groups of caregivers and their children (a methadone exposed group and a non-exposed comparison group) at birth, eighteen months, two years and again at age 4.5 years. The current study data is drawn from the 9.5 year follow-up to this MIP study in which the author contributed to the protocol design, re-recruitment of participants and administration of child and caregiver measures. The focus of the author for this MSc thesis was children's effortful control and behavioural adjustment as measured at 9.5 years of age. Ethical approval for the 9.5 year follow-up was obtained from the Southern Health and Disability Ethics Committee (URB/07/10/042) (see appendix A).

3.2 Prenatal Participant Recruitment for the MIP Study

The sample for the larger MIP study consisted of two groups of children and their caregivers - a methadone-exposed (ME) group and a non-methadone exposed (Non-ME) comparison group. Between 2002 and 2008, the MIP study recruited 100 opiate-dependant mothers who were enrolled in methadone maintenance treatment with the Christchurch Methadone Programme at the time of delivery. Methadone and other drug use during pregnancy was collected via maternal report, clinical records, urine tests and meconium sampling. At the same time, 110 comparison women were recruited after being identified from the hospital delivery database as being registered to give birth in Christchurch and approached during their pregnancy to participate in the study. Randomisation via a random number generator was used to select the women identified from this database (see

www.randomizer.org). Regional census data for Canterbury was compared with socio-economic status (SES) data collected for the comparison group at term to ensure the group was representative of the Canterbury region (Statistics New Zealand, 2006). Study exclusion criteria for both groups were: mother spoke or understood English insufficiently to give informed consent, mother lived outside of the Canterbury region, mother had incomplete methadone dose records, still birth, child born with serious congenital abnormalities, child born with Foetal Alcohol Syndrome, child HIV positive, or child very preterm (<33 weeks gestation). Mothers in the Non-ME group had the additional exclusion criteria of neither receiving methadone treatment nor using opiates from any other source.

3.3 Participants Included in the Current Study

The retention rates (see appendix B) achieved by the CCDRG for the larger MIP study at the completion of the birth, eighteen months, two year and 4.5 year old follow-up assessments meant that eighty-eight (88%) of caregivers and their children in the ME group and 103 (94%) caregivers and their children in the Non-ME group were available for further recruitment at age 9.5 years. From the eighty-eight caregiver-child dyads retained in the larger MIP study's ME group, the current study recruited the first fifty ME children and their caregivers to form the 9.5 year follow-up ME group. The same recruitment procedure was applied to the Non-ME group with the first fifty comparison children and their caregivers (from the available 103) enrolled in the larger MIP study forming the Non-ME group at age 9.5 years. It was not possible to include all participants from the larger MIP study in the current study due to the extended recruitment period (six years), meaning that it would have not been possible to finish this thesis within the expected timeframe for Masters research. Therefore, the sample for this thesis was limited to 100 participants.

3.3.1 Methadone-Exposed Group

To date a total of fifty-four caregiver-child dyads from the MIP study's ME group have been approached for participation. Of those fifty-four dyads one refused to participate in the current follow-up, one had relocated to Australia and was not able to be brought back for assessment and two dyads remained untraceable after exhausting all avenues of contact. The final ME sample for the current study was therefore comprised of fifty caregiver-child dyads consisting of twenty-three females and twenty-seven males.

Although the larger MIP study originally recruited mothers and infants, over the nine and a half years of the study many children had experienced temporary or permanent changes to their living arrangements due to factors such as removal by child protection services, legal custody changes, incarceration of the mother or parental death. Of the fifty children included in the ME sample for the current study, 52% remained in their biological mothers care, 12% lived with their biological father only, 22% were placed with a relative and 14% had been placed in the care of a non-relative. To accommodate this, the current study will refer to child-caregiver dyads rather than child-mother dyads, where caregiver is defined as the person responsible for providing the basic necessities of life (food, shelter, clothes) while ensuring a safe and caring home environment (Child Youth and Family, 2016).

3.3.2 Non-Methadone Exposed Comparison Group

To date a total of fifty-five caregiver-child dyads from the MIP study's non-exposed comparison group have been approached for participation. Of those fifty-five dyads there was one refusal to participate, two dyads had relocated (Australia and England) and were not able to be brought back for assessment, one dyad remained untraceable and one child had recently received a diagnosis of epilepsy and was not able to participate in the study at the current time. The final Non-ME group sample for the current study was therefore comprised of fifty

caregiver-child dyads consisting of twenty-five males and twenty-five females. All children included in the comparison sample for the current study remained in the care of their biological mothers.

3.4 Procedure

3.4.1 Recruitment and Consent

Each caregiver was initially approached by either the author or other member of the research team via telephone to describe the purpose of the current follow-up and to determine interest in participating. Once the caregiver had agreed to participate, an appointment time was made for them to attend an assessment at the Child Development House (a research facility specifically designed and equipped for developmental assessment) on the University of Canterbury campus. Following this, an information sheet was sent in the mail detailing the aims of the current follow-up, what the assessment would involve for the caregiver and the child and finally all ethical conditions of the study. If the child wore glasses or a hearing aid then parents were asked to bring these to the assessment. Appointment times were confirmed by a letter sent immediately after the booking was made and then again by text-message or phone the week prior to the assessment dates.

Written consent from each caregiver for their own participation and consent on behalf of the child at the 9.5 year follow-up was obtained at the beginning of each assessment (see appendix C). The author sat down with each caregiver on their arrival at the Child Development House and provided a verbal explanation of what the assessment would involve and their rights as participants. It was explicitly stated that participation was voluntary and that either the caregiver or the child were free to withdraw their consent at any point during the assessment. Each caregiver was informed that all information gathered at the assessment was confidential and contact details for the research team were provided should they have

any questions following the assessment. Before beginning the assessment oral consent from the child was required. Each child was asked if they would be willing to complete some school type activities involving reading and maths in addition to computer tasks and games with the researcher while their caregiver did some work of their own in the next room.

At the end of each assessment all consenting caregivers were given participant gratuity of a $20.00 MTA or Progressive Food Enterprises voucher. Children were provided with a small food treat during the assessment such as jellybeans or chocolate bar costing less than $5.00 to thank them for participating in the assessment. Permission was sought from the caregivers at the time of booking the appointment for their child to be rewarded with sweets, if the caregiver did not wish their child to be rewarded in this way, then the child was offered a small toy costing less than $5.00.

3.4.2 Assessment Procedure

On arrival at the child development house caregivers were given a detailed explanation of the assessment procedure and consent was obtained from both the caregiver and child as described previously. The author and two other members of the research team, including a registered clinical psychologist, attended each assessment. As was done at previous follow-ups, the first research assistant was responsible for administering a comprehensive interview with the caregiver in the waiting room of the house where the caregiver could watch their child on the television in the room as they went through the assessment. During this interview, each caregiver was asked a series of questions covering topics such as family composition, child health, current drug use, occupation/education and mental health. In addition to the interview, each caregiver was given the Parent Rating Scale- Child (PRS-C) from the Behavioural Assessment System for Children- Second Edition to complete. Although the forms are designed to be read at a fourth grade reading level (ages 9-10), the interviewer remained in the room

with the caregiver while they filled in the form in case they had any questions or trouble understanding what was being asked. In cases where a caregiver had low reading ability, the interviewer read aloud each question and recorded the caregiver's responses. Caregivers were offered a drink and a snack at the beginning of the interview and again approximately half-way through the interview. The child remained in the assessment room with the remaining research team members where they were administered two laboratory behavioural tasks designed to assess effortful control ability – The Frustrating Puzzle Box and the Parametric Go/No-go Stop Signal Task. The child was offered a drink and a snack during this time and encouraged to get out of their chair and move around if needed.

3.5 Measures

3.5.1 Demographic and Clinical Data Collected at Birth and Age 9.5 Years

Information on early environmental risk factors and poly-substance use during pregnancy was collected as part of the larger MIP study assessment conducted at birth. Shortly after giving birth, mothers in both groups were administered a comprehensive maternal interview by a registered research nurse with the Canterbury Child Development Research Group. Mothers were asked to report their age, marital status, ethnicity, highest level of education and their own and partner's (if applicable) employment status. Occupation information was then used to inform socio-economic Status (SES) using the Elley-Irving Socio-Economic Index Scale which uses New Zealand Census data to rank occupations based on the median income and education level associated with that occupation (Elley & Irving, 2003). The rankings form six categories ranging from 1 (professional) - 6 (unskilled). An additional category of '7' was used to denote a stay at home parent and '8' was used to indicate an unemployed status. These codes where then further classified into the categories of 1 (occupation represents a professional/managerial position), 2 (occupation involves clerical,

technical or skilled work), 3 (occupation involves unskilled/ labour work) and 4 (unemployed). Families were considered 'high' SES if the person in the household with the highest ranked occupation fell into categories 1 and 2, while families who were categorised as a 3 or 4 we classified as 'low SES'.

Mothers were also asked about the frequency and quantity of their use of alcohol, tobacco, benzodiazepines, stimulants, cannabis and illicit opiates during each week of their pregnancy. As mentioned previously, these recollections were supported by clinical records, urine tests and meconium sampling. In addition to drug use information, mothers were assessed for post-natal depression using the Edinburgh Postnatal Depression Scale (Cox, Chapman, Murray, & Jones, 1996). Infant characteristics collected at the term assessment from hospital records included their gender, gestational age, birthweight, head circumference, days spent in hospital and any treatment for Neonatal Abstinence Syndrome.

A second interview (see appendix D) was conducted at the 9.5 year follow-up assessment with the caregiver that accompanied the child to the assessment. This interview involved the same measures as the interview conducted at birth including age, ethnicity, marital status, occupation and substance use. The caregiver who attended the interview at the child assessment was also asked about the child's current living situation and responses were recorded as either 'living with biological mother', 'living with biological father only', 'living with other relative' or 'living with non-relative'.

3.5.2 Measure of Externalizing Behaviour: the Behaviour Assessment System for Children – Second Edition (BASC-2)

The Behaviour Assessment System for Children-Second Edition (BASC-2) is a revised, multi-method and multidimensional system used in the evaluation of self-perceptions and behaviour from the ages of two to twenty-five. It is designed to assist in the differential

diagnosis and educational classification of a wide range of emotional and behavioural disorders and to help in the planning of interventions and treatment (Reynolds & Kamphaus, 2004). The scales included in the BASC-2 are standardized on norm samples of 13,000 children aged between two and eighteen from 275 cities across the United States, producing both combined-sex and male/female norms in which to compare data. (Reynolds & Kamphaus, 2004).

The current study used the Parenting Rating Scales- Child (PRS-C) (see appendix E) from the assessment system, which is designed to be used with children between the ages of six and eleven. The PRS-C consists of fourteen primary clinical sub-scales designed to measure a child's adaptive and problem behaviours, and seven content scales to aid in the interpretation of the primary scales and broaden the depth of the information gathered. Each item on the scale describes a behaviour, for example 'refuses to join group activities' or 'adjusts well to changes in routine', and caregivers are asked to respond to each item by circling either N (never), S (sometimes), O (often) or A (almost always) depending on how often they feel the child exhibits the behaviour described (Reynolds & Kamphaus, 2004). An Externalizing Behaviour Composite score is calculated by the BASC-2 ASSIST computer scoring programme using the Hyperactivity (fiddling with things, interrupting others, over activity, poor self-control, acting without thinking and being unable to wait for a turn), Conduct Problems (socially deviant and disruptive behaviours such as cheating, stealing, lying, being truant from school and running away from home) and Attention Problems (inability to maintain attention, easily distracted from tasks) subscales from the PRS-C. This composite is characterised by the disruptive, delinquent and aggressive nature of a child's behaviour. For the BASC-2 system a T-score of 60 to 69 (representative of scores between one and two standard deviations from the mean) on the individual scales or composite, indicates the presences of a behavioural problem in the 'at-risk' range which while requiring treatment and monitoring, may not be sufficient for a clinical diagnoses. A T-score above 70 (representative of scores greater than two standard deviations

from the mean) is classed as 'clinically significant' and indicative of a high level of maladaptive behaviour (Reynolds & Kamphaus, 2004).

The BASC-2 forms include a number of built in validity checks. The F index gives an idea of whether the parent filling out the form has responded in an exceedingly negative manner potentially skewing the results, while the consistency index identifies whether someone has responded differently to items that should be rated in a similar way. The PRS-C also includes a response pattern index to identify cases where someone has possibly responded randomly or has not paid close attention to the items (Reynolds & Kamphaus, 2004). The BASC-2 forms have been found to correlate well with the Connors' Parent Rating Scale-Revised (r=0.79), the Child Behaviour Checklist (r= 0.69-0.84) and the Behaviour Rating Inventory of Executive Function (BRIEF) (r=0.48-0/80) (Chee Soon Tan, 2007; Colletti et al., 2008; Reynolds & Kamphaus, 2004). The BASC-2 forms have also been shown to be internally consistent with coefficients ranging from 0.73-0.88 while test-retest reliability coefficients for the forms range from 0.78-0.92 (Chee Soon Tan, 2007; Colletti et al., 2008; Reynolds & Kamphaus, 2004). The BASC-2 PRS-C form has been found to efficiently discriminate between typically developing children and those with externalising behavioural symptoms. Studies have reported that the two forms reliably detected aggression, conduct problems and inattention in children diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD) (Curtis, Chapman, Dempsey, & Mire, 2013; P. Graziano, Geffken, & McNamara, 2011; P. A. Graziano, McNamara, Geffken, & Reid, 2013).

3.5.3 Measure of Effortful Control: The Frustrating Puzzle Box

The Frustrating Puzzle Box is based on a puzzle task originally developed by Eisenberg and colleagues as a behavioural measure of effortful control in children (Eisenberg et al., 1996; Eisenberg, Guthrie, et al., 2000; Eisenberg, Spinrad, Fabes, Reiser, Cumberland, Shepard, Valiente, Losoya, Guthrie, Thompson, et al., 2004; Eisenberg et al., 2003; Zhou et al., 2007).

The puzzle box consists of a wooden box measuring 24in. x 12in. x 14in. containing a small wooden puzzle of a tiger. Sleeves are attached to either side of the box for the child to place their arms. The top of the box is made of clear Perspex which is then covered by a cloth to hide the puzzle from the child. The back of the box is also made of clear Perspex in order to observe the child's hand movements. The child is instructed to try and complete the puzzle within five minutes and if they manage to do so they will receive a prize. The cloth covering the Perspex lid of the box can be easily lifted so that the child can cheat by looking at the puzzle.

The task requires the child to focus their attention on the task without being distracted and effortfully inhibit any behaviours that arise from being frustrated at not being able to see the puzzle (such as lifting the cloth). The amount of time the child works on the puzzle is divided by the number of seconds the child is left alone with the task to give an observed persistence proportion score that reflects the time the child persisted on the challenge rather than being off task or cheating (Eisenberg, Spinrad, Fabes, Reiser, Cumberland, Shepard, Valiente, Losoya, Guthrie, Thompson, et al., 2004). Each child was video recorded at the time of assessment for later coding of the task. An observed persistence proportion score was calculated from the recording by timing the amount of time the child spent working on the puzzle and dividing it by the time the child was left alone with the puzzle.

The Frustrating Puzzle Box taps multiple components of effortful control (sustained attention, inhibitory control) and although it has not yet been used extensively, several studies do support its utility as a behavioural measure of effortful control. Eisenberg et al. (1996) found significant correlations between parent and teacher reports of children's self-regulation with observed persistence on the puzzle box ($r = 0.27$-0.32) (Eisenberg et al., 1996). Similar correlations between parent/teacher reports of regulation and observed regulation on the box task have also been reported in studies looking at emotional self-regulation at two separate time

points (r = 0.25-0.27, p<.01) (Eisenberg & Spinrad, 2004), (r= 0.24-0.27) (Eisenberg et al., 2003).

3.5.4 Measure of Effortful Control: Stop-Signal Task

The stop signal task is a visual choice reaction time task designed to measure the child's capacity to inhibit an already initiated response. The current task is a shortened version of Scott Langeneckers Parametric Go/No-Go Stop Task downloaded from the authors web page http://sitemaker.umich.edu/slangen/downloads (Langenecker, 2011). The task was set up on a laptop computer which was placed on the table directly in front of the child and involved setting up a pre-potent response tendency (in this case using letters of the alphabet) and a less frequent stop signal for participants to withhold their response. The stop signal for the current task is a picture of a stop sign. The first trial consists of a series of letters presented rapidly one at a time on a computer screen. The child is told that they must press the 'n' key on the computers keyboard every time they see the letter 'r' or the letter 's'. For trial two the child is again told to press the 'n' key whenever they see the letters 'r' or 's' but that this time there is a new rule called the stop sign rule. The stop sign rule means that whenever the child sees the target letters, rather than immediately pressing the 'n' key they are told to wait to see if a picture of a stop sign flashes up after the target letter is presented. If a stop sign does flash up, then the child is not to push the 'n' key, if no stop sign appears and instead another non-target letter of the alphabet is presented then it is ok to press the 'n' key. Trial three is a repeat of trial one with another target letter added. For this trial the child is told to press the 'n' key every time they see the letters 'r,'s' or 't'. Trial four is a repeat of trial two with the addition of the third target letter 't'.

The theory behind the task is that the requirements of the task itself correspond to the temporal race model of behaviour control (Dougherty, Mathias, Marsh, & Jagar, 2005).

Sometimes called the horse-race model, it describes two neural processes racing against each other (the process responding to the go stimulus and the process responding to the stop stimulus), whether the behaviour is expressed or restrained (i.e. whether the button is pushed or not pushed) depends on which process gets completed first. Those low in inhibitory control have a reduced capacity to inhibit the initiated response meaning a go response process is completed more frequently than the stop process (Dougherty et al., 2005; Logan, Cowan, & Davis, 1984).Varying versions of a stop-signal task based on this model have been used extensively in research and are considered a reliable and valid measure of inhibitory control with the main dependent variable calculated from the task being the stop-signal reaction time (SSRT). The SSRT is the time required to inhibit the 'go' response when a stop signal is presented, those who are low in inhibitory control require more time to action this inhibition so a slower SSRT has been found to be a robust indicator of poor inhibitory control (Eagle & Robbins, 2003; Fillmore & Rush, 2002; Gordon, Schachar, & Tannock, 1997; Levitan et al., 2015; Lipszyc & Schachar, 2010; McLaughlin et al., 2016; Nederkoorn, Jansen, Mulkens, & Jansen, 2007; Raiker, Rapport, Kofler, & Sarver, 2012; Schachar & Logan, 1990; Schreiber, Grant, & Odlaug, 2012; Snorrason, Smári, & Ólafsson, 2011; Strakowski et al., 2009).

