# Exploring The Effect of Maternal Heroin Use:

# A Case Study On Long-Term Neonatal Learning Outcomes

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Abstract

Heroin has become one of the most used opioid drugs by pregnant women and is an increasing concern to obstetricians. Heroin use has major social and medical implications and, when used during pregnancy, it has adverse effects on the mother, the fetus and the new-born child. Children who are exposed to maternal heroin use reveal a delay in cognitive function at 3 years of age, lower verbal ability, reading and math skills, and delayed acquisition of motor milestones. The current study explores the relationship of maternal heroin use on neonatal learning development and outcomes. A four-month illustrative case study was conducted with one nine-year-old male participant, who displayed significant learning deficits in reading, writing and mathematics. His biological mother was inducing heroin throughout her pregnancy and, at five weeks old, he was adopted and situated into a new home with his current adoptive mother. Interviews were administered to the child and adoptive mother, and a data analysis of medical records and elementary provincial academic report cards was conducted. The results suggest an evident negative effect of maternal heroin use on cognitive development but limited long-term effect due to early adoption and a significant amount of support systems. Overall, the results of this study influence adoptive parents, foster homes and any environments that a child who was prenatally exposed to heroin has now been situated in. This research also fills a gap in the current limited research on prenatal heroin exposure.

*Keywords:* learning development, opioid use, early intervention, long term outcomes

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# CHAPTER 1

## INTRODUCTION

This thesis explores the effects of prenatal heroin use on the development of children. More specifically, this thesis studies how prenatal exposure to heroin may be affecting the learning and well-being of a 9-year old boy. Over the course of four months, I had spent an extensive amount of time learning about Benjamin, a grade four male student whose biological mother was inducing heroin during the course of her pregnancy. In addition to the heroin-use, Benjamin was adopted and situated in a new home at five weeks old. The purpose of this illustrative case study was to uncover the apparent effects of Benjamin's prenatal exposure to heroin through a data analysis of academic and medical records, as well as interviews with his adoptive mother, Michelle, and himself as a learner. The results from these interviews and the data analysis were combined to produce the claims of this study.

Numerous studies, including large longitudinal studies, have explored the effects of maternal exposure to drugs and alcohol on children's development (e.g. Ackerman, Riggins, & Black, 2010; Flak et al., 2014). It is well known that prenatal alcohol exposure has been linked to long-term detrimental effects on the children's cognitive abilities (Flak et al., 2014). To a lesser extent, research has also documented the effects of drug use, particularly cocaine, on child development (Bauer et al., 2002). A well-known study of prenatal cocaine exposure is the Maternal Lifestyle Study where researchers examined 1,100 children exposed to cocaine (Bauer et al., 2002; Neonatal Research Network, 2013). In this study, children were followed for 15 years and it was found that prenatal cocaine exposure was significantly associated with sustained attention and behavioral self-regulation issues (Ackerman et al., 2010). However, despite this

research, there is currently only a paucity of research on opioid exposure (i.e. heroin) during pregnancy (Lester & Lagasse, 2010; Logan, Brown, & Hayes, 2013).

Preliminary evidence suggests an association with prenatal heroin exposure and compromised memory performance and academic achievement in adolescence (Buckingham-Howes et al., 2013). Several brain regions are altered due to maternal heroin use such as the hippocampus, amygdala and frontal cortex resulting in possible functional deficits in memory, learning and executive functioning that can last a lifetime (Shonkoff & Garner, 2012; Shonkoff, 2010; Lupien et al., 2009; McEwan & Gianaros, 2011). Many studies have reported executive control and attention as common functions that are effected as a result of maternal opioid use (Hans, 1996; Hickey, Suess, Newlin, Spurgeon, & Porges, 1995; Melinder, Konijnenberg, & Sarfi, 2013; Ornoy et al., 2001; Slinning, 2004; Wahlsten & Sarman, 2013) and behavior regulation (de Cubas & Field, 1993; Hans, 1996; Sowder & Burt, 1980). Fine motor abilities, often associated with executive control, have also been found to be negatively impacted due to maternal heroin use (Logan et al., 2011). Although studies cannot control for all extraneous causal mechanisms, there is a demand for research on cognitive function of children who have been prenatally exposed to opioids.