Other variables measured by the task include the number of target 'hits' in both the Go and Stop conditions (how often the child the child correctly responded to the target letters), reaction time for the Go condition (the speed at which the child responded to the target letter) the number of omissions in both conditions (how often the child failed to respond to the target letters) and commission errors for the Stop condition (responding to a target letter when a stop sign was presented). The task was scored in Excel using macros and instructions provided by the author of the task

3.6 Data Entry and Data Analyses

3.6.1 Data Entry

Data for all measures administered during the current study was initially entered into a Microsoft Access 2010 database specifically set up for the 9.5 year follow-up data wave. Term clinical and demographic variables for the study sample had previously been entered into a Microsoft Access database specifically relating to term study data. Required variables from both Access databases were then imported and collated into a Statistical Package for Social Sciences (SPSS) version 22 file. Data in the complete SPSS file was then cleaned and sent to a fellow post-graduate psychology student working for the CCDRG who checked 10% of the data against original paper copies and electronic files.

3.6.2 Statistical Methods

Data was analysed using SPSS version 22, including both parametric and non-parametric tests where relevant. All data was examined for missing values, outliers and violations in distribution using scatter plots, histograms and Levene's test. Further data analysis was then conducted in stages according to study aims, with a significance level of $p<.05$ used to detect statistically significant results across all analyses.

Analysis of Sample Characteristics at Birth: Statistical analyses involved examining between group differences on all clinical and demographic variables from the assessment wave conducted at birth using two-tailed independent samples t-tests for continuous variables and the chi-square test of independence for dichotomous variables. Following this, a cumulative socio-environmental risk composite was computed by combining dichotomous variables representing significant maternal socio-environmental risk factors. The variables selected for the composite included in the current study were based on risk indices that have been

previously used in research by the Canterbury Child Development Research Group in addition to other research involving high risk populations which found these variables to impact on child development (Foster-Cohen, Friesen, Champion, & Woodward, 2010; Lean et al., 2013; Lee, 2012; Lengua, Honorado, & Bush, 2007; Roberts, Lim, Doyle, & Anderson, 2011; Whitaker et al., 1996). Variables measured at birth only were used for the composite due to the fact that when recruiting for the 9.5 year follow-up a number of ME children were found to no longer be in the care of their biological mothers, and the length of time between the child being removed from their mothers care and placed with the caregiver who attended the 9.5 year interview ranged from a few weeks to a number of years. This meant that the length of time a child had been exposed to the home environment and care of the adult they attended the assessment with varied widely. Given this issue and research supporting the notion that early socio-environmental risk factors have a large and continuing impact on development (Appleyard, Egeland, van Dulmen, & Alan Sroufe, 2005; Brooks-Gun & Duncan, 1997; Sameroff, 1998), variables from the birth assessment were believed to be the most consistently reflective of the socio-environmental risk factors faced by the child.

The five variables collected during the parent interview and incorporated into the risk composite were defined as: minority ethnicity – mother identified as belonging to a racial group that was not New Zealand European (e.g. Maori, Pacific Islander, Asian or other), early motherhood – mother was under the age of twenty-one at the time she gave birth, low education – mother had no high school or tertiary qualifications, single parent – mother had no partner at the time she gave birth and low household SES – Families where both parents were either unemployed or had unskilled/labouring occupations. Each risk variable was coded as either '1' for exposure to risk is present or '0' for no exposure to risk present. The cumulative socio-environmental risk score was then calculated by summing the scores for each risk variable with

each child receiving a score from zero (no exposure to risk factors) to five (child is exposed to all included risk factors).

Analysis of behavioural data: For analysis of the externalizing behaviour composite and the individual scales involved in creating the composite, between-group differences were examined using either two-tailed independent samples t-test or chi-square test of independence. The association between group status and outcomes on the behavioural scales was further examined using effect size estimates and Odds Ratios. For dichotomous variables effect size was calculated using Odds Ratios, while effect size for continuous variables was calculated using Cohen's d and classified according to Cohen's criteria of small effect size (0.2), medium effect size (0.5) and large effect size (0.80) (Cohen, 1992). For scales that were found to have a non-normal distribution, subsequent analysis using the non-parametric Mann-Whitney U test was conducted to confirm consistently significant between-group differences.

Analysis of effortful control variables: Between-group differences on measures of effortful control were examined using the same statistical methods previously described for the behavioural outcome data. Following this examination of between group differences, a composite measure of effortful control was calculated in order to create a more psychometrically robust measure to use in subsequent analyses. Composite measures of effortful control are routinely used in previous research given the multi-dimensional nature of the construct. Various combinations of parent/ teacher reports and/or laboratory behavioural based measures have been combined in previous studies to give an overall indication of effortful control ability (Blair & Razza, 2007; Rina D. Eiden et al., 2009; Hirvonen, Torppa, Nurmi, Eklund, & Ahonen, 2016; Hofer, Eisenberg, & Reiser, 2010; Karreman, van Tuijl, van Aken, & Dekovic, 2009; G. Kochanska et al., 2000; Lengua, Bush, Long, Kovacs, & Trancik, 2008; Liew et al., 2008; Murray & Kochanska, 2002; Olson et al., 2005; Smith, Diaz, Day, & Bell, 2016; Valiente et al., 2003; Voigt, Pietz, Pauen, Kliegel, & Reuner, 2012; Xu, Zhang, &

Farver, 2009; Zhou et al., 2008). As the effortful control variables for the current study were scored on different metrics, a weighted composite was created using z-score transformations. This was achieved by first converting each raw score into a z-score using the formula (score-mean)/standard deviation. Variables on which a low score indicated more ability were reversed scored for consistent interpretation. Following transformation, z-scores for each variable were summed together to form a composite. This composite was then used in all statistical analyses, however in order to aid in the interpretation of the composite score in the results table, the composite was standardised into a distribution of mean =100, SD=10. Between-group differences on the composite were then calculated using two-tailed independent samples t-test.

Analysis of predictors of externalizing behaviour: A hierarchical multiple regression analysis was used to examine whether low levels of effortful control ability would significantly predict whether or not a child had externalizing behavioural problems at age 9.5 years over and above the contribution of prenatal methadone exposure, socio-environmental risk factors and poly-substance exposure.

First, variables were selected for inclusion in the analysis based on established group differences identified in birth characteristics, and the available literature on the relationship between effortful control and externalizing problem behaviour. A correlation matrix was then produced to identify which of the selected variables had a significant relationship with externalizing behaviour using Pearson's *r* and a significance level of $p<0.05$. Once the significantly related variables were identified, the variables were checked for multicollinearity using tolerance and VIF values and examined for outliers, normality, linearity and homoscedasticity using the Normal Probability Plot of the Regression Standardized Residuals and scatter plots to ensure the assumptions of multiple regression were not violated. Variables were then entered into the regression using a hierarchical method in order to identify which of the selected variables made a unique and significant ($p<.05$) contribution to externalizing

behaviour outcomes at 9.5 years of age. Specific results for all analyses according to the study aims are presented in the following chapter.

Chapter Four: Results

4.1 Demographic Characteristics of the Study Sample Measured at Birth

Table 2 presents a demographic background of ME and Non-ME children and their mothers at birth. The results show that while group differences in the age at which the mothers gave birth approached significance (p= .07), on average methadone maintained (MM) mothers gave birth at a similar age to Non-Methadone maintained (Non-MM) mothers. No significant differences in the proportion of mothers in either group giving birth before the age of twenty-one were found (p=0.31). Infant characteristics show a similar proportion of male and female infants in both the ME and Non-ME groups, and while ME infants had a similar gestational age to Non-ME infants they were found to have a significantly shorter birth length (p=.001), smaller head circumference (p=.002) and were significantly lighter at birth, weighing on average nearly 400grams less than Non-ME infants (p<.001).

No significant between-group differences were found for the ethnic identity of study group mothers, with 64% of MM mothers and 66% of Non-MM mothers identifying as New Zealand European (p=0.18). This finding is consistent with the latest ethnicity data from the 2013 New Zealand Census which reports the majority of the population predominately identify as New Zealand European (74.6%) (Statistics New Zealand, 2015).

In terms of marital status, a significantly greater proportion of Non-MM mothers were legally married at the time of giving birth (72%) in comparison to MM mothers (2%), with the majority of MM mothers choosing to cohabitate with their partners (52%, p<.001). Results also showed that over three quarters of MM mothers had left school before completing their high school education, while just under a quarter of Non-MM mothers had not completed secondary school (p<.001). In addition to having a limited education, family socioeconomic status data as defined by the Elley-Irving Socio-Economic Index (Elley & Irving, 2003) revealed that 94%

of MM mothers were living in households classified as ‘low SES’, a significantly higher proportion than seen for Non-MM mothers (30%, $p<.001$). The five socio-environmental risk variables of young mum, minority ethnicity, no high-school education, single parent and low SES were dichotomised and summed to form a cumulative risk index, with results showing that ME children were significantly more likely to be born into households characterised by greater cumulative risk than children in the Non-ME group ($p<.001$).

Table 2

Comparison of Mother and Infant Demographic Data Collected at Birth

Measure	Methadone-Maintained Mothers (*n*=50)	Non-Methadone-Maintained Mothers (*n*=50)	X^2/t	*p*
Maternal Characteristics				
Age, M ±SD, years	29.48 ± 4.85	31.30 ± 5.14	-1.82	0.07
Young Mother[a], % (*n*)	2.0 (1)	6.0 (3)	1.04	0.31
No high-school education, % (*n*)	82.0 (41)	22.0 (11)	36.06	<.001
Ethnic Status				
Maori, % (*n*)	24.0 (12)	16.0 (8)		
NZ European, % (*n*)	64.0 (32)	66.0 (33)		
Pacific Islander, % (*n*)	0	2.0 (1)		
Asian, % (*n*)	0	8.0 (4)		
Other, % (*n*)	12.0 (6)	8.0 (4)	6.22	0.18
Marital Status				
Legally married, % (*n*)	2.0 (1)	72.0 (36)		
Cohabitating, % (*n*)	52.0 (26)	16.0 (8)		
No partner, % (*n*)	46.0 (23)	12.0 (6)	52.60	<.001
Family Socio-Economic Status				
High SES[b], Professional/managerial position, % (*n*)	0	26.0 (13)		
Medium SES[b], Clerical. Technical or skilled work, % (*n*)	6.0 (3)	44.0 (22)		

Low SES[b], Unskilled/ labour work/unemployed[b], % (*n*)	94.0 (47)	30.0 (15)	43.96	<.001
Cumulative social risk score[c], M ±SD	2.48 ± 0.89	0.98 ± 1.29	6.79	<.001

Measure	ME Infants (n=50)	Non-ME Infants (n=50)	X^2/t	*p*
Infant Characteristics				
Male, % (*n*)	54.0 (27)	50.0 (25)	0.16	0.69
Gestation Age, M ±SD, weeks	38.81 ± 1.39	39.15 ± 1.49	-1.19	0.24
Birth-weight, M ±SD, grams	3051.70 ± 399.47	3429.30 ± 506.93	-4.14	<.001
Head circumference, M ±SD, cm	33.98 ± 1.57	34.88 ± 1.17	-3.22	.002
Birth length, M ±SD, cm	50.56 ± 2.67	52.42 ± 2.80	-3.36	.001

Note. SES=Socio-economic Status

[a]mother less than 21 years of age at time of giving birth, [b]as defined by the Elley Irving Scale (Elley & Irving, 2003), [c]young mum, no high school education, minority ethnicity, single parent status and low SES variables dichotomised and summed.

4.2 Clinical characteristics of the Study Sample Measured at Birth

Examination of group differences in clinical characteristics from the assessment conducted at birth are presented in Table 3 and show that MM mothers were not significantly more likely than Non-MM mothers to report signs of depressive symptomology following the birth of their child (p=0.63). The results of detailed accounts of both licit (tobacco, alcohol) and illicit (cannabis, opiates, benzodiazepines, stimulants) drug use did reveal significant between-group differences in the prevalence of drug use during pregnancy. For licit drug use during pregnancy, nearly all MM mothers reported smoking tobacco while pregnant (92%) compared to less than a quarter of Non-MM mothers (p<.001), while 22% of mothers in both groups reported that they had drunk alcohol during their pregnancy. Cannabis was the most commonly used illicit substance with nearly half of all MM mothers reporting that they had

smoked cannabis during their pregnancy compared to only 2% of Non-MM mothers ($p<.001$). Cannabis was the only illicit substance used during pregnancy to be acknowledged by Non-MM mothers, i.e. none of the Non-MM mothers reported using opiates, benzodiazepines or stimulants. MM mothers however reported that they had continued to use other opiates in addition to methadone (26%), benzodiazepines (30%) and/or stimulants (22%) during pregnancy ($p<.001$). Overall, over half of all MM-mother reported illicit drug use during their pregnancy.

In terms of the methadone exposure of ME infants, the average methadone dose of women maintained on methadone during pregnancy was 55.83 milligrams. A total of 86% of ME infants required treatment for neonatal abstinence treatment at birth, and on average required approximately two months of drug intervention treatment ($p<.001$). Due to this treatment, ME infants were also significantly more likely to have an extended stay in hospital, with an average stay of approximately seventeen days compared to just three days for Non-ME infants ($p<.001$).

Table 3

Comparison of Maternal and Infant Clinical Data Collected at Birth

Measure	Methadone-Maintained Mothers (n=50)	Non-Methadone Maintained Mothers (n=50)	X^2/t	*p*
Maternal Characteristics				
Methadone dose during pregnancy, M ±SD	55.83 ± 33.86	0	11.66	<.001
Mental Health				
in clinical range for depressive symptomology on EDS, % (*n*)	24.0 (12)	20.0 (10)	0.23	0.63
Substance use during pregnancy				
Any tobacco use, % (*n*)	92.0 (46)	22.0 (11)	49.98	<.001
Any alcohol use, % (*n*)	22.0 (11)	22.0 (11)	0.00	1.00
Any cannabis use, % (*n*)	46.0 (23)	2.0 (1)	26.54	<.001
Any opiate use, % (*n*)	26.0 (13)	0	14.94	<.001
Any benzodiazepine use, % (*n*)	30.0 (15)	0	17.65	<.001
Any stimulant use, % (*n*)	22.0 (11)	0	12.36	<.001
Measure	ME Infants (n=50)	Non-ME Infants (n=50)	X^2/t	*p*
Infant Characteristics				
Total days in hospital, M ±SD	16.62 ± 12.99	2.76 ± 1.60	7.49	<.001
Requiring treatment for Neonatal Abstinence Syndrome, % (*n*)	86.0 (43)	0	75.44	<.001
Days of drug intervention required, M ±SD	62.00 ± 43.48	0	8.81	<.001

Note. EDS= Edinburgh Depression Scale

4.3 Demographic Characteristics of the Study Sample at the 9.5 Year Follow-Up

Table 4 presents demographic data collected from caregiver interviews conducted during the 9.5 year assessment wave. Unlike the results of the birth assessment data where there was no significant differences in the age of the mothers, the average age of caregivers at the 9.5 year assessment were found to be significantly different between the caregivers of ME Children (MEC caregivers) and caregivers of Non-ME Children (Non-MEC caregivers) (p=.004). It is important to note that for the 22% of ME children in the care of another relative, the 'other' relative was generally the grandparents of the child which likely accounted for the slight difference in mean caregiver age for each group.

No significant differences in ethnic identity were found between groups with 26% of MEC caregivers and 36% of Non-MEC caregivers reporting they identified with an ethnicity other than New Zealand European (p=0.28). Significant group differences were however found in the marital status of caregivers at the 9.5 year follow-up with nearly three quarters of Non-MEC caregivers reporting they were legally married compared to only 18% of MEC caregivers (p<.001). The majority of MEC caregivers instead reported that they currently had no partner (60%), with a significantly smaller proportion of Non-MEC caregivers reporting that they were single (12%, p<.001).

Over three quarters of all Non-MEC caregivers were found to be working in clerical/technical/skilled type work or professional/managerial positions which placed them in the medium to high SES brackets according to the Elly-Irving criteria (Elley & Irving, 2003). In comparison, 70% of the MEC caregivers were currently working in either unskilled/labour type jobs or were unemployed making them four times more likely to be living in households classified as low SES (p<.001).

Table 4

Comparison of Caregiver Demographic Characteristics at the 9.5 Year Assessment

Measure	ME Child Caregivers (n=50)	Non-ME Child Caregivers (n=50)	X^2/t	*p*
Caregiver Characteristics				
Age, M ±SD, years	45.92 ± 10.99	40.80 ± 5.17	2.98	.004
Ethnic Status				
Maori, % (*n*)	18.0 (9)	18.0 (9)		
NZ European, % (*n*)	72.0 (36)	64.0 (32)		
Pacific Islander, % (*n*)	0	2.0 (1)		
Asian, % (*n*)	0	8.0 (4)		
Other, % (*n*)	10.0 (5)	8.0 (4)	5.35	0.25
Marital Status				
Legally married, % (*n*)	18.0 (9)	72.0 (36)		
Cohabitating, % (*n*)	22.0 (11)	16.0 (8)		
No Partner, % (*n*)	60.0 (30)	12.0 (6)	32.64	<.001
Family Socio-Economic Status				
High SES[a], Professional/managerial position, % (*n*)	2.0 (1)	44.0 (22)		
Medium SES[a], Clerical, Technical or skilled work), % (*n*)	28.0 (14)	38.0 (19)		
Low SES[a], Unskilled/ labour work/unemployed, % (*n*)	70.0 (35)	18.0 (9)	38.22	<.001

Note. SES= Socio- Economic Status

[a]as defined by the Elley Irving Scale (Elley & Irving, 2003).

4.4 Externalizing Behaviour of ME Children in Comparison to Non-ME Children at Age 9.5 Years.

Results of the examination of ME children's behavioural adjustment at age 9.5 years presented in Table 5 support the first hypothesis, with ME children receiving a higher score on the composite measure of externalizing behaviour from the BASC-2 than Non-ME children (p<.001). Also in support of the first hypothesis is the finding that ME children were significantly more likely than Non-ME children to be rated as having a level of behavioural issues that met the criteria for 'at-risk' or clinically significant'. According to BASC-2 normative data, a T-score of 60-69 is indicative of a level of behaviour that falls into the at-risk category while a T-score of 70 or greater indicates a high level of maladaptive behaviour that is clinically significant. A total of 24% of children in the ME group received scores that placed them in the at-risk category, with a further 18% receiving scores that met the criteria for the clinically significant category. In comparison, no children in the Non-ME group received scores on the externalizing behaviour composite that met the cut-off for either category (p<.001 -.002).

On examination of the individual scales which inform the externalizing behaviour composite, results showed that when compared with children in the Non-ME group, ME children were characterized as having higher levels of problem behaviour across all three behaviour scales. Table 5 shows the mean scores obtained by the ME group and Non-ME group on the PRS-C from the BASC-2. When compared with children in the Non-ME group at age 9.5 years, ME children were characterized as having higher levels of conduct problems (p<.001), attention problems (p<.001), and hyperactivity (p<.001) as rated by their caregivers. Results presented in Table 5 also show that based on caregiver report, approximately a quarter of ME children received scores that placed them in the at-risk category on the conduct problems scale (22%), attention problems scale (32%) and the hyperactivity scale (26%). In comparison

Non-ME children were unlikely to receive scores that placed them in the at-risk range with no Non-ME children scoring in the at-risk category for conduct problems (p<.001), 12% receiving scores that placed them in this category for attention problems (p=0.02) and only 8% for hyperactivity (p=0.02). When scores that met the criteria for the clinically significant category were considered, it was found that no children in the Non-ME group received a score that placed them within this category for any of the three individual scales. In comparison, 16% of ME children scored above the cut-off for clinically significant behaviour on the conduct problems scale (p<.001), 12% for the attention problems scale (p=0.01) and 14% for the hyperactivity scale (p=.006). Effect size estimates for group comparisons across the three scales and composite were large, ranging from d = 0.95 – 1.20.

Table 6 presents the proportion of children in both the ME and Non-ME groups who met the criteria for either an 'at-risk' or 'clinically significant' level of behaviour across multiple behaviour subscales. Results show that ME children were significantly more likely than Non-ME children to be rated as having comorbid conduct and attention problems (p<.001), conduct and hyperactivity problems (p<.001) and attention and hyperactivity problems (p<.001). Overall only one Non-ME child was found to show any sign of co-existing behavioural problems (attention and hyperactivity problems), which is in stark comparison to ME children where over a quarter (26%) were found to score above cut-off criteria across all three behaviour subscales.

Table 5

Caregiver Reported Externalizing Behaviour of ME and Non-ME Children on the BASC-2

Variable	ME Children (n=50)	Non-ME Children (n=50)	X^2/t	*p*	Effect size (*d* / OR, 95% CI)
Composite Score					
Externalizing Behaviour Composite T-score M ±SD	58.48 ± 11.62	47.42 ± 5.86	6.01	<.001	1.20
Score in 'at-risk' range, % (*n*)	24.0 (12)	0	13.63	<.001	-
Score in 'clinically significant' range, % (*n*)	18.0 (9)	0	9.89	.002	-
Individual Scale Scores					
Conduct Problems Scale					
Conduct Problems T-score, M ±SD	56.76 ± 9.28	47.16 ± 6.09	4.77	<.001	0.95
Score in 'at-risk' range, % (*n*)	22.0 (11)	0	12.36	<.001	-
Score in 'clinically significant' range, % (*n*)	16.0 (8)	0	8.70	.003	-
Attention Problems Scale					
Attention Problems T-score, M ±SD	57.94 ± 9.28	48.96 ± 8.54	5.04	<.001	1.01
Score in 'at-risk' range, % (*n*)	32.0 (16)	12.0 (6)	5.83	0.02	3.45 (1.22 – 9.76)
Score in 'clinically significant' range, % (*n*)	12.0 (6)	0	6.38	0.01	-
Hyperactivity Scale					
Hyperactivity T-Score, M ±SD	58.80 ± 10.89	48.56 ± 7.25	5.34	<.001	1.11
Score in 'at-risk' range, % (*n*)	26.0 (13)	8.0 (4)	5.74	0.02	4.04 (1.22 – 13.43)
Score in 'clinically significant' range, % (*n*)	14.0 (7)	0	7.53	.006	-

Note. BASC-2 = Behaviour Assessment System for Children –Second Edition.

Table 6

Proportions of ME and Non-ME Children with Behavioural Problems in Multiple Categories

Behaviour Category	ME children (n=50)	Non-ME children (n=50)	X^2	*p*
Conduct and Attention Problems, % (*n*)	26.0 (13)	0	14.94	<.001
Conduct and Hyperactivity Problems, % (*n*)	32.0 (16)	0	19.05	<.001
Attention and Hyperactivity Problems, % (*n*)	34.0 (17)	2.0 (1)	17.34	<.001
Problem across all three behaviour categories, % (*n*)	26.0 (13)	0	14.94	<.001

4.5 Performance of ME and Non-ME children on Measures of Effortful Control at Age 9.5 Years.

Results presented in Table 7 support the second hypothesis that ME children would have poorer effortful control abilities than Non-ME children on tasks tapping the attention and inhibitory control components of effective effortful control. This was evidenced by ME children having a shorter persistence time on the frustrating puzzle box task, a slower stop-signal reaction time (SSRT) on the stop-signal task and an overall lower score on a composite measure of effortful control ability compared to Non-ME children.

Table 7 shows the mean scores obtained by children in the ME group and Non-ME group on the two laboratory based tasks tapping effortful control ability. For the stop-signal task, children in the ME group had a significantly slower stop signal reaction time (sign of poor inhibitory control) than Non-ME children (p<.001) indicating that they took longer to engage the inhibition process required to prevent themselves from responding to the 'go' response on trials where the stop signal was presented. Aspects of poor attentional control were also evident

in the ME group with a reduced number of target hits and increased target omissions when compared with the task performance of children in the Non-ME group (p<.001). Performance on the frustrating puzzle box task also characterised ME children as having poor attention and inhibitory control. ME children were less likely to avoid the temptation of peeking at the puzzle and remain focused on the task at hand without letting their attention wander off-task. This was reflected in the total time they spent on task and their overall persistence proportion score, both of which were significantly lower than what was found for the Non-ME group (p<.05).

The total persistence time on the frustrating puzzle box task and the SSRT from the stop-signal task were then used to inform a composite measure of overall effortful control ability. Results presented in Table 7 show that ME children on average scored significantly lower (M=95.71) on this composite measure than Non-ME children (M=104.12, p<.001). Effect size estimates for group comparisons on all variables were medium to large ranging from d = 0.41- 1.36.

Table 7

Child Performance on Laboratory Based Effortful Control Tasks

Variable	Methadone-Exposed (n=50)	Non-Exposed Comparison (n=50)	X^2/t	*p*	Effect Size (*d* / OR, 95% CI)
Individual Tasks					
Stop Signal Task					
Two Target Condition					
'Go' RT	573.05 ± 57.61	572.75 ± 72.05	0.02	0.98	0.00
Target hits 'Go' condition, M ±SD	22.57 ± 2.99	24.54 ± 1.50	-4.13	<.001	0.83
Target Hits 'stop' condition M ±SD	18.23 ± 5.61	22.90 ± 3.49	-4.95	<.001	0.99
Omission errors 'Go condition', M ±SD	3.43 ± 2.99	1.46 ± 1.50	4.13	<.001	0.83
Omission errors 'stop' condition M±SD	8.79 ± 5.58	4.10 ± 3.49	4.99	<.001	0.42
Commission errors M±SD	2.78 ± 2.79	4.10 ± 2.64	-2.38	0.02	0.49
Three Target Condition					
'Go' RT	679.93 ± 141.41	625.86 ± 91.74	2.25	0.03	0.45
Target hits 'Go' condition, M ±SD	16.57 ± 5.91	23.18 ± 3.53	-6.73	<.001	1.36
Target hits 'stop' condition	19.83 ± 4.74	22.16 ± 4.65	-2.44	0.02	0.50
Omission errors 'Go' condition, M ±SD	10.23 ± 5.84	3.82 ± 3.53	6.58	<.001	1.33
Omission errors 'stop' condition M±SD	8.40 ± 4.95	5.84 ± 4.65	2.63	0.01	0.53

Commission errors M±SD	2.74 ± 2.46	2.54 ± 1.84	0.48	0.64	0.09
SSRT[a] M ±SD	321.19 ± 20.53	304.96 ± 12.26	4.76	<.001	0.96
Frustrating Puzzle Box					
Total time spent on task, min, M ±SD	2.40 ± 1.79	3.14 ± 1.85	-2.04	0.04	0.41
Persistence proportion score, %, M ±SD	47.95 ± 35.81	62.83 ± 36.94	-2.04	0.04	0.41
Composite Score					
Effortful Control Composite Score, M ±SD	95.71 ± 10.59	104.12 ± 7.42	-4.57	<.001	0.92

Note. SSRT=Stop Signal Reaction Time,
[a]Average SSRT across all trials.

4.6 Predictors of Externalizing Behavioural Problems in ME and Non-ME Children at Age 9.5 Years

Results presented in Table 9 partially support the third hypothesis. Prenatal methadone exposure was found to significantly contribute to externalizing problem behaviour scores at age 9.5 years after controlling for socio-environmental risk factors and poly-substance exposure during pregnancy. Effortful control ability was also predicted to make a significant contribution to externalizing behaviour outcomes over and above the effect of socio-environmental risk factors and poly-substance exposure but this was not supported by the results.

Hierarchical multiple regression was used to examine the extent to which methadone exposure, low effortful control ability and/or socio-environmental and drug exposure factors contributed to an increased risk for higher externalizing problem behaviour scores on the

BASC-2 at age 9.5 years. Selection of variables which could potentially contribute to an understanding of externalizing problem behaviour at age 9.5 years in all children (n=100) was based on established group differences in social risk and drug use variables identified in the analysis of sample characteristics at birth and the previous literature on the relationship between effortful control ability and externalizing behaviour. Gender was also included to assess the possibility boys are more likely to be rated as having externalizing behavioural problems as suggested by normative BASC-2 data (Reynolds & Kamphaus, 2004). Correlational analysis (Pearson's *r*) was used to determine which of the selected variables had a significant relationship with externalizing behaviour at age 9.5 years. Socio-environmental risk factors, effortful control ability and externalizing behaviour were entered as continuous composite scores as described previously, while group status and other drug use were entered as dichotomised (no exposure =0, exposure=1) variables. Table 8 presents the results of the correlation analyses which showed that higher levels of externalizing behaviour at age 9.5 years was significantly associated with exposure to methadone (r=.52, p<.01), low effortful control ability (r=**-.**35, p<.01), prenatal exposure to tobacco (r=.38, p<.01), cannabis (r=.35, p<.01) and benzodiazepines (r=.24, p<.05) and also a higher level of socio-environmental risk (r=.44, p<.01). No significant relationship between gender and score on the externalizing behaviour composite was found.

Table 8

Correlation Matrix of the Relationship between Effortful Control, Postnatal Socio-Environmental Risk Variables and Externalizing Behaviour at age 9.5 years.

	1	2	3	4	5	6	7	8	9	10
1 Externalizing Behaviour	-									
2 Group Status	.52**	-								
3 Effortful Control	-.35**	-.42**	-							
4 Tobacco use	.38**	.71**	-.35**	-						
5 Cannabis use	.35**	.52**	-.34**	.39**	-					
6 Benzo use	.24*	.42**	-.24*	.25*	.49**	-				
7 Opiate use	.11	.39**	-.15	.22*	.41**	.25*	-			
8 Stimulant use	.13	.35**	-.19	.18	.33**	.39**	.34**	-		
9 Social Risk	.44**	.57**	-.31**	.56**	.29**	.32**	.26**	.17	-	
10 Gender	-.09	-.04	.14	.03	.07	-.01	.05	-.02	.08	-

Note. Pearson's *r* used. Benzos= Benzodiazepines. $p<.05$*, $p<.01$**.

Only variables which had a significant correlation of $r > .30$ ($p < .05$) were retained for further analysis as per regression guidelines (Pallant, 2010; Tabachnick & Fidell, 2014). Group Status was entered in to the regression model first and was found to make a significant contribution to explaining externalizing behaviour outcomes at age 9.5 years ($\beta = 0.52$, $p<.001$) as shown in Model One of Table 9. Next, the potential confounding variables of socio-environmental risk and prenatal exposure to tobacco and cannabis substances were entered into the regression. Results for Model Two showed that after controlling for risk factors identified at birth and poly-substance exposure during pregnancy, prenatal exposure to methadone continued to make the strongest contribution to explaining externalizing behaviour outcomes at age 9.5 years ($\beta=0.37$, $p=.007$). However in addition to prenatal methadone exposure, early socio-environmental risk was also found to be significantly associated with externalizing behaviour after controlling for other factors in the model ($\beta=0.23$, $p=0.04$). The final regression model (Model Three) which accounted for 30% of the variance (adjusted $R^2= 0.30$), included the addition of effortful control ability as measured at 9.5 years of age. Results showed that the variance explained by effortful control ability was not-significant ($p=0.16$), with effortful control ability failing to contribute to an explanation of externalizing behaviour outcomes over and above that of prenatal methadone exposure ($p<.001$) and socio-environmental risk ($p=0.04$).

Table 9

Summary of Hierarchical Regression Analysis for Variables Associated with Externalizing Behaviour at Age 9.5 Years

Variable	B	SE	β	*p*
Model 1-Unadjusted				
Group Status	11.06	1.85	0.52	<.001
	F (1, 97) = 35.75, p<.0001, R^2= 0.27, Adjusted R^2= 0.26			
Model 2-Adjusted for Socio-environmental risk and Poly- Substance Exposure				
Group Status	7.93	2.86	0.37	.007
Socio-environmental Risk	1.85	0.88	0.23	0.04
Tobacco exposure	-1.39	2.75	-0.06	0.62
Cannabis exposure	3.02	2.49	0.12	0.23
	F (4, 94) = 10.66, p<.0001, R^2= 0.31, Adjusted R^2= 0.28			
Model 3-Adjusted for Effortful Control Ability				
Group Status	7.19	2.89	0.34	0.02
Socio-environmental risk	1.76	0.88	0.22	0.04
Tobacco exposure	-1.55	2.74	-.07	0.57
Cannabis exposure	2.46	2.51	0.10	0.33
Effortful Control	-0.72	0.51	-0.14	0.16
	F (5, 93) = 9.03, p<.0001, R^2= 0.33, Adjusted R^2= 0.30			

Chapter Five: Discussion

Dependence on opiates is being described as having reached 'epidemic proportions' and the number of infants born addicted to opiates is increasing both locally and internationally. Methadone maintenance is currently the only approved option for treating opiate dependence in pregnant women in New Zealand and while the benefits of this form of treatment are numerous for the mother, the long-term impact of prenatal exposure to an opioid substance for the child is unclear. The available literature, although limited by a number of methodological issues, suggests that ME children are significantly more likely than Non-ME children to have poor behavioural outcomes and have observationally noted self-regulation issues, yet to the authors knowledge no study has examined the relationship between these two constructs within an ME population. The current study aimed to address this issue by first comparing externalizing problem behaviour and effortful control ability in a cohort of ME children at age 9.5 years with a Non-ME comparison group of children. Finally, the current study aimed to identify the relevant contribution of regulatory, socio-environmental and drug-use variables to externalizing problem behaviour within the study sample at age 9.5 years. The key findings relating to the specific aims and hypotheses of the current study are discussed below.

5.1 Behavioural Adjustment Outcomes of ME Children in Comparison to Non-ME Children.

Children in the ME group were rated by their caregivers as having significantly higher levels of externalizing problem behaviours than Non-ME children on both the composite measure of externalizing behaviour and the individual scales from which the composite is comprised (conduct problems, attention problems and hyperactivity). These findings support the first hypothesis of the current study and indicate that children exposed to methadone during pregnancy are characterized as having a greater number of disruptive or 'undercontrolled' type

behavioural issues. When examined more closely, caregivers of children in the ME group were more likely than caregivers of Non-ME children to report that their child displayed delinquent or antisocial behaviours, were overactive or impulsive, or had difficulty maintaining attention with a tendency to be easily distracted. The findings from the current study are supported by the available previous research in this area which has consistently reported children prenatally exposed to opiates to have greater difficulty with anti-social type behaviours (Davis & Templer, 1988; de Cubas & Field, 1993; Ornoy et al., 2001; Wilson et al., 1979), were more likely to be delinquent (de Cubas & Field, 1993; Ornoy et al., 2001), had significantly more problems with attention and distractibility (Davis & Templer, 1988; Nygaard et al., 2016; Ornoy et al., 2001; Suess et al., 1997; Walhovd et al., 2007) and were overall more likely to exhibit a higher level of externalizing problem behaviour (de Cubas & Field, 1993; Nygaard et al., 2016; Soepatmi, 1994; Walhovd et al., 2007).

While the caregiving ratings of an ME child's behaviour was significantly higher than what was found for children in the Non-ME group across the individual scales and composite score, according to American normative data the mean score for both groups on the scales and composite score fell within the 'average' range (T-score between 41 and 59). However, the differences between the two groups become more apparent when looking at score classifications. A T score of 60-69 (equivalent to scores greater than one standard deviation from the mean) is used by the BASC-2 to signify when behaviour has crossed over from the 'average' range to 'at-risk, where the child is exhibiting significant behavioural problems that may require treatment and should be monitored carefully. Nearly a quarter of children in the ME group met the criteria for the 'at-risk' range on the externalizing behaviour composite with a further 18% receiving a T-score above 70 which indicated a high level of maladaptive behaviour classified as 'clinically significant' (equivalent to scores greater than two standard deviations from the mean). No children in the Non-ME group were rated as having a level of

behavioural issues that met either the at-risk or clinically significant criteria for the externalizing behaviour composite score or conduct problems scale. Scores for several children in the Non-ME group were classified as at-risk for the attention problems and hyperactivity scales, yet the scores of children in the ME group meant that ME children still had approximately three and a half to four times the odds of Non-ME children of scoring within the at-risk range on these scales. Direct comparison of these results with previous literature is difficult due to all but one of the reviewed studies only reporting differences in mean scores on behavioural scales with no further interpretation. Soeptami (1994) did not report the percentage of the children in their heroin-exposed group that scored above the cut-off for a 'high' level of behavioural problems on the Total Behavioural Problem Score (TPBS) from the CBCL, but did note that is was significantly higher than the 10% of children that scored above this cut-off in the non-exposed reference group (children participating in other large scale Dutch studies). No children in the Non-ME group were found to score above either cut-off for the externalizing behaviour measure used in the current study, however the TPBS score from the CBCL includes performance on internalizing behaviour scales rather than externalizing alone which may account for this difference.