Substance use disorders (SUDs) have become a substantial public health concern due to the societal and economic costs and their direct correlations with poor health outcomes (Severtson, Hedden, Martins, & Latimer, 2012). Illegal drugs have accumulated over $180 billion healthcare costs as of 2002, with poor health outcomes and lost productivity as common factors (Office of National Drug Control, 2004). The United States is currently facing the highest amount of heroin, also known as diacetylmorphine, overdose rates in history (National Institute on Drug Abuse [NIDA], 2018a). From 1999 to 2014, the death rate caused by overdose has

tripled from 4.71 deaths to 13.56 deaths per 100,000 population, creating a public health crisis. Specifically, these numbers have emerged due to prescription opioid use and, in recent years, heroin and fentanyl (Centres for Disease Control and Prevention, 2016). There has also been a shift from individuals beginning to use heroin as opposed to prescription pain relievers as a cheaper alternative and the belief that pure heroin is safer than less pure forms due to non-injection (Cicero, Ellis, & Surratt, 2012). Since 1999, deaths caused by overdose have nearly quadrupled, signifying a large increase of opioid use over the past twenty years. Mortality caused by drug overdose seem to occur among people aged 45 to 54 years of age. Historically, fatal overdoses occur more frequently for men in their late 20s to early 30s than any other age groups (Centers for Disease Control and Prevention, 2000; Darke & Hall, 2003). But, from 2010 to 2012, all age groups revealed a significant increase in heroin death rate (Rudd, Paulozzi, & Bauer, 2014) and in 2007 and 2012, individuals aged 25 to 34 revealed the highest levels of overdose than any other age group (Rudd et al., 2014). Unfortunately, heroin has become less expensive, more accessible and more pure (Huang, Keyes, & Li, 2018; U.S. Drug Enforcement Administration, 2016), which may influence both sexes and all age groups.

Current research reveals higher levels of heroin use for individuals aged 18-25 (Johnston et al., 2017). In 2016, the National Survey on Drug Use and Health (NSDUH) reported about 948,000 Americans using heroin in the past year (Substance Abuse Center for Behavioral Health Statistics and Quality (SAMHSA), 2016). 626,000 people in 2016, as opposed to 214,000 people in 2002, have met the criteria for dependence or heroin use disorder as described in the Diagnostic and Statistical Manual of Mental Disorders 4$^{th}$ edition (DSM-IV). Heroin use no longer predominates in urban areas, as several suburban and rural areas are reporting higher

amounts of overdoses due to heroin use (NIDA, 2014). Usage continues to rise in many areas among young adults aged 18-25 (NIDA, 2014).

An important factor to consider when discussing heroin use is heroin access. If an individual is able to obtain a drug, it is likely easier for them to use the drug on a typical basis (Salas-Wright et al., 2018). It has been made significantly clear through past research that drug access directly correlates with the risk of drug use (Hawkins, Catalano, & Miller, 1992; Keyes et al., 2011; Resnick et al., 1997; Salas-Wright et al., 2017a). Heroin use is often triggered by traumatic or difficult experiences that may provoke users to obtain the drug as a calming mechanism (Huang et al., 2006; Salas-Wright, Vaughn, Perron, Gonzalez, & Goings, 2016). Furthermore, Nygaard, Slinning, Moe, and Walhovd (2015) suggest that there may be multiple unhealthy habits that coexist with heroin use for drug-dependent females. Heroin has become one of most used opioid drugs by pregnant women (Wang & Han, 2009), becoming an increasing concern to obstetricians. Heroin abuse has major social and medical implications, and, in pregnancy, it has an adverse effect on the mother, the fetus and the new-born child (Thangappah, 2000). A variety of neurobehavioral (differences) in the offspring emerge due to heroin use during pregnancy as opioids cross the placenta (Hutchings, 1982; Wilson, 1989; Minozzi, Amato, Vecchi, & Davoli, 2008; Kaltenbach, Berghella, &, Finnegan 2008), yet the neuronal mechanisms producing these risks remain unclear. The placenta was originally thought of as a source of protection against toxins, but studies reveal that metabolites from drugs enter the fetal bloodstream (Minnes, Lang, & Singer, 2011).