The fact that so few children in the Non-ME group were rated as having any type of behavioural problem could also be suggested to be due to social desirability effects in Non-ME children's caregivers responding. Although the BASC-2 system includes a number of in-built validity checks to detect when a rater is being overly negative in their rating ('fake bad'), there is no check for overly positive or 'fake good' ratings on the PRS-C form. In addition, the criteria for having a significant problem on any of the scales or composite score was dependent on how the child scored compared to a normative sample of American children. The applicability of using cut-off criteria based on data from an American population is questionable due to potential cultural differences in how caregivers view 'problem' behaviours

as described in research on the developmental trajectories of externalizing behaviour (Bongers et al., 2003; Keenan & Shaw, 1997). Although it would have been ideal to interpret the results of the current study within a cultural framework more applicable to the one in which the behavioural data was gathered, this was not possible due to a) no normative data available for the BASC-2 in New Zealand or Australia and b) a regionally representative sample of Non-ME children too small to allow for cut-off scores to be determined based on their performance in the current study.

Interpretation of the externalizing behaviour data was also complicated for the ME children given that the results were based solely on caregiver ratings which can potentially limit findings due to issues with reporter bias. Differences in caregiving arrangements may alter how the same behaviours are perceived between children (Crea et al., 2008; Redding, Fried, & Britner, 2000). Caregivers of ME children in the current sample included biological mothers, biological fathers, grandparents, aunties, and foster parents, some of whom had had care of the child for the majority of their life while others had been caring for the child for only a few weeks. The current study did not account for the child's living arrangements in the assessment of behavioural outcomes of ME children due to the small numbers within each caregiving category resulting in a lack of power of the study to investigate this further. The current study can therefore not rule out in any possible differences in perception of child behaviour for example between an elderly grandparent or biological mother, or a foster parent who had cared for the child from birth compared to a foster parent who had cared for the child for six months, although the validity checks included in the BASC-2 assessment system did not reveal any caregiver to be excessively negative in their behaviour ratings. Given the use of parent reports only, the current study can also not determine whether the behavioural issues present in the current sample are situational or whether the child exhibits pervasive behavioural problems extending into other domains of functioning.

Despite these limitations, all together these findings support the previously cited methadone literature for externalizing behavioural outcomes in school aged-children and builds onto the previous literature on pre-school behavioural outcomes in ME children (Barth & Needell, 1996; Konijnenberg et al., 2015; Sarfi et al., 2013; Slinning, 2004; van Baar et al., 1994; Wilson et al., 1981), by reinforcing the importance of continued follow-up of behavioural outcomes within this population. Early behavioural difficulties can lead to extensive problems as a child enters adolescence with an increased likelihood of difficulties with social, academic and occupational functioning, increased antisocial behaviour, criminal activity and violence (American Psychiatric Association, 2013; Jianghong, 2004). Symptoms of clinical disorders such as ADHD, conduct disorder and oppositional defiance disorder also begin to emerge around middle childhood, therefore it is highly important that the behavioural development of ME children continues to be monitored given the findings of the current study strongly suggest they are particularly at risk of significant externalizing behavioural issues compared to their Non-ME peers. Future research into behavioural outcomes in ME children that controlled for caregiving arrangement, compared performance of ME children to New Zealand normative data (if available) or included multiple informants on the child's behaviour (such as teachers) may build on the work of the current study by further pinpointing the extent of the severity of externalizing behaviour issues within ME populations.

5.2 Effortful Control Outcomes of ME Children in Comparison to Non-ME Children.

The second aim of this thesis was to evaluate effortful control ability as a component of effective self-regulation in ME children compared to Non-ME children at age 9.5 years. Children in the ME group were found to perform poorly on laboratory tasks tapping two key indicators of effortful control ability (inhibitory and attentional control) when compared with Non-ME children supporting the second hypothesis. Results showed that ME children had a slower SSRT time than Non-ME children indicating greater difficulty with inhibitory control.

The SSRT is the time taken to engage the neural inhibitory processes needed to prevent responding to a go stimulus when the stop signal appears, those who have difficulty with inhibitory control require longer to engage those processes and will therefore have a slower reaction time. While there is no available methadone research in which to directly compare this finding, it is consistent with previous studies examining the effects of other prenatal drug exposures such as cocaine, which have found impaired inhibitory control ability in drug-exposed children when compared with non-exposed children (Accornero et al., 2007; Bendersky et al., 2003; Bridgett & Mayes, 2011; Carmody et al., 2011).

ME children's inhibitory control and attentional control (ability to focus and sustain attention) was also measured via a frustrating puzzle box task which required a child to complete a puzzle they could not see within five minutes in order to win a prize. Children in both groups not only had to keep focused on the challenging task, but were also required to suppress the desire to 'cheat' by lifting the cover of the box to look at the puzzle. An overall persistence proportion score reflecting the amount of time each child spent on task without cheating or doing something other than attempting to solve the puzzle was found to be significantly lower in ME children, indicating greater difficulty with attentional and inhibitory control ability than Non-ME children. This finding remains consistent with the cocaine literature on inhibitory control listed previously, cocaine-exposure literature on attentional control (Bandstra et al., 2001; Dennis et al., 2006; Richardson et al., 1996) and also supports methadone/opiate exposure studies which have reported greater attention problems in their samples (Davis & Templer, 1988; Suess et al., 1997; Walhovd et al., 2007).

Performance on the two tasks was standardized and combined to create a composite measure of effortful control ability. Children in the ME group were found to have a significantly lower composite score than Non- ME children which indicated a lower level of effortful control ability at age 9.5 years. The construct of effortful control has not been

specifically assessed before in a methadone-exposed or opiate exposed population which again makes direct comparison difficult, however this finding is consistent with the cocaine literature previously mentioned which includes measures of key effortful control components suggesting that lower effortful control ability is a noted finding in drug-exposed populations. This finding could also potentially be linked to the study by Walhovd et al. (2007) discussed in chapter two, which noted anterior cingulate and orbito-frontal cortex reductions in MRI images of opiate exposed children aged between nine and eleven years after controlling for caregiving environment. These brain regions have been linked to inhibitory control, complex cognitive processing, response selection, regulating emotions and modulation of the autonomic nervous system (Ochsner & Gross, 2005; Völlm et al., 2006; Walhovd et al., 2007). Effortful control which draws on many of those processes is believed to primarily function within the anterior cingulate gyrus and prefrontal cortex. It may be that reductions in the brain structures suggested to be linked to prenatal opiate exposure could impact development of effortful control abilities also, however this remains speculative and requires further research involving MRI analysis for support.

The fact that effortful control ability has not been assessed in methadone populations before is interesting given that a large proportion of ME children begin life in a highly dysregulated state due to neonatal abstinence syndrome (NAS). NAS symptoms are suggestive of a dysfunction in the central and autonomic nervous system which leads to the infant being difficult to settle, easily over stimulated, have difficulties with feeding, sleeping, alertness and have an impaired ability to communicate cues to caregivers (Lagasse et al., 2003; Quick et al., 2009; Velez & Jansson, 2008). Abnormalities in the central nervous system can be an early warning sign of later problems that manifest as deficits in self-regulatory abilities (Minnes et al., 2011). In conjunction with potential deficits in intrinsic regulatory processes, NAS symptoms may also disrupt extrinsic regulatory processes. As described previously, caregivers

play a large role in the development of effective emotion regulation in children via extrinsic regulatory processes such as establishing routines, engaging in reciprocal social interactions with their child, being sensitive to their child's cues of over stimulation and guiding them in in the appropriate behaviours or responses for a given situation, which in turn supports and guides the child in engaging in increasingly more intrinsic emotion regulation processes (C.B. Kopp, 1982; Claire B. Kopp, 1989). Parent interaction is highly important for helping the infant learn to self-regulate during the postnatal period, yet extrinsic regulatory processes can be disrupted in infants with NAS for two main reasons that have been described previously in this thesis:

1) Normal infant cues for distress and over-arousal are masked by the dysregulation of opiate withdrawal and are not easily interpretable by parents without the assistance of professionals trained in non-pharmacological NAS treatments.
2) Not only is the situation complicated by dysregulated infant distress cues, but receiving effective training in understanding a NAS infants behavioural cues is often further complicated by sensitivities to stigmas associated with drug use, feelings of guilt when faced with a distressed infant suffering withdrawal symptoms and fear of child protection agencies getting involved. In addition the mother may still be using drug substances or suffering from a mood disorder which is common in drug taking woman.

These factors can all impact the degree to which the mother is willing and able to focus on learning effective strategies for responding to their infant, their tolerance for dealing with the challenging behaviours exhibited by their infant and decrease their motivation to engage with them (Dow et al., 2012; Kruschel, 2007; Velez & Jansson, 2008). Therefore the child is potentially not receiving the guidance required to facilitate effortful control development.

A total of 86% of the ME infants in the current sample received treatment for NAS which meant that there was insufficient sample size and too high a level of multicollinearity

with methadone exposure to be able to compare the effortful control ability of children who had or had not experienced NAS to determine whether this was a contributing factor. However with this in mind, the findings strongly suggest that effortful control development is compromised in ME children indicating continued dysregulation difficulties and warranting further research into the factors contributing to this outcome.

Given effortful control ability had not yet been previously assessed in methadone populations, the current study aimed only to determine whether or not this was an area of development in which ME children were significantly different to their Non-ME peers. Predictors of poor effortful control ability other than methadone exposure were not considered but given the double jeopardy nature of this population it is unlikely that prenatal methadone exposure is the only contributing factor to poor effortful control development in ME children. Direct and indirect effects of other factors such as genetics (i.e. being prone to a more negative or reactive temperament style), parenting, caregiver instability and other risk factors associated with growing up in a household with an opiate dependent parent may contribute to effortful control development over and above that of methadone exposure

It is also important to note that the current study used only laboratory-based behavioural measures of effortful control. Although the conditions under which children perform tasks in research facilities are held constant for all participants, they may not always be reflective of the conditions under which children will be expected to draw on these skills or functions in real life, therefore it is possible that the current study may have over or under estimated effortful control ability in ME and Non-ME children. The addition of parent and/or teacher ratings of effortful control ability (or when age appropriate self-report) in addition to the behavioural tasks in future research, may provide a more consistent picture of ability. However, the current study was able to establish significant group differences and provide a solid theoretical starting point on which to further test and expand the findings.

5.3 Significant Predictors of Externalizing Behaviour Outcomes

The final aim of this thesis was to identify the relative contribution regulation, drug exposure and socio-environmental risk factors made to understanding externalizing problem behaviour in children aged 9.5 years. Group status (ME or Non-ME), the effortful control composite, prenatal tobacco exposure, prenatal cannabis exposure and the social risk composite were all found to significantly correlate with scores on the externalizing behaviour composite from the BASC-2. Hierarchical multiple regression was used to determine which variables made a unique significant contribution to externalizing behaviour scores in the current study sample. After controlling for prenatal tobacco and/or cannabis exposure and effortful control ability, it was shown that group status and level of social-environmental risk were the only significant predictors of externalizing problem behaviour scores at age 9.5 years. More specifically, ME children that came from an early home environment characterized by a greater number of risk factors were more likely to be rated by their caregiver as having higher levels of externalizing problem behaviours than Non-ME children living in low-risk home environments. This result partially supported the third hypothesis which predicted group status and effortful control ability to be the most relevant contributors to child externalizing behavioural problems at age 9.5 years over and above the effects of socio-environmental risk factors.

The finding that prenatal methadone exposure and level of socio-environmental risk made a significant contribution to externalizing problem behaviour scores at age 9.5 years is consistent with previous opiate-exposure studies which reported that environmental risk factors alone did not completely account for differences in externalizing behaviour scores between opiate- exposed and non-exposed middle-school aged children (Nygaard et al., 2016; Ornoy et al., 2001; Walhovd et al., 2007; Wilson et al., 1979). While Sarfi et al. (2013) in contrast reported that prenatal methadone or buprenorphine exposure did not significantly predict

externalizing behaviour in preschool age children after taking into account risk factors, the variables included to represent risk in their sample were maternal anxiety or depression which wasn't included in the current study's risk composite score. The Edinburg Depression Scale was used by the larger MIP study to screen for depression at term, but in the sub-sample of participants recruited for the current study methadone maintained mothers were no more likely than mothers in the comparison group to score in the clinical range for depressive symptomology so this risk factor was not included in subsequent analyses.

Effortful control ability at age 9.5 years was not found to significantly contribute to externalizing behavioural problem scores after taking into account prenatal methadone exposure. There is unfortunately no methadone or opiate exposure research in which to directly compare this finding but it does contradict previous research on the relationship between effortful control ability and externalizing behaviour outcomes which have consistently reported a relationship between the two constructs (De Panfilis et al., 2013; R.D. Eiden, C. Colder, E.P. Edwards, & K.E. Leonard, 2009; Eiden et al., 2007; Eisenberg et al., 1996; Eisenberg, Fabes, Guthrie, & Reiser, 2000; Eisenberg, Guthrie, et al., 2000; Hill et al., 2006; G. Kochanska et al., 2008; Olson et al., 2005; Spinrad et al., 2007; Valiente et al., 2003). A possible reason for this finding is that given none of the listed previous studies have examined the relationship between effortful control ability and externalizing problem behaviour in children with prenatal methadone exposure, there may a third intervening variable via which effortful control ability exerts its influence. Children exposed to methadone have complex developmental backgrounds given the number of adverse prenatal and postnatal factors that characterize the population, and research into this relationship in other substance-exposed cohorts have reported an influence of these factors. For example Eiden et al. (2014) found that low effortful control ability was related to externalizing behaviour problems in their cocaine exposed sample via maternal harshness, which is believed to reflect poor modelling of effective regulation strategies. This

finding supported an earlier study by the authors which found an indirect relationship between effortful control ability and externalizing problem behaviours in children of alcoholics via level of parental warmth/sensitivity (Eiden et al., 2007). Other research into effortful control and externalizing behaviour outcomes in non-exposed populations have also highlighted the influence of parenting (G. Kochanska et al., 2008; Spinrad et al., 2007), although a study by Olson et al. (2005) reported that effortful control ability predicted externalizing behaviour over and above the effects of parenting factors such as discipline and responsiveness.

The study by Olson et al. (2005) involved a cohort that demographically looks very different from the kinds of samples recruited for research into the effects of substance abuse with higher average incomes, higher educational achievement and lower rates of single parent households. Financial difficulties, the pressures of raising a child as a single parent, lower levels of education and high rates of maternal depression and anxiety are all common in families struggling with substance abuse issues and contribute to a parenting style that can be inconsistent, emotionally neglectful and authoritarian (Dawe, Harnett, Rendalls, & Staiger, 2003). Given the role of parents in the developmental shift from extrinsic forms of emotion regulation to effortful and intrinsic self-regulation, the difficulties associated with parenting in methadone exposed samples and the potential role of NAS in disrupting the parent-child relationship as discussed previously, it is possible that 'group status' in the regression model of the current study is masking an indirect relationship of effortful control to externalizing problem behaviour via aspects of parenting.

Longitudinal research incorporating parenting practices will be critical for the continued study of this relationship in ME children, particularly when it comes to establishing the direction of influence. Children genetically prone to more negative or reactive (impulsive) temperament styles that are low in effortful control ability can often illicit a negative responding style from their caregivers, which in turn increases risk for behavioural problems

and further exasperates negative caregiver responding (Eisenberg et al., 2010). Understanding the bi-directional influences of these constructs will be important in any intervention design.

Overall these findings provide support for the theory that children prenatally exposed to drug substances are a double jeopardy population and developmental outcomes are best studied within the context of both prenatal and postnatal factors. The results of the current study are able to suggest two possible mechanisms that are predictive of externalizing behaviour problems in ME children:

1) Direct biological effect of methadone exposure. Given the correlational nature of this study, any direct effect of prenatal methadone exposure on children can only be hypothesised. While animal studies have found direct links between methadone exposure during pregnancy and disrupted brain development (Hutchings et al., 1993; Robinson, 2000; Robinson et al., 1996; Vathy, 2002; Wu et al., 2014; Zmitrovich et al., 1994), establishing this type of link in human populations is more speculative. Methadone is known to be transferred bi-directionally from maternal circulation to foetal circulation via the placenta membrane, amniotic fluid and umbilical cord (Farid et al., 2008; Nekhayeva et al., 2005; Ostrea et al., 2004) and as discussed previously, many children of mothers maintained on methadone are born addicted to opiates and experience NAS indicating disruption to the central nervous system. However not all infants exposed to methadone during pregnancy experience NAS symptoms and there are a number of other possible explanations for why methadone exposure remained a significant predictor of externalizing problem behaviour in the current study.

   The first is that any differences in developmental outcomes of ME children may be due to the effect of other drug substances commonly used by methadone-maintained women that are also suggested to impact foetal brain development such as tobacco exposure (Konijnenberg et al., 2015). However a strength of the current study is that

consideration of a range of other possible drug exposures was included in the study design and while prenatal exposure to cannabis and tobacco was correlated with the externalizing behaviour composite at age 9.5 years, they were not found to significantly predict externalizing behaviour over and above the other factors in the model.

Second, the final regression model accounted for only 30% of the variance in externalizing behaviour outcomes in the current study. Lester and Tronick (1994) proposed that prenatal drug exposure leads to the infant having a direct acute neurobehavioral vulnerability and that the long term effects of drug exposure are indirect, determined by the interaction between the vulnerability and caregiving environment. It is possible that the pathway between prenatal methadone exposure and externalizing behaviour outcomes at age 9.5 years is not direct but rather mediated or moderated by variables not accounted for in the model. Factors such as poor parenting practices, caregiver instability, abuse and maternal mental health issues (Crea et al., 2008; Dawe et al., 2000; Jianghong, 2004; Sarfi et al., 2013) have all been found to be associated with both behavioural outcomes in children and opiate substance abuse which may account for some or all of the variance in the pathway between methadone exposure and behavioural outcomes. Research examining behavioural outcomes in ME children exposed to high or low doses of methadone during pregnancy will be beneficial for further exploring the effects of methadone exposure as a possible mechanism contributing to poor behavioural outcomes in ME children.

2) Socio-environmental risk. The finding that as the number of socio-environmental risk factors children in the current study were exposed to at term increased so did scores on the externalizing behaviour composite, highlights the importance of including consideration of postnatal factors in any study of ME children. The inclusion of a

cumulative socio-environmental risk composite is a strength of the current study given that, as discussed earlier, the contribution of postnatal risk factors in previous research on behavioural outcomes in ME children has been inconsistent. The current study accounted for children born into low SES households where both parents were either unemployed or worked in unskilled/labouring occupations, and children born to mothers who identified as a minority ethnicity, had no schooling qualifications, were raising their child as a single parent or were under the age of twenty-one when giving birth. The cumulative impact of each of the included risk factors was found to be associated with increased behavioural problems at age 9.5 years independent of prenatal methadone exposure.

The use of a composite score to represent socio-environmental risk has both advantages and disadvantages. An advantage of this method is that a larger number of risk factors were able to be controlled for in the regression model than would have otherwise been possible given the sample size. In order for the results of any multiple regression analysis to be reliable and allow generalisability, it is important that the number of predictors included in the model does not significantly outweigh the number of cases. For the sample size of the current study, five independent predictors is the suggested maximum (Tabachnick & Fidell, 2014). Given the complicated nature of ME populations, a composite score not only allowed for the inclusion of multiple risk factors but also took into account the co-occurrence of many of those factors. A limitation of this method however is that each of the individual risk factors is weighted equally and therefore the individual contribution of each of the included factors to child behavioural outcomes cannot be determined.

A further limitation is that the included socio-environmental composite was also only able to account for risk factors identified at the term assessment. While these early

risk factors still appear to be associated with behavioural outcomes in middle childhood, it was not possible from the results of the current study to determine the mechanisms via which they influence behavioural development. As mentioned previously, factors such as poor parenting, maternal mental health and caregiver instability have been found to be associated with both child behavioural outcomes and opiate substance abuse. These factors are also associated with variables included in the socio-environmental risk composite, for example poor parenting practices have been found to be influenced by the stress of low income which in turn influenced behavioural outcomes in children (Dawe et al., 2000; Dawson-McClure et al., 2015; Luther, D'Avanzo, & Hites, 2003). Given the continued influence of these early social-environmental risk factors as identified by the current study, it will be important in future research to identify the mechanisms via which they impact behavioural development in middle school aged children.

Development pathways to externalizing problem behaviours in ME children are clearly complex and the current study provides more robust support for the relationship between prenatal methadone exposure, early socio-environmental adversity and increased behavioural problems in middle-childhood. However studying drug-exposed populations is clearly not a case of either-or when it comes to drug effects and while the current study provides a theoretical stand point, further research is required in order to elucidate the mechanisms via which these factors influence behavioural outcomes in children This is particularly evident in the findings of effortful control ability as a measure of effective regulation in ME children.

5.4 Implications of Findings

The findings of the current study make a unique contribution to the limited available literature on the developmental outcomes of ME children. Results indicated that prenatal

methadone exposure was associated with lower effortful control ability and higher rates of externalizing problem behaviour at age 9.5 years. In addition, the current study found that both prenatal methadone exposure and postnatal socio-environmental risk factors contributed to problem behaviour, highlighting the double-jeopardy nature of ME populations. These findings have a number of implications for understanding and assessing developmental outcomes in ME children.

5.4.1 Contribution to an Understanding of Behavioural Development in ME children

Current research investigating behavioural development in ME children is scarce and as discussed, may of the previous studies in this area suffer from a number of methodological limitations such as small sample sizes and poor consideration of pre and postnatal risk factors. In comparison, the current study involved a larger methadone-exposed sample followed longitudinally from birth with good retention rates, methadone dose during pregnancy was confirmed via hospital service records and polysubstance use during pregnancy and socio-environmental risk factors were considered in data analyses. Together this contributes a more robust finding to the limited field of research aiming to understand the association between being born to a mother maintained on methadone and later developmental outcomes.

While further research is needed to explore potential mechanisms, the results of the current study strongly suggest that ME children are at greater risk of externalizing behaviour problems at 9.5 years of age than their non-exposed peers. These types of behavioural problems increase the risk of the child having more pervasive difficulties with their social, academic and occupational functioning during their years at school and continuing into adulthood. Without intervention these early issues can extend into crime, violence and a continued cycle of substance abuse (American Psychiatric Association, 2000; Fergusson, Horwood, & Ridder,

2007; Jianghong, 2004). Improving parenting skills has been found to significantly reduce behavioural problems in children (Brestan & Eyberg, 1998; Dawe et al., 2003; Dawe et al., 2000) however this type of training is not readily available as part of treatment programmes for pregnant woman maintained on methadone in New Zealand. Any intervention with this population would need to be comprehensive and likely long-term (Dawe et al., 2000) given the complexity of the risk factors associated with substance dependence. Balancing this against cost-effectiveness and removing barriers to service uptake such as fear of CYF involvement (Ornoy, Michailevskaya, Lukashov, Bar-Hamburger, & Harel, 1996; Suess et al., 1997) will be a challenge faced by those responsible for designing protocols and policies, but the results of the current study provide further support for the need for behavioural intervention services targeted at ME children.

5.4.2 Foundation for Understanding the Self-Regulation of Emotion in ME children

The current study, to the best of the authors knowledge, is the first to examine self-regulatory development in ME children beyond infancy. An assessment of effortful control ability in ME children aged 9.5 years identified a significant deficit in the inhibitory and attentional control components of effortful control when compared with the performance of their Non-ME peers. Reduced capacity for effortful control ability is associated with a number of poor developmental outcomes such as high rates of aggression, low levels of social competency, poor academic achievement, less compliance and resiliency, poor peer relationships, increased risk of having psychopathological symptoms and poor interpersonal functioning as an adult, and has been most notably implicated in developmental pathways to externalizing behavioural problems (Blair & Razza, 2007; Calkins, 1999; Checa et al., 2008; Eisenberg, Guthrie, et al., 2000; Eisenberg et al., 2010; Liew et al., 2008; Spinrad et al., 2007; Vohs & Baumeister, 2013; Zorza et al., 2013). While the current study did not establish a direct

link between effortful control ability and externalizing behaviour problems, the complex nature of researching developmental outcomes in ME children means that there are a number of possible indirect pathways via which effortful control ability affects outcomes in ME children that were not explored at this time. The results of the current study contribute to the limited knowledge of regulatory abilities in methadone and opiate exposed children and support the continued follow-up of ME children in this area.

There is evidence that the capacity for effortful control continues to develop through middle childhood (P. Anderson, 2002; V. A. Anderson, 2001; Crone et al., 2006; Diamond & Taylor, 1996; Simonds et al., 2007; Williams et al., 1999) and that increasing effortful control ability can have a buffering effect against socio-environmental risk factors predictive of poor developmental outcomes (Bakker et al., 2011; Gardner et al., 2008; G. A. Kochanska, 2003; Lengua, 2008; Valiente et al., 2006). Effortful control plays a central role in the self-regulation of emotion and aids the transition from extrinsic forms of control to intrinsic self-regulation. With a reduced capacity for effortful control, ME children may be more reliant on parents/caregivers (or other adults in their lives such teachers) to assist them in frustrating, emotional or difficult situations where their own self-regulatory ability is overwhelmed. Given the increased risk of a cascade of poor developmental outcomes associated with lower effortful control, the current study advocates for treatment interventions that encompasses increasing the self-regulatory abilities of ME children themselves, but also involves teaching parents how to assist their child in engaging in regulatory processes when overwhelmed.

5.5 Limitations of the Current Study

While several steps were taken to avoid the methodological issues present in previous research on ME children, there remains a number of limitations in the current study that have

not yet been discussed in this thesis, but should be considered in any interpretation of the findings.

Retention rate: Considering the length of time the cohort of the larger MIP study has been followed for and the difficulties inherent in retaining high-risk families in research, the current study has so far maintained a good retention rate across follow-ups. Despite this, problems with attrition (common in many longitudinal studies) may limit the findings of the current study. At the commencement of the 9.5 year follow-up 16% of ME children and their caregivers had dropped out of the study with a further four families not available for assessment at age 9.5 years due to refusal, relocation or being untraceable. It is possible that those families who had already dropped out or were not assessed at the current follow-up represent those at the greatest disadvantage in terms of socio-environmental risk factors. Inclusion of these families may have revealed poorer outcomes in the ME group, however the high retention rate and the power of the current study to establish significant between group differences increases confidence in the generalisability of these findings to ME children growing up in Christchurch and the wider methadone population of New Zealand.

Measurement: The results of the effortful control assessment are limited by a technical aspect of the stop-signal task used as a measure of the inhibitory control component of effortful control. It was discovered that the trials in the task were presented sequentially rather than randomly which means the possibility of ordering effects cannot be ruled out. While short, medium and long delays between the presentation of the target and stop-signal stimuli were used to make the stop signal unpredictable within each trial, the four trials of the task were presented in the same order (1,2,3,4) for each child. Therefore, decreased performance in trials three and four may be due to other issues such as fatigue rather than the difficulty of the trials. In future using methods such as counterbalancing will prevent this issue and improve the interpretation of this task.

5.6 Directions for Future Research

The current study has made a unique contribution to understanding developmental outcomes in children born to mothers maintained on methadone during pregnancy. In turn the results of this research have highlighted several areas in which future studies in this area can further expand on these findings, the most notable being that continued follow-up of ME children is critical. Previous longitudinal research involving ME children has primarily focused on infant and toddler outcomes with few studies extending beyond the preschool years. However, this study has identified significant problems with effortful control and behaviour in middle-school aged children prenatally exposed to methadone, indicating that poor developmental outcomes identified early on can potentially lead to more pervasive difficulties as ME children grow and face increasing demands on their cognitive, emotional and social functions. As discussed previously, the effortful control deficits and behavioural issues suggested by the results of the current study are associated with serious implications for adolescent developmental outcomes. Therefore continued follow-up of ME children during the adolescent years will be of high importance for establishing possible developmental trajectories and outcomes during a complex stage of human development.

In terms of behavioural outcomes in ME children, future research aiming to build on or support the findings of the current study should consider the use of a corroborative measure of behaviour. The BASC-2 assessment system incorporates a teacher rating form that examines child behaviour within a classroom setting. Multiple informant measures would not only increase the reliability of the findings, but it would also be of interest to see if behavioural difficulties in ME children at school age are situational, i.e. unique to the home setting, or if they extend into multiple settings occupied by the child indicating more severe and pervasive behavioural problems.

The use of multiple informant measures applies to the assessment of effortful control ability in ME children as well. The current study provided preliminary evidence for the presence of effortful control deficits in children exposed to methadone during pregnancy. This finding is the first for this population and repetition of this research involving corroborative measures of effortful control in other ME cohorts will be important for not only supporting the validity of this finding, but also the generalisability of the results of this study to ME children outside of the Canterbury region. Gaining a more detailed understanding of both the protective and debilitating effects of differing levels of effortful control ability in ME children and its relationship with early signs of dysregulation such as NAS, will be important for informing intervention programmes targeted at ME children and their families.

Finally, there were a number of risk factors associated with being born to a mother maintained on methadone that were not accounted for in the current study yet may have important implications for understanding developmental mechanisms associated with the constructs examined in this research. Just under half of ME children included in the sample of the current study were no longer living with their biological mothers. Caregiving arrangements in the ME group included biological mothers only, biological fathers only, placement with another relative in the family, or foster placement with a non-relative. This meant children in the ME group likely experienced greater variance in the parenting practices and styles they were exposed to. Qualitative assessment of the caregiver-child relationship, parenting styles and home environment along with careful tracking of placement history may prove key to explaining a significant proportion of variance in the relationship between prenatal methadone exposure and poor developmental outcomes. In addition, this type of assessment would also be useful in identifying target factors for intervention programmes and informing policies around child placement in order to optimise positive outcomes for ME children.

5.7 Conclusion

Given opiate abuse is approaching epidemic levels both in New Zealand and internationally, opioid substitution therapies are increasingly being called on to treat dependence. In New Zealand, methadone maintenance is the only approved option available for treating opiate dependency during pregnancy. Despite the numerous benefits of MMT for mothers, relatively little is known about the developmental consequences of prenatal methadone exposure for the children, particularly beyond the preschool years. A detailed understanding of the types of developmental difficulties faced in ME populations is critical for informing intervention and support services. Therefore, the current study aimed to further contribute to the field by examining effortful control and externalizing behavioural outcomes in ME children compared to a comparison group of Non-ME children at age 9.5 years.

The specific aims of the study were threefold. First, the behavioural adjustment of ME children was examined using a composite externalizing behaviour measure encompassing conduct problems, attention problems and hyperactivity. ME children were rated by their caregivers as exhibiting a higher level of externalizing behavioural problems than Non-ME children both in overall score and in the proportion of children whose scores classified them as having an at-risk or clinically significant level of disruptive or maladaptive behaviour. Second, the inhibitory and attentional control components of a latent construct known as effortful control was examined using laboratory-based behavioural tasks. Children in the ME group scored significantly lower on the effortful control composite than Non-ME children indicating significant self-regulatory deficits at 9.5 years of age. Finally, the current study aimed to examine the contribution of prenatal methadone exposure and effortful control ability to externalizing behaviour outcomes, within the context of poly-substance abuse and socio-environmental risk factors characteristic of ME populations previously unaccounted for in research in this area. Prenatal methadone exposure and socio-environmental risk factors

identified at term were found to significantly contribute to externalizing behaviour problems over and above that of poly-substance exposure and concurrent effortful control ability.

The findings of the current study provide further support for the double jeopardy nature of ME populations and the importance of considering multiple risk-factors in any research conducted within this population. Impaired effortful control ability and high rates of externalizing behavioural problems identify two areas of vulnerability in which ME children and their families may require additional support to manage and ameliorate difficulties associated with these issues. The hope is that through findings from research such as the current study, targeted interventions and family support services can be implemented early, and potentially as standard protocol for pregnant woman undergoing methadone maintenance, to ensure ME children are given the best chance possible to remain on a positive developmental trajectory.

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Appendices

Appendix A: Ethical Approval for Methadone in Pregnancy Study

Health and Disability Ethics Committees

Health and Disability Ethics Committees
1 the Terrace
PO Box 5013
Wellington 6011
04 816 2403
hdecs@moh.govt.nz

28 November 2012

Dr Lianne Woodward
Canterbury Child Development Research Group
Psychology Department
University of Canterbury
Christchurch 8041

Dear Dr Woodward

Re:	**Ethics ref:**	**URB/07/10/042**
	Study title:	Neurodevelopmental Outcomes of Children Exposed to Methadone During Pregnancy at Ages 4.5 and 6 Years: Role of neuroanatomical and Socio-Environmental Factors.

I am pleased to advise that this amendment has been *approved* by the Southern Health and Disability Ethics Committee. This decision was made through the HDEC Expedited Review pathway.

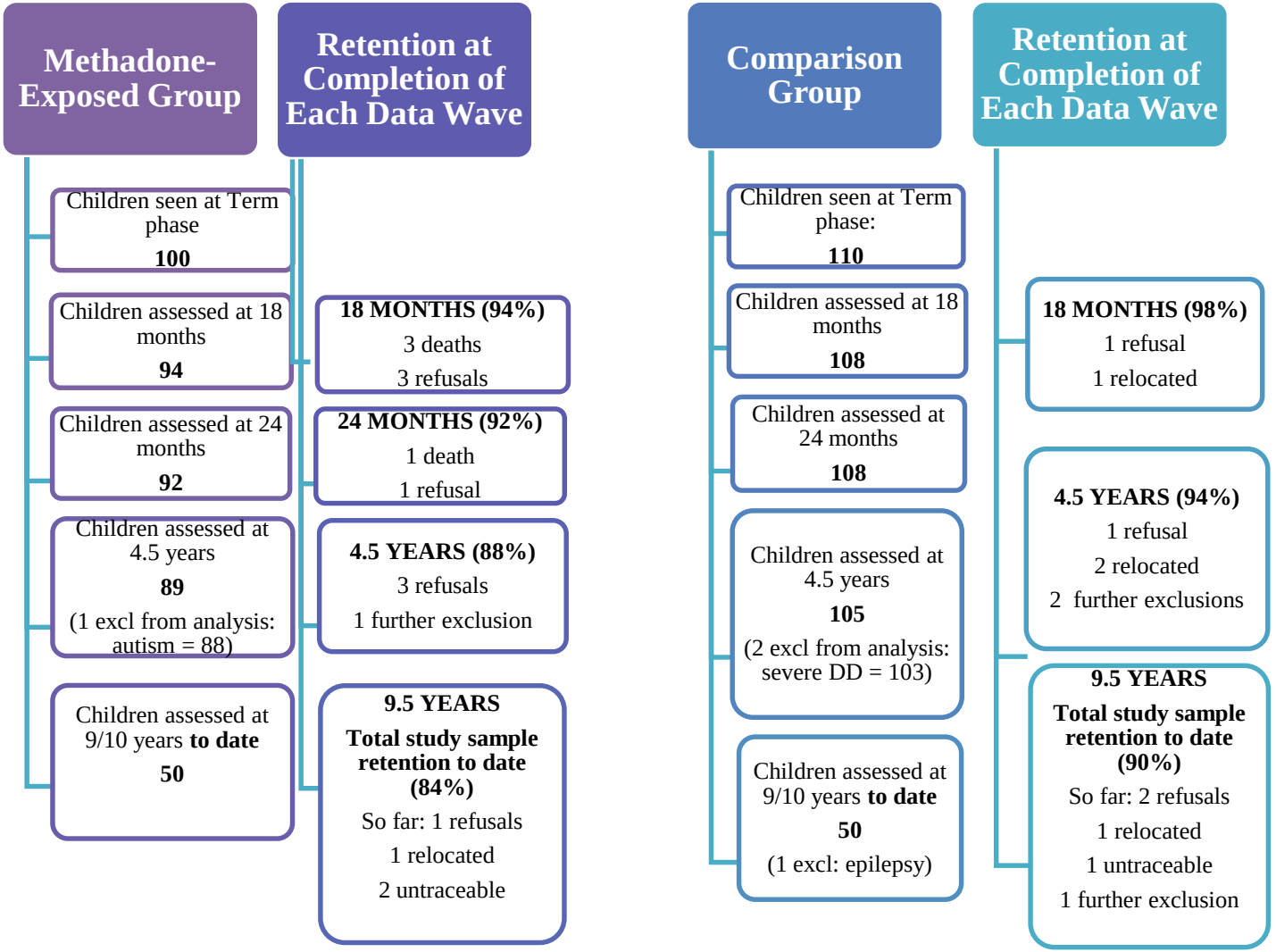
Please don't hesitate to contact the HDEC secretariat for further information. We wish you all the best for your study.