# CHAPTER 2

## LITERATURE REVIEW

Benjamin's multiple and diverse risk factors for poor development are what constitute this literature review's framework. Benjamin was born prenatally exposed to heroin, diagnosed with Hepatitis C, prescribed a significant amount of Fenobarb and Morphine during early detrimental developmental periods, adopted at five weeks old and was never admitted into daycare due to his medical history. Benjamin's unique case is extremely important for an evident larger demographic of children exposed to maternal heroin use that lack information and evidence on long term developmental outcomes. Specifically, parents and caregivers of these exposed children who cannot retrieve this vital information from current health providers. By exploring multiple surfaces of his life, insight can be brought and transferred onto many cases such as his that require medical attention and long-term guidance. In order to do so, this case study contains a variety of significant components that need to be extensively reviewed and explained in order to fully understand the nature and extraneous factors of this study. There are many potential contributing factors to the relationship of maternal heroin use and a newborn child, so it is necessary to explain and draw attention towards the multiple components. I will first direct attention to heroin use in general, and the history of statistics and consequences over time. This is important in order to understand the complexity and desire for the drug. Furthermore, in order to fully understand how heroin interrupts typical brain functioning, it is important to address how a brain functions without externally induced opioids. This will simplify the neurological underpinnings of how heroin enters the system and disrupts ordinary brain functioning. I will then discuss the relationship of maternal heroin use on learning outcomes and what the current literature suggests and argues; which is the core and bulk of this study. Due to

the complexity of this particular case, I think it is also important to acknowledge adoption as another risk factor for Benjamin's development. It will be useful to analyze what literature suggests about its potential effects that may have also been external factors contributing to the case. Since I conducted a case study, I will also spend time discussing case study research and its benefits and framework. Finally, I will discuss the reading process and how to teach vulnerable readers as that is embedded in my overall methodology and design of my time spent with Benjamin.

**Heroin Use: Medical and Social Consequences**

Although there are many evident and presumed medical consequences of heroin use, it is important to address the social consequences that have emerged at a larger level. The significant negative consequences related to the opioid epidemic have raised concern throughout not only Canada, but North America as well (Salas-Wright et al., 2018). Such consequences include increases in opioid-related social and health care spending, drug-related arrests, opioid use disorder, and opioid overdose mortality (Dart et al., 2015; Florence, Zhou, Luo, & Xu, 2016.; Martins et al., 2017; Palamar, Shearston Dawson, Mateu-Gelabert, & Ompad, 2016.; Rudd, Aleshire, Zibbell & Gladden, 2016). The use of heroin has repercussions that exceed beyond the individual user. HIV/AIDS, fetal effects, crime, violence and disruptions in family, workplace, and educational environments are some of the medical and social concerns that significantly impact society and cost billions of dollars each year (NIDA, 2019). In 2018, the White House declared the opioid epidemic a worldwide public health concern, with the city of St. Catharines being a recognizable population apart of this concern. The US Surgeon General demanded health providers and worried citizens to learn how to administer the overdose-reversing drug, Naloxone, and to have it accessible at all times (U.S. Department of Health and Human Services, 2018).

Regardless of how heroin is administered, chronic heroin users experience a wide range of medical difficulties including insomnia and constipation. Heroin has a debilitating effect on respiration that may lead to lung complications including various types of pneumonia and tuberculosis (Cicero, Ellis, Surratt, & Kurtz , 2014). Mental disorders such as depression and antisocial personality disorder are often experienced by drug users. Additionally, men typically experience sexual dysfunction and women's menstrual cycles often become irregular. Specific consequences also arise with different routes of administration (Carlson, Nahhas, Martins, & Daniulaityte, 2016). For example, when heroin is inhaled, mucosal tissues in the nose are damaged and the nasal cavity (the tissue that separates the nasal passages) is perforated (NIDA, 2019). Repeated use of chronic injection may include scarred and/or collapsed veins, bacterial infections of the blood vessels and heart valves, abscesses (boils), and other soft-tissue infections. Street heroin may include substances that do not readily dissolve and result in clogging the blood vessels that lead to the lungs, liver, kidneys, and brain. This may result in infection or possibly death of small patches of cells in vital organs. Arthritis or other rheumatologic problems may be a result of these immune reactions as well. Additionally, sharing injection equipment or fluids can cause severe consequences within heroin use including Hepatitis B and C, HIV, and a wide range of other blood-borne viruses, which drug users can transmit to sexual partners and children over time (NIDA, 2019).

**Regular Brain Functioning**

To fully comprehend how heroin affects the brain, it is important to understand how the brain operates. The brain consists of billions of cells, called neurons, which are organized into circuits and networks (NIDA, 2019). Neurons control the flow of information throughout the brain. If a neuron receives enough signals from other neurons connected to it, it "fires," sending

its own signal on to other neurons in the circuit. The brain consists of multiple parts with interrelated circuits that work in unity with each other. Certain brain