Yours sincerely,

Ms Raewyn Idoine
Chairperson
Southern Health and Disability Ethics Committee

Encl: appendix A: documents submitted
appendix B: statement of compliance and list of members

Appendix B: Retention Rates for the Methadone in Pregnancy Study



Appendix C: Consent Form at 9.5 year Follow-up

Canterbury Child Development
Research Group
Department of Psychology
College of Science

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

CODE NUMBER

9.5 YEAR FOLLOW-UP STUDY
CONSENT FORM

- 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 read and understood the Information sheet dated November 2012.

- 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 understand my child will be videotaped during the procedure and that this information will only be used for further observation by the named investigators and the material will be secured and kept strictly confidential.

- 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 am willing for the research team to contact my child's class teacher to obtain information on my child's school progress during the last year. **YES/NO**
- 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 wish to receive a summary of the results of this study. **YES/NO**

I consent to take part in this study.

Parent/s Name: _____

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

I consent to my child taking part in this study.

Child's name_____ 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**: _____

Child's GP (Family Doctor) Contact Details:

Name:……..

Medical Centre/Practice:……

Address and phone (If known) ……

Previous GP's and Name of Medical Centres (if changed over past 4 years)

Name:……..

Appendix D: Maternal Interview at 9.5 year Follow-up

CANTERBURY CHILD DEVELOPMENT STUDY

MATERNAL INTERVIEW

9.5-YEARS

CODE NUMBER | | | |

INTERVIEWER | |

	DD	MM	YY
DATE			

SECTION A: FAMILY COMPOSITION

A.1 How old is <name> now?

Years	Months

A.2 How many people live in the household excluding <name>?

Number

A.3 For each person living in the household (excluding <name>) complete the coding frame below.

Person	Age (Years)		Gender	Relationship to survey child
1 (Eldest)				
2				
3				
4				
5				
6				
7				
8				
9 (Youngest)				

Coding:

Age: Self code in whole years; NA = 99

Gender: Female = 1; Male = 2; NA = 9

Relationship to child: Natural parent = 1; Natural sibling = 2; Step parent = 3; Step sibling = 4; Half sibling = 5; Adoptive sibling = 6; Other relative = 7; Non relative = 8; NA = 9

A.4 How long have you lived in this household?

Years		
Months		

A.5 Have you had any changes of residence since our last interview? If so, how many?

Number of changes		

A.6 Complete the coding frame below giving details of the child's parent-figures during each month of life since the last interview. If the child's parent-figures changed within a two-month period record the person who was acting as parent-figure for the longest time. Ignore temporary absences of mother or father for holidays, business trips etc, except if these are longer than one month. Coding instructions are given at the foot of the frame.

Time	Mother Figure	Father Figure	Change of Mother-Figure and reason		Change of Father-Figure and reason	
First year of school						
2nd year at school Yr2						
3rd year at school Yr3						
4th Year at school Yr4						
Last year Yr5						

Coding:

Mother Figure: Natural mother = 0, Adoptive mother = 1, Foster mother = 2, Step mother = 3, Grandmother = 4, De facto mother (not natural mother, etc) = 5, Relative = 6, Non-relative = 7, No mother figure = 8, Not known = 9.

Father Figure: Natural father = 0, Adoptive father = 1, Foster father = 2, Step father = 3, Grandfather = 4, De facto father (not natural father, etc) = 5, Relative = 6, Non-relative = 7, No father figure = 8, Not known = 9

Change and Reason: (This is coded in the same way for both mother and father figures):	No change = 00, Parents separated = 01, Parents reconciled = 02, Parent died = 03, Parent discharged from or admitted to hospital = 04, Parent discharged from or admitted to prison = 05, Child admitted to or discharged from hospital = 06, Child in Social Welfare custody = 07, Child adopted or fostered = 08, Other = 09, Not known = 99.

Details:……
……
……...

A.7 Since <name> began school, has there been anyone other than yourself that you believe has played a significant role in his/her upbringing?

If yes, who and why?.....

…….

…….

Yes	No
1	2

A.8 Have you had over the last year or do you currently have a steady partner?

Yes	No
1	2

IF YES ASK A.9, A.10, & A.11. IF NO ENDORSE THESE ITEMS WITH 9's AND SKIP TO A.12

A.9 How old is your partner? Years

A.10 How long have you had a relationship with your partner?

<3 months	1
3-5 months	2
6-11 months	3
12+ months	4
NA	9

A.11 What is your relationship to your partner?

	Going out casually	1
	Going out seriously	2
	Living together as a couple	3
	Engaged to be married	4
	Married	5
If other specify: _____	Other	6
_____	NA	9

A.12 a) Do you have an ex-partner that remains in regular contact with your child?

Yes	No
1	2

b) Does the child's father remain in regular contact with your child?

Yes	No
1	2

IF NOT BIOLOGICAL MOTHER ASK A.13, OTHERWISE MARK AS N/A

A.13 Does the child's birth mother remain in regular contact with the child?

Yes	No	N/A
1	2	9

SECTION B: FAMILY FINANCES

B.1 What type of accommodation do you currently live in?

Detached house	1
Townhouse/Ownership Flat	2
Flat (not ownership)	3
Other	4

If other, specify: _____

_____

B.2 Is your accommodation

Owned/mortgaged	1
Rented from private owner	2
Rented from Housing NZ (state house)	3
Rented from local authority (eg City Council)	4
Other (eg boarding)	5

If other, specify: _____

_____

_____

B.3 How many bedrooms does your accommodation have?

Number [ ]

B.4 Overall, how adequate is your present accommodation to meet your family's needs?

More than adequate	1
Adequate	2
Inadequate	3
Very inadequate	4

If respondent reports accommodation is inadequate or very inadequate, record reasons for inadequacy below:

_____

_____

_____

B.5 Do you currently work in paid employment?

Yes	No
1	2

If yes, specify: NZSCO | | | |

a) Occupation: _____

b) Industry: _____

c) Number of hours per week (If not working enter 00) Hours | | |

d) How much do you receive each week after tax? (If not working enter 0's) $ | | | | |

B.6 What would be your total family income **before taxes** for the last 12 months?

Zero income or loss	0
$1 – $5,000	1
$5,001-$10,000	2
$10,001 – $15,0000	3
$15,001 – $20,000	4
$20,001 – $25,000	5
$25,001 – $30,0000	6
$30,001 – $40,000	7
$40,001 – $50,000	8
$50,001 – $70,000	9
$70,001 – $100,000	10
$100,001 or more	11
NA/Can't say	99

IF NO COHABITING PARTNER ENTER 9's IN B.7 – B.8

B.7 Does your partner work in paid employment?

Yes	1
No	2
NA	9

If yes, specify: NZSCO | | | |

a) Occupation: _____

b) Industry: _____

c) Hours per week worked (If not working enter 00) Hours | | |

d) How much does he receive each week after tax? (If not working enter 0's) $ | | | | |

B.8 Do you or your partner receive any Family Assistance payments (that are not already included above)?

Yes	No	N/A
1	2	9

B.9 Since our last interview have you had to do any of the following because you were short of money

	Yes	No
Borrow money from family or friends	1	2
Been unable to pay electricity bill	1	2
Been unable to pay rent	1	2
Been unable to pay phone bill	1	2
Gone without meals on some days	1	2
Bought second-hand clothing	1	2

Postponed visits to the doctor	1	2
Postponed visits to the dentist	1	2
Visited budget advisory service	1	2
Been declared bankrupt	1	2
Had something repossessed because you couldn't keep up the payments	1	2
Received a summons regarding unpaid bills	1	2
Had to sell or pawn belongings to get money	1	2
Needed to seek help from the food bank or a social agency	1	2
Needed to seek assistance from WINZ to pay bills	1	2
Moved to cheaper accommodation	1	2

B.10 Have you obtained any new educational or employment related qualifications in the past 4 years?

If yes, specify: _____	Yes	1
_____	No	2

SECTION C: THE CHILD

C.1 At the present time do you have any concerns about the following aspects of your child's development?

a) Her/his physical co-ordination, e.g., clumsy, always tripping over, walks poorly.

If yes, specify: _____	Yes	1
_____	No	2

b) Her/his language development, e.g., speech difficult to understand, does not talk well compared to same aged peers.

If yes, specify:		
_____	Yes	1
_____	No	2

c) Her/his growth or height or weight, e.g., small for age, or overweight.

If yes, specify:		
_____	Yes	1
_____	No	2

d) Her/his intellectual development, e.g., doesn't seem to understand things, is slow to "catch on" to things.

If yes, specify:		
_____	Yes	1
_____	No	2

e) Eating problems, e.g., eats poorly or eats too much.

If yes, specify:		
_____	Yes	1
_____	No	2

f) Toileting problems.

If yes, specify:		
_____	Yes	1
_____	No	2

g) Health problems.

If yes, specify:		
_____	Yes	1
_____	No	2

h) Any other problem or concern.

If yes, specify:

_____

_____

11 1
2 2

Yes No

Yes

No

SECTION D: CHILD HEALTH

General Health Conditions

D.1 Has your child been diagnosed with, or been suspected of having, any of the following conditions?

	No	Suspected	Yes
Asthma/wheezy bronchitis	0	1	2
Hayfever	0	1	2
Eczema/skin rash	0	1	2
Ear infections	0	1	2
Vision problems	0	1 Go to D2	2 Go to D2
Hearing loss	0	1 Go to D3	2 Go to D3
ADHD	0	1	2
Food allergies	0	1	2
Coeliac disease or Gluten free	0	1	2

Poor growth	0	1	2

Tell us of any other health problems not mentioned here:
_____
_____
_____
_____
____

D.2 If parent reports visual problems, what kind of visual difficulties does your child have?

Short sighted (no glasses)	1
Short sighted (has glasses)	2
Long sighted (no glasses)	3
Long sighted (has glasses)	4
Other	5

Other visual problem (please specify):

D.3 a) What kind of hearing loss does your child have?

Needs hearing aides	1
Glue ear/ needs grommets	2
Frequent infections	3

Other	4
Other hearing problem (please specify):	

D.4 Has your child ever needed an operation for grommets/ adenoidectomy/ tonsillectomy/ other ?

If other please specify……

……

Yes	1
No	2

Medication

D.5 Is your child currently on any form of prescribed medication?

Yes	No
1	2

If Yes, please give details/names of medicines:

……..

……

….

If not sure of name, circle the type of medicine:

ASTHMA / CONSTIPATION / ADHD / IRON / MULITVITIMINS / OTHER

D.6. Has your child ever required fillings for dental caries?

If Yes how many?.....

Yes	No
1	2

SECTION E: EDUCATION AND CHILDCARE

E.1
a) What school is your child attending at present?

Schools name: _____

Teachers Name: _____

_____

b) Type of school?	Public	1
	Private non-church	2
	Private church	3
If other please specify:	Special school	4
	Other	5
	Does not go to school	6

E.2. Is your child currently experiencing any problems or difficulties at school?

Specify…….

Yes …….	1
No …….	2

E.3. a) Does your child currently receive any of the following school support resources:

	Yes	No
School based support services (e.g. Individual needs)	1	2
OORS (Ongoing and Reviewable Resourcing Schemes) Funding	1	2
Number works	1	2
Specialist psychological or educational assessment	1	2
Paediatric services	1	2
Attends special school e.g. Seabrook Mckenzie, Allandale	1	2
Speech and Language Therapy	1	2
Resource Teachers: Learning and Behaviour Association (RTLB)	1	2
Other (e.g extension classes), please specify:	1	2

b) Has your child ever received any of those resources since starting school?

Yes	No
1	2

Details of any help received:

Help1)……

……

……

Help2)……

……

……

Help3)……

……

……

E.4 How does <name> feel about school?

	Always	Usually	Sometimes	Not at all
a) Looks forward to going	1	2	3	4
b) Enjoys it	1	2	3	4
c) Is stimulated by it	1	2	3	4
d) Is frightened by it	1	2	3	4
e) Talks about his or her friends	1	2	3	4
f) Seems bored by school	1	2	3	4
g) Likes his/her teacher(s)	1	2	3	4

E.5 During the last school year, has you child ever refused to go to school?

Yes	1
No	2

E.6 During the last school year has your child ever played truant from school?

Yes	1
No	2

E.7 During the last school year has your child ever been sent to the principals office?

If yes do you know why?.....

Yes	1
No	2

E.8 During the last school year has your child ever been given detention?

If yes do you know why?.....

Yes	1
No	2

E.9 During the last school year has your child's teacher or principal ever requested a private meeting with you?

If yes, what was the meeting for?.....

…… Yes	1
…… No	2

E.10 Parental Satisfaction/Investment

	Yes, very	Yes, mostly	No, not really
a) Are you interested in what your child does at school?	1	2	3
b) Are you happy with the teaching your child is getting at school?	1	2	3
c) Are you happy with the progress your child is making at school?	1	2	3

SECTION F: CHILD DISCIPLINE AND PHYSICAL PUNISHMENT

F.1 Children often do things that are wrong, disobey or make their parents angry. We would like to know what you or your partner have done when <child's name> did something wrong or made you upset or angry.

I am going to read a list of things you or your partner might have done in the past year and would like you to tell me which of the numbers on this card best describes the number of times you or your partner have done each of these things in the past year.

INTERVIEWER: YOU WILL FIRST NEED TO ESTABLISH WHETHER MOTHER HAS HAD A RESIDENT PARTNER IN THE PAST YEAR. IF THERE HAS BEEN NO PARTNER ENTER 0's FOR PARTNER ITEMS. IN THE CASE OF MULTIPLE PARTNERS RECORD TOTAL EPISODES FOR ALL PARTNERS

Coding: 0 = never; 1 = once only; 2 = twice only; 3 = 3-5 times; 4 = 6-10 times; 5 = 11-20 times, 6 = 21+ times.

	Mother	Partner
Explained why something was wrong		
Put <name> in "time out" (or sent to his/her room)		
Shook <name>		
Hit <name> on the bottom with something like a belt, hairbrush, a stick or some other hard object		
Gave <name> something else to do instead of what he/she was doing wrong		
Shouted, yelled, or screamed at <name>		
Hit <name> with a fist or kicked her/him hard		
Smacked <name> on the bottom with your bare hand		

Grabbed <name> around the neck and choked her/him		
Swore or cursed at <name>		
Hit <name> over and over as hard as you could		
Burned or scalded <name> on purpose		
Threatened to smack or hit <name> but did not actually do it		

Hit <name> on some other part of the body besides the bottom with something like a belt, hairbrush, a stick or some other hard object		
Slapped <name> on the hand, arm or leg		
Took away privileges or a toy		
Pinched <name>		
Threw or knocked <name> down		
Called <name> dumb or lazy or some other name like that		
Slapped <name> on the face, head or ears		

F.2 Since our last interview, have you ever been so angry with <name> that you felt like smacking or shaking him/her?

No never	1
Yes sometimes	2
Yes often	3

F.3. On how many occasions over the last week have you smacked or shaken your child?

Four or more times	1
Three times	2
Twice	3
Once	4
None	5

F.4 Since our last interview, have you ever smacked or hit <name> so hard that you hurt him/her?

Yes	1
No	2

If yes, ask mother to describe incident. If more than one incident, choose the incident that the mother sees as the most serious.

What led to the incident: _____

What happened: _____

_____

Consequences for <name>: _____

_____

F.5 Do you ever feel that you might lose control and really hurt <name>?

No never	1
Yes sometimes	2
Yes often	3

F.6 Since our last interview, have you had any contact with an agency or organisation concerning physical child abuse?

If yes, specify: agency, when contact was made, reason for contact and outcome.	Yes	1
When:	No	2

_____

Agency:

_____

Reason:

_____

Outcome:

_____

F.7 Since our last interview, has your partner (or ex-partner) ever been so angry with <name> that he has threatened to hit or shake him/her?

No never	1
Yes sometimes	2
Yes often	3
NA	9

F.8 Since our last interview, has your partner (or ex-partner) ever smacked or shaken <name>?

No never	1
Yes sometimes	2
Yes often	3
NA	9

F.9 Since our last interview, has your partner (or ex-partner) ever smacked or hit <name> so hard that he has hurt him/her?

Yes	1
No	2
NA	9

If yes, ask mother to describe incident. If more than one incident, choose the incident that the mother sees as the most serious.

What led to the incident: _____

What happened: _____

_____

Consequences for <name>: _____

_____

F.10 Since our last interview, have you ever been concerned that your partner (or ex-partner) might lose control and really hurt <name>?

No never	1
Yes sometimes	2
Yes often	3
NA	9

F.11 Since our last interview, has your partner (or ex-partner) ever been in contact with any agency or organisation regarding physical child abuse?

If yes, specify agency, when contact was made, reason for contact and outcome.

When:_____

Agency:_____

Reason:_____

Outcome:_____

Yes	1
No	2
NA	9

F.12 Since our last interview have you or your partner (ex-partner) received any counselling courses regarding parenting, anger management or stopping violence?

1	2

If yes specify course and circumstances leading to course attendance

Yes	1
No	2

_____

_____

F.13 Since our last interview, have you or your partner (ex-partner) been the subject of a complaint to the Child Youth and Family Service regarding your treatment of <name>?

Yes	No
1	2

If yes, specify source of complaint, details of allegation and outcome:…….....

……

……

F.1.4 Since our last interview, have you or your partner (ex-partner) ever attended a court hearing regarding your treatment of <name>?

Yes No

If yes, specify details of the case:

……..

……..

…….

SECTION G: BEING A PARENT

G.1 I am going to read a list of statements about how parents' react and respond to their children. Please look at the following scale and select one number which reflects your typical behaviours. *(SHOW PARENT THE CODING SCALE BELOW)*

CODING: 1 = Very much like the description on the left.
2 = A little like the description on the left.
3 = The midpoint of the scale indicates that you typically do not do either of these behaviours or do them both equally.
4 = A little like the description on the right.
5 = Very much like the description on the right.

When my child misbehaves …

1. I get so frustrated or angry that my child can see I'm upset	1	2	3	4	5	I handle it without getting upset
2. Things build up and I do things I don't mean to	1	2	3	4	5	Things do not get out of hand
3. I raise my voice and yell	1	2	3	4	5	I speak to my child calmly
4. I hold a grudge	1	2	3	4	5	Things get back to normal pretty quickly
5. I insult my child, say mean things, or call my child names	1	2	3	4	5	I can speak to my child without saying mean things
6. I often get into a long argument with my child	1	2	3	4	5	My child and I rarely get into long arguments
7. I give my child a long lecture	1	2	3	4	5	I keep my talks short and to the point
8. I often use bad language or curse / swear	1	2	3	4	5	I rarely use bad language
9. I make my child tell me why he/she did it	1	2	3	4	5	I say "no" or take some other action

10.I say a lot	1	2	3	4	5	I say very little
11.If saying no doesn't work right away, I keep talking and try to get through to my child	1	2	3	4	5	I take some other kind of action
12.If my child talks back or complains when I can't handle a problem, I give a talk about not complaining	1	2	3	4	5	I ignore the complaining and stick to what I said
13.I give my child several reminders or warnings	1	2	3	4	5	I use only one reminder or warning

When I'm upset or under stress…….

14. I'm on my child's back (critical, nagging)	1	2	3	4	5	I am no more picky than usual
15. I blame my child for causing me problems	1	2	3	4	5	I don't find fault with my children

16. I get irritated by my child's needs / demands	1	2	3	4	5	I don't get irritated at all by my child's needs / demands
17. My children are afraid of me	1	2	3	4	5	My children rarely notice anything is wrong

When I say my child can't do something…

18.I let my child do it anyway	1	2	3	4	5	I stick to what I said

If my child gets upset…

19.I back down and give in	1	2	3	4	5	I stick to what I said

When my child does something I don't like…

20.I often let it go	1	2	3	4	5	I do something about it every time it happens

When I give a clear threat or warning…

21.I often don't carry it out	1	2	3	4	5	I always do what I said

When my child won't do what I ask…

22. I often let it go or do it myself	1	2	3	4	5	I take some other action

If saying "no" doesn't work…

23. I offer my child something nice so he/she will behave	1	2	3	4	5	I take some other kind of action
24. I coax or beg my child to stop	1	2	3	4	5	I firmly tell my child to stop
25. I let my child do whatever he or she wants	1	2	3	4	5	I set limits on what my child can do
26. I threaten to do things that I know I won't actually do	1	2	3	4	5	I only threaten things I am sure I can carry out

If my child misbehaves and then acts sorry…

27. I let it go that time	1	2	3	4	5	I handle the problem like I usually would

When we're not at home…

28. I let my child get away with a lot more	1	2	3	4	5	I handle my child the same way

When my child misbehaves…						
I do something right away	1	2	3	4	5	I do something about it later
When my child pesters me…						
I can ignored the pestering	1	2	3	4	5	I can't ignore the pestering
When my child is out of sight…						
I often don't know what my child is doing	1	2	3	4	5	I always have a good idea of what my child is doing
When my child misbehaves, I spank, slap, grab, or hit my child…						
Never or rarely	1	2	3	4	5	Most of the time
When I have to handle a problem…						
I tell my child I'm sorry about it	1	2	3	4	5	I don't say I'm sorry

SECTION H: MATERNAL HEALTH

H.1 Over the last month/last year have you had a period of at least two weeks when you	Last month? Yes	Last month? No	Last year? Yes	Last year? No
Felt sad, blue or depressed every day	1	2	1	2
Lost interest in most things like work, your family, hobbies, etc	1	2	1	2
You lost your appetite	1	2	1	2
Had an increase in appetite	1	2	1	2
Gained weight	1	2	1	2

Had trouble falling asleep every night	1	2	1	2
Had trouble staying asleep every night	1	2	1	2
Were waking up too early in the morning	1	2	1	2
Were sleeping too much (nearly every night)	1	2	1	2
Felt slowed up in your speech or movements most days	1	2	1	2
Felt restless, couldn't sit still or paced up and down	1	2	1	2
Felt tired, lacking in energy all the time	1	2	1	2
Felt worthless, guilty or sinful most days	1	2	1	2
Felt inferior, not as good as others	1	2	1	2
Lacked self confidence	1	2	1	2
Felt slowed up in your thinking	1	2	1	2
Your thoughts were all mixed up	1	2	1	2
Could not make up your mind about things	1	2	1	2
Thought a lot about death (your own, someone else's or death in general)	1	2	1	2
Felt like you wanted to die	1	2	1	2

(ANSWER H.2 IF YOU HAVE ANSWERED YES TO ONE OR MORE OF THE ITEMS IN H.1, OTHERWISE SKIP TO H.3)

H.2 To what extent have these feelings interfered with:	Not at All	A Little	A Great Deal	NA
Your ability to care for your child/children	1	2	3	9
Your ability to look after the house	1	2	3	9
Your relationships with your friends	1	2	3	9
Your relationship with family members and relatives	1	2	3	9
Your paid employment	1	2	3	9

Your ability to do things you enjoy (hobbies, going out, etc)	1	2	3	9

H.3 Below is a list of common symptoms of anxiety. Please carefully read each item in the list. Indicate how much you have bothered by each symptom during the PAST WEEK, INCLUDING TODAY, by circling the corresponding number in the column next to each symptom.

		Not at all	Mildly. It did not bother me much	Moderately. Unpleasant but I could stand it	Severely. I could barely stand it
1.	Numbness or tingling	0	1	2	3
2.	Feeling hot	0	1	2	3
3.	Wobbliness in legs	0	1	2	3
4.	Unable to relax	0	1	2	3
5.	Fear of the worst happening	0	1	2	3
6.	Dizzy or lightheaded	0	1	2	3
7.	Heart pounding or racing	0	1	2	3
8.	Unsteady	0	1	2	3
9.	Terrified	0	1	2	3
10.	Nervous	0	1	2	3
11.	Feelings of choking	0	1	2	3
12.	Hands trembling	0	1	2	3
13.	Shaky	0	1	2	3
14.	Fear of losing control	0	1	2	3
15.	Difficulty breathing	0	1	2	3
16.	Fear of dying	0	1	2	3
17.	Scared	0	1	2	3
18.	Indigestion or discomfort in abdomen	0	1	2	3
19.	Faint	0	1	2	3

20.	Face flushed	0	1	2	3
21.	Sweating (not due to heat)	0	1	2	3

H.4 Below is a list of social situations that commonly cause anxiety. Please carefully read each item in the list. Using the scale below, indicate (by placing the corresponding number in the column next to each situation) how much fear or anxiety each situation would evoke **and** how often you would avoid each situation.

Fear or Anxiety
0 = None
1 = Mild
2 = Moderate
3 = Severe

Avoidance
0 = Never (0%)
1 = Occasionally (1-33%)
2 = Often (33-67%)
3 = Usually (67-100%)

		Fear or Anxiety	Avoidance	
1.	Telephoning in public. (P)			1.
2.	Participating in small groups. (P)			2.
3.	Eating in public places. (P)			3.
4.	Drinking with others in public places. (P)			4.
5.	Talking to people in authority. (S)			5.
6.	Acting, performing or giving a talk in front of an audience. (P)			6.
7.	Going to a party. (S)			7.
8.	Working while being observed. (P)			8.
9.	Writing while being observed. (P)			9.
10.	Calling someone you don't know very well. (S)			10.
11.	Talking with people you don't know very well. (S)			11.
12.	Meeting strangers. (S)			12.
13.	Urinating in a public bathroom. (P)			13.
14.	Entering a room when others are already seated. (P)			14.

15.	Being the centre of attention. (S)			15.
16.	Speaking up at a meeting. (P)			16.
17	Taking a test. (P)			17
18.	Expressing a disagreement or disapproval to people you don't know very well. (S)			18.
		Fear or Anxiety	Avoidance	
19.	Looking at people you don't very well in the eyes. (S)			19.
20.	Giving a report to a group. (P)			20.
21.	Trying to pick up someone. (P)			21.
22.	Returning goods to a store. (S)			22.
23.	Giving a party. (S)			23.
24.	Resisting a high pressure salesperson. (S)			24.

H.5. Are you currently seeking advice, counselling or other support for problems with depression or anxiety?

If yes, give details below: _____ Yes | 1

_____ No | 2

H.6. a) Are you currently taking medication prescribed by a doctor for depression or anxiety?

If yes, specify: _____ Yes | 1

_____ No | 2

b) Did you take the medication as directed?

If not, why not: _____ Yes | 1

_____ No | 2

No medication	9

H.7. Are you currently seeking treatment for a health related problem?

If yes, give details: _____	Yes	1
_____	No	2

SECTION I: CIGARETTES AND ALCOHOL

I.1 Over the last month have you smoked a cigarette or cigarettes? If so, how many cigarettes would you smoke per day?

Non smoker	1
<1 per day	2
1-4 per day	3
5-9 per day	4
10-20 per day	5
21+ per day	6

I.2 Over the last month would your partner have smoked a cigarette or cigarettes? If yes, how many cigarettes would he smoke per day?

Non smoker	1
<1 per day	2
1-4 per day	3
5-9 per day	4
10-20 per day	5
21+ per day	6

No partner | 9

IF NO COHABITING PARTNER ENTER 9

I.3 Are there any other people in your household who smoke?

Yes	1
No	2

IF RESPONDENT NEVER DRINKS ALCOHOL ENTER 0's IN I.4 & I.5

I.4 For the next questions when I use the word "drink", I mean a glass of wine, a can or bottle of beer, a shot or nip of spirits, either alone or in a mixed drink.

a) In a typical week when you have something to drink, how many drinks would you have in total from Monday to Thursday (four days)?

Number of drinks | | |

b) And how many drinks would you usually have, in total, from Friday to Sunday (three days)?

Number of drinks | | |

c) In the past year how many times would you have had 6 or more drinks in one sitting or occasion?
(If more than 98 occasions enter 98)

Number of occasions | | |

d) On the last occasion you drank how many drinks in total would you have consumed over the session/occasion?

Number of drinks | | |

e) What is the most you have drunk in one session or occasion in the past 12 months?

Number of drinks | | |

I.5 On how many occasions in the past 12 months would you have got seriously drunk? Number | | |

I.6 In the last 12 months, have any of the following happened as a result of your drinking?	Yes	No
Arguments with your husband, partner or boyfriend	1	2
Arguments with friends or family members	1	2
Getting into fights	1	2
Getting into trouble with the Police	1	2
Financial problems	1	2
You or someone else having an accident or getting injured (as a result of your drinking)	1	2
Missing out on important activities or obligations because you'd been drinking	1	2
Having difficulty stopping drinking before you were drunk	1	2
Drinking much more or for much longer than you intended	1	2
Spending large amounts of time drinking or getting over its effects	1	2
Has drinking made you feel depressed, guilty or distrustful of others?	1	2

Have you attempted to quit or cut down on your drinking and found you couldn't?	1	2

IF MOTHER HAS HAD A RESIDENT PARTNER AT ANY TIME IN THE PAST 12 MONTHS ASK I.7 - I.10, OTHERWISE ENDORSE THESE ITEMS WITH 9's

I.7 How often does your partner (ex-partner) drink alcohol?

Never	1
Very occasionally	2
At least monthly	3
At least weekly	4
Most days	5
NA	9

IF NO PARTNER ENTER 9's IN I.8 – I.10. IF PARTNER DOES NOT DRINK ENTER 0's IN I.8 - I.19 AND 2's IN I.10.

I.8

a) In a typical week when your partner have something to drink, how many drinks would they have in total from Monday to Thursday (four days)?

Number of drinks | | |

b) And how many drinks would they usually have, in total, from Friday to Sunday (three days)?

Number of drinks | | |

c) In the past year how many times would they have had 6 or more drinks in one sitting or occasion?
(If more than 98 occasions enter 98)

Number of occasions | | |

d) On the last occasion they drank how many drinks in total would they have consumed over the session/occasion?

Number of drinks | | |

e) What is the most they have drunk in one session or occasion in the past 12 months?

Number of drinks | | |

I.9 To your knowledge, on how many occasions in the past 12 months would your partner (ex-partner) have got seriously drunk?

Number | | |

I.10 In the past 12 months, have any of the following happened as a result of your partner's drinking?

	Yes	No	NA
Problems in your relationship with your partner	1	2	9
He got into arguments with friends or family members	1	2	9
He got into fights	1	2	9
He got into trouble with the Police	1	2	9
Financial problems	1	2	9
He or someone else had an accident or got injured (as a result of his drinking)	1	2	9
Missing out on important activities or obligations because he'd been drinking	1	2	9
He had difficulty stopping drinking before he was drunk	1	2	9
Drinking much more or for much longer than he intended	1	2	9

Spending large amounts of time drinking or getting over its effects	1	2	9
Drinking made him feel depressed, guilty or distrustful of others	1	2	9
Has he attempted to quit or cut down on his drinking and found he couldn't?	1	2	9

SECTION J: OTHER SUBSTANCE USE

J.1 Since (name) started school, have you used cannabis?

Yes	1
No	2

IF YES TO J.1 ASK J.2 - J.3. OTHERWISE ENDORSE THESE ITEMS WITH 9's AND ASK J.4

J.2 At the present time how often do you use cannabis?

Nearly every day	1
At least once a week	2
At least once a month	3
Less than once a month	4
Not used cannabis in past 12 months	9

J.3 Over the last 12 months, has your use of cannabis resulted in	Yes	No	NA

Problems with your family	1	2	9
Problems with your friends	1	2	9
Problems with the Police	1	2	9
Problems with your husband/partner/boyfriend	1	2	9
You being in a situation where being high increased your chances of being hurt, having an accident	1	2	9
You having a strong and irresistible desire to smoke cannabis	1	2	9
You wishing to stop or cut down on using cannabis but finding you couldn't	1	2	9
Often using larger amounts of cannabis than you intended to when you started	1	2	9
Using cannabis for longer than you intended to	1	2	9
Spending a great deal of time using cannabis or getting over its effects	1	2	9
Having to use more to get the same effect	1	2	9
Having withdrawal symptoms if you tried to stop or cut down on using cannabis (e.g. feeling sick, headaches etc)	1	2	9
Problems with your health	1	2	9
Psychological problems	1	2	9
Have you ever stolen goods or money in order to buy cannabis	1	2	9

J.4 Over the last 30 days have you used any of the following

	Frequency (Days)	Amount used over a 24 Hour Period	Route (Oral, Nasal, Smoke)
Heroin (*China, White, Tar, homebake, Misti*)		(# $)	

Methadone *(Unprescribed LAAM)*		(# mg)	
Painkillers *(Other opiates/analgesics, morphine, Demerol, Percoset, Fentanyl, 4's, Codeine, Dilaudid, Quaaludes, Goofballs, Ts, Downs, Downers, 714's, Ludes, Reds, Junk)*		(# mg)	
Barbiturates		(# pills)	
Other sedatives *(Hypnotics, tranquilizers, Bennies, Traxene, Benzodiazepines, Valium, Librium, Xanax)*		(# pills)	
Cocaine (*Coke, candy, snow, white lady, crack, ice, flake, toot, rock, freebase)*		(# $)	
Methamphetamine *(Crystal, crank)*		(# mg)	
Ectasy *(Adam)*		(# pills)	
Amphetamines *(Dexedrine, dexies, bennies, black beauties, uppers, speed, ups)*		(# pills)	
Cannabis *(Marijuana, THC, pot, reefer, weed, grass, smoke, boo)*		(# joints)	
Hallucinogens *(LSD, acid, PCP, Angel dust, DMT, STP, trips, mescaline, lotter, green flakes, magic mushroom, TIC, killer weed)*			
Inhalants *(Glue, gas, solvents, nitrous oxide/whippets, amyl nitrate/poppers)*			

J.5 a) In the last 12 months, have you consulted a doctor or sought other advice, counselling or treatment for problems with alcohol, cannabis or other drugs?

	Number of Contacts
General practitioner	
Psychiatrist	
Psychologist	
Substance abuse counsellor/clinic	
Other, specify:	

b) For each contact give details of advice/treatment

EPISODE 1. Date: Reason(s) for seeking help: Source of advice/treatment: Treatment/outcome: Duration of Treatment:
EPISODE 2. Date: Reason(s) for seeking help: Source of advice/treatment: Treatment/outcome: Duration of Treatment:
EPISODE 3. Date: Reason(s) for seeking help: Source of advice/treatment: Treatment/outcome: Duration of Treatment:

IF RESPONDENT HAS SOUGHT ADVICE/TREATMENT ASK J.6, OTHERWISE ENDORSE J.6 WITH 9's AND SKIP TO J.7

J.6 What led you to seek treatment?

	Yes	No	NA
You felt you needed treatment	1	2	9
Parents felt you needed treatment	1	2	9
Boyfriend/partner felt you needed treatment	1	2	9
Friends felt you needed treatment	1	2	9
Counsellor suggested you seek treatment	1	2	9

Ordered to by the Court or Police	1	2	9
Others suggested you needed treatment. Specify:	1	2	9

1	2	9

J.7	Drug use in the home	Yes	No
	Has your child ever accidentally seen you using drugs?	1	2
	Has your child ever accidentally seen you buy drugs?	1	2
	Has your child ever accidentally seen you inject drugs?	1	2
	Has your child ever accidentally seen anyone else in the house buy drugs or use drugs?	1	2
	Have your child ever found drugs in the house by mistake?	1	2

J.8	Prescribed Drugs	Yes	No
a)	Are you currently being prescribed methadone?	1	2

If yes, what is your prescribed dose level? _____mg/day

If no and have previously been on methadone, how long ago did they stop?.....

		Yes	No	N/A
b)	Does your child know you are on the methadone program?	1	2	9

If Yes do they know why? Yes No N/A

		Yes	No
c)	Are you currently on any prescribed medication other than methadone?	1	2

If yes, please specify_____

IF MOTHER HAS HAD A RESIDENT PARTNER IN PAST 12 MONTHS ASK J.9
OTHERWISE ENDORSE THESE ITEMS WITH 9'S

SECTION K: PROBLEMS IN THE LAST YEAR

J.9. In the last 12 months, has your partner (or ex-partner) used any of the following drugs?	Yes	No	NA
Cannabis	1	2	9
Solvents - glue, petrol, etc	1	2	9
Sedatives - downers	1	2	9
Stimulants - amphetamines/methamphetamines ('P')	1	2	9
Heroin/homebake	1	2	9
Morphine/MSTs	1	2	9
Cocaine	1	2	9
LSD, PCP, ecstasy (or other designer drugs)	1	2	9
Any other substance. Specify:	1	2	9

K.1 a) Over the last year, have <u>you</u> had any contact with the following agencies for these problems?	No. of Times

Contact with the Police as a result of your involvement in property or violent crime	
Contact with the Police for traffic offences you have committed (including speed camera fines)	
Contact with the Police for alcohol or drug related offences	
Contact with the Police as a result of domestic violence	
Contact with a debt collection agency for unpaid bills	
Contact with Work and Income NZ because of benefit overpayments or suspected overpayments	
Contact with the Family Court concerning child custody or other issues	
Have you appeared in court in the last year	
Have you received a court conviction in the last year	

b) For each incident above give details below:

INCIDENT 1:

Description of incident: _____

_____

Agency involved: _____

Outcome: _____

INCIDENT 2:

Description of incident: _____

_____

Agency involved: _____

Outcome: _____

INCIDENT 3:

Description of incident: _____

_____

Agency involved: _____

Outcome: _____

INCIDENT 4:

Description of incident: _____

_____

Agency involved: _____

Outcome: _____

IF MORE THAN FOUR INCIDENTS RECORD DETAILS BELOW

K.2 Since (name) started school, have you had any contact with Child, Youth and Family Services?

Yes	1
No	2

If yes give details:

When:_____

Reason for contact: _____

_____

Outcome of contact: _____

_____

SECTION L: PARTNERS AND PARTNER RELATIONSHIPS

L.1 Thinking about your current (most recent) relationship, to what extent do the following statements describe your relationship with your partner?	Doesn't Apply	Applies Somewhat	Def. Applies	NA
I have (had) a sense of "belonging" with my partner	1	2	3	9
I tell (told) my partner intimate things about myself	1	2	3	9
We frequently argue(d) with each other	1	2	3	9
I "give" ("gave") a lot to our relationship	1	2	3	9
I try (tried) to change things about my partner that bother(ed) me (eg behaviours, attitudes)	1	2	3	9
I feel (felt) confused about my feelings towards my partner	1	2	3	9
I love(d) my partner very much	1	2	3	9

	Doesn't Apply	Applies Somewhat	Def. Applies	NA
We often discuss(ed) and help(ed) each other solve problems	1	2	3	9
I worry (worried) about losing my independence by being in this relationship	1	2	3	9
Things that happen(ed) to my partner affect(ed) and are (were) important to me	1	2	3	9
We often talk(ed) about the quality of our relationship (eg how good it is, how satisfying etc)	1	2	3	9
I often feel (felt) angry and resentful towards my partner	1	2	3	9
This relationship feels (felt) more special than others I have been in	1	2	3	9
I try (tried) to change my own behaviour to help solve problems with my partner	1	2	3	9
I am (was) unsure about whether to continue this relationship	1	2	3	9
I feel (felt) a strong commitment to this relationship	1	2	3	9
I feel (felt) very close to my partner	1	2	3	9
My partner demands (ed) or requires (ed) too much of my time and attention	1	2	3	9
I need(ed) my partner very much	1	2	3	9
I feel (felt) trapped and pressured to continue with this relationship	1	2	3	9
We have (had) a good sexual relationship	1	2	3	9

I can (could) talk to my partner about what I want(ed) and need(ed) from our relationship	1	2	3	9
I feel (felt) very attached to my partner	1	2	3	9
We have (had) serious problems and arguments	1	2	3	9
I often get (got) angry and frustrated with my partner	1	2	3	9

SECTION M: LIFE EVENTS

M.1 Since our last interview, have any of the following events occurred to you?

INTERVIEWER: IF "YES" ASK "HOW UPSET OR DISTRESSED WERE YOU BY THIS?"

	No Event	Not Upset	Mildly Upset	Upset	Very Upset
Moved house	1	2	3	4	5
Took out a mortgage	1	2	3	4	5
Built a home or had one built	1	2	3	4	5
Remodelled a home	1	2	3	4	5
Increased financial problems from taking on a mortgage or purchasing a business	1	2	3	4	5
Partner became unemployed	1	2	3	4	5
Partner changed his job or started a new job	1	2	3	4	5
Partner took a cut in wage or salary without a demotion	1	2	3	4	5
Respondent started a new job	1	2	3	4	5
Respondent took a cut in wage or salary without a demotion	1	2	3	4	5

Respondent became unemployed	1	2	3	4	5
Respondent changed her job	1	2	3	4	5
Person moved out of the household	1	2	3	4	5
Someone stayed on in the household after he/she was expected to leave	1	2	3	4	5
Serious family argument other than with spouse	1	2	3	4	5
Family member other than partner or child died	1	2	3	4	5
Close friend died	1	2	3	4	5
Had serious or prolonged disagreements with parents/in-laws	1	2	3	4	5
Serious financial problems	1	2	3	4	5
Suffered a financial loss or loss of property not related to work	1	2	3	4	5
Foreclosure of mortgage or loan	1	2	3	4	5
Became engaged	1	2	3	4	5
Married	1	2	3	4	5
Relations with partner changed for the worse without separation or divorce	1	2	3	4	5
Serious or prolonged arguments with partner/ex-partner	1	2	3	4	5
Divorce	1	2	3	4	5
Separation from partner	1	2	3	4	5
Reconciliation with partner	1	2	3	4	5
Problems with sex (i.e., sexual incompatibility with partner, alleged frigidity, etc)	1	2	3	4	5
Assault by partner	1	2	3	4	5
Assault (other than by partner)	1	2	3	4	5

Robbed	1	2	3	4	5
Respondent involved in court case	1	2	3	4	5
Partner involved in court case	1	2	3	4	5
Serious illness (respondent)	1	2	3	4	5
Injury (respondent)	1	2	3	4	5
Unable to get treatment for an illness or injury (respondent)	1	2	3	4	5
Serious illness or accident of partner	1	2	3	4	5
Serious illness or accident (study child)	1	2	3	4	5
Serious illness or accident of child (other than survey child)	1	2	3	4	5
Serious illness (other family members)	1	2	3	4	5
Became pregnant	1	2	3	4	5
Had a miscarriage	1	2	3	4	5
Had a pregnancy termination (abortion)	1	2	3	4	5
Gave birth	1	2	3	4	5
Pet died	1	2	3	4	5
Broke up with a friend	1	2	3	4	5

SECTION N: ADMIN

N.1 Who completed this interview?

Relationship to study child……

N.2. Ethnicity of caregiver:

(please tick all that apply to you)

New Zealand European ☐

Maori ☐

Samoan ☐

Cook Island Maori ☐

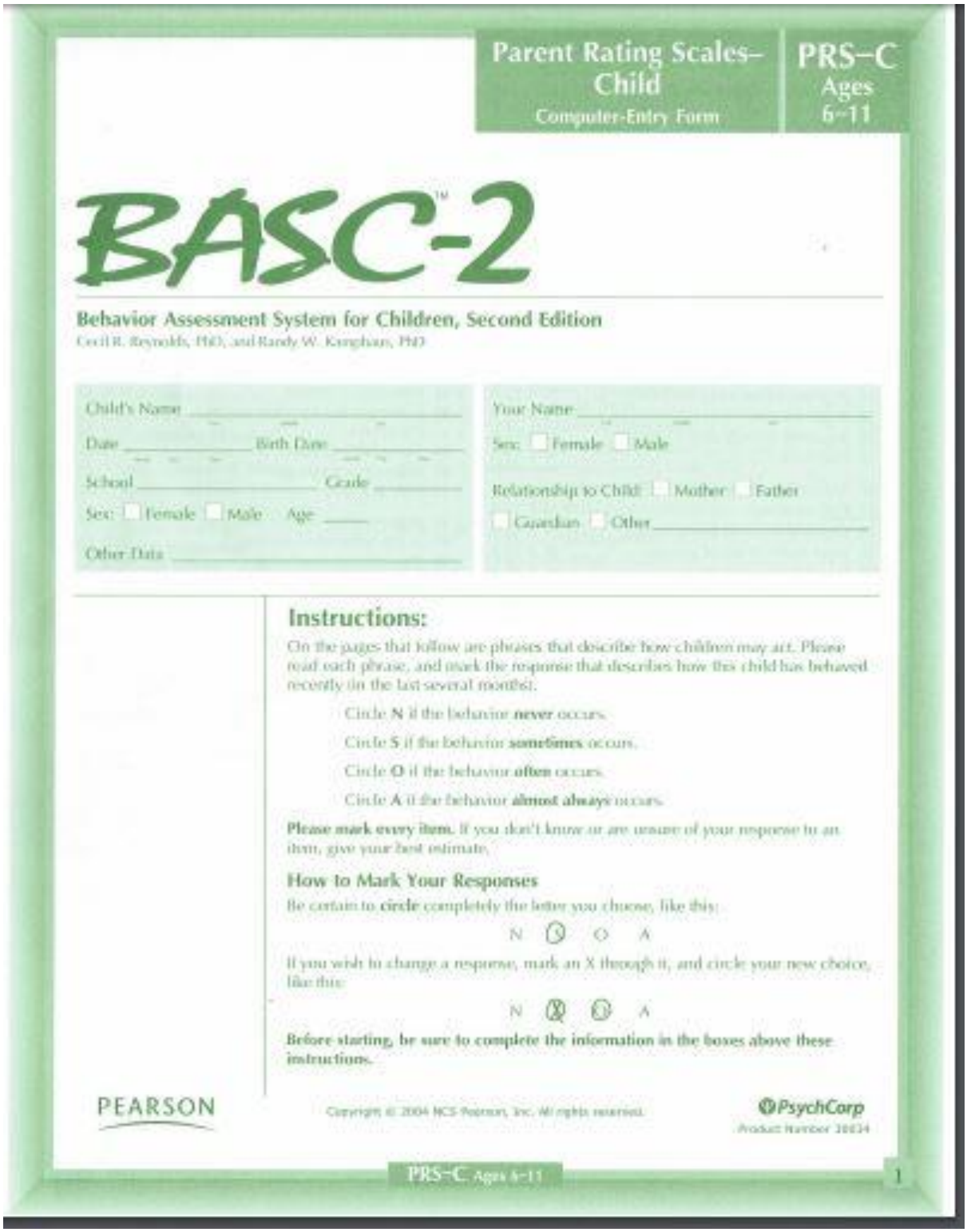
Tongan ☐

Chinese ☐

Indian ☐

Other (such as Dutch, Japanese, Tokelauan) Please State:……
…….

Appendix E: The PRS-C form from the BASC-2



Parent Rating Scales–Child
Computer-Entry Form

PRS–C
Ages 6–11

BASC-2™

Behavior Assessment System for Children, Second Edition

Cecil R. Reynolds, PhD, and Randy W. Kamphaus, PhD

Child's Name _____

Date _____ Birth Date _____

School _____ Grade _____

Sex: ☐ Female ☐ Male Age _____

Other Data _____

Your Name _____

Sex: ☐ Female ☐ Male

Relationship to Child: ☐ Mother ☐ Father

☐ Guardian ☐ Other _____

Instructions:

On the pages that follow are phrases that describe how children may act. Please read each phrase, and mark the response that describes how this child has behaved recently (in the last several months).

Circle **N** if the behavior **never** occurs.

Circle **S** if the behavior **sometimes** occurs.

Circle **O** if the behavior **often** occurs.

Circle **A** if the behavior **almost always** occurs.

Please mark every item. If you don't know or are unsure of your response to an item, give your best estimate.

How to Mark Your Responses

Be certain to **circle** completely the letter you choose, like this:

N (S) O A

If you wish to change a response, mark an X through it, and circle your new choice, like this:

N (X) (O) A

Before starting, be sure to complete the information in the boxes above these instructions.

PEARSON

PsychCorp

Product Number 28624

Remember: N – Never S – Sometimes O – Often A – Almost always

1. Shares toys or possessions with other children. N S O A
2. Eats too much. N S O A
3. Has trouble following regular routines. N S O A
4. Gives good suggestions for solving problems. N S O A
5. Worries. N S O A
6. Cannot wait to take turn. N S O A
7. Is easily annoyed by others. N S O A
8. Teases others. N S O A
9. Has a short attention span. N S O A
10. Is easily upset. N S O A
11. Does strange things. N S O A
12. Worries about what teachers think. N S O A
13. Is too serious. N S O A
14. Recovers quickly after a setback. N S O A
15. Disobeys. N S O A
16. Makes friends easily. N S O A
17. Pays attention. N S O A
18. Complains about being teased. N S O A
19. Joins clubs or social groups. N S O A
20. Is unable to slow down. N S O A
21. Refuses to join group activities. N S O A
22. Has seizures. N S O A
23. Babbles to self. N S O A
24. Bullies others. N S O A
25. Will change direction to avoid having to greet someone. N S O A
26. Hits other children. N S O A
27. Eats things that are not food. N S O A
28. Cries easily. N S O A
29. Stuals. N S O A
30. Expresses fear of getting sick. N S O A
31. Congratulates others when good things happen to them. N S O A
32. Worries about making mistakes. N S O A
33. Is easily soothed when angry. N S O A
34. Provides own telephone number when asked. N S O A
35. Acts in a safe manner. N S O A
36. Is a "self-starter." N S O A
37. Worries about what parents think. N S O A
38. Disrupts other children's activities. N S O A
39. Organizes chores or other tasks well. N S O A
40. Argues with parents. N S O A
41. Listens to directions. N S O A
42. Says, "Nobody understands me." N S O A
43. Acts confused. N S O A
44. Worries about schoolwork. N S O A
45. Is fearful. N S O A
46. Adjusts well to changes in routine. N S O A
47. Breaks the rules. N S O A
48. Avoids competing with other children. N S O A
49. Pays attention when being spoken to. N S O A
50. Complains about not having friends. N S O A
51. Is good at getting people to work together. N S O A
52. Acts out of control. N S O A
53. Is chosen last by other children for games. N S O A
54. Complains of pain. N S O A
55. Repeats one thought over and over. N S O A
56. Argues when denied own way. N S O A
57. Is shy with other children. N S O A
58. Threatens to hurt others. N S O A
59. Has stomach problems. N S O A
60. Says, "Nobody likes me." N S O A
61. Lies to get out of trouble. N S O A
62. Says, "I think I'm sick." N S O A
63. Encourages others to do their best. N S O A
64. Tries too hard to please others. N S O A
65. Adjusts well to new teachers. N S O A
66. Speaks in short phrases that are hard to understand. N S O A
67. Sets realistic goals. N S O A
68. Is creative. N S O A
69. Is nervous. N S O A
70. Fiddles with things while at meals. N S O A
71. Volunteers to help clean up around the house. N S O A
72. Annoys others on purpose. N S O A
73. Is easily distracted. N S O A
74. Is negative about things. N S O A
75. Seems out of touch with reality. N S O A
76. Answers telephone properly. N S O A
77. Worries about things that cannot be changed. N S O A
78. Adjusts well to changes in family plans. N S O A
79. Deceives others. N S O A
80. Quickly joins group activities. N S O A

Remember: N – Never S – Sometimes O – Often A – Almost always

81. Is unclear when presenting ideas. N S O A
82. Says, "I don't have any friends." N S O A
83. Is usually chosen as a leader. N S O A
84. Is overly active. N S O A
85. Offers help to other children. N S O A
86. Has headaches. N S O A
87. Acts as if other children are not there. N S O A
88. Seeks revenge on others. N S O A
89. Shows fear of strangers. N S O A
90. Loses temper too easily. N S O A
91. Complains about health. N S O A
92. Says, "I want to die" or "I wish I were dead." N S O A
93. Sneaks around. N S O A
94. Gets sick. N S O A
95. Compliments others. N S O A
96. Seems unaware of others. N S O A
97. Is cruel to animals. N S O A
98. Has difficulty explaining rules of games to others. N S O A
99. Attends to issues of personal safety. N S O A
100. Will speak up if the situation calls for it. N S O A
101. Says, "I'm afraid I will make a mistake." N S O A
102. Interrupts others when they are speaking. N S O A
103. Has trouble fastening buttons on clothing. N S O A
104. Calls other children names. N S O A
105. Listens carefully. N S O A
106. Says, "I hate myself." N S O A
107. Hears sounds that are not there. N S O A
108. Is able to describe feelings accurately. N S O A
109. Says, "I'm not very good at this." N S O A
110. Is a "good sport." N S O A
111. Lies. N S O A
112. Avoids other children. N S O A
113. Tracks down information when needed. N S O A
114. Is sad. N S O A
115. Has a hearing problem. N S O A
116. Acts without thinking. N S O A
117. Tries to bring out the best in other people. N S O A
118. Has fevers. N S O A
119. Stares blankly. N S O A
120. Sleeps with parents. N S O A
121. Has trouble making new friends. N S O A
122. Responds appropriately when asked a question. N S O A
123. Is afraid of getting sick. N S O A
124. Seems lonely. N S O A
125. Breaks the rules just to see what will happen. N S O A
126. Complains of being sick when nothing is wrong. N S O A
127. Volunteers to help with things. N S O A
128. Says things that make no sense. N S O A
129. Throws up after eating. N S O A
130. Is clear when telling about personal experiences. N S O A
131. Needs to be reminded to brush teeth. N S O A
132. Makes decisions easily. N S O A
133. Says, "It's all my fault." N S O A
134. Interrupts parents when they are talking on the phone. N S O A
135. Has toileting accidents. N S O A
136. Is cruel to others. N S O A
137. Falls down. N S O A
138. Says, "I want to kill myself." N S O A
139. Sees things that are not there. N S O A
140. Accurately takes down messages. N S O A
141. Worries about what other children think. N S O A
142. Is stubborn. N S O A
143. Sets fires. N S O A
144. Prefers to be alone. N S O A
145. Has trouble getting information when needed. N S O A
146. Eats too little. N S O A
147. Runs away from home. N S O A
148. Has poor self-control. N S O A
149. Shows interest in others' ideas. N S O A
150. Vomits. N S O A
151. Shows feelings that do not fit the situation. N S O A
152. Has eye problems. N S O A
153. Is shy with adults. N S O A
154. Communicates clearly. N S O A
155. Wets bed. N S O A
156. Changes moods quickly. N S O A
157. Gets into trouble. N S O A
158. Complains of shortness of breath. N S O A
159. Says, "please" and "thank you." N S O A
160. Acts strangely. N S O A

PEARSON

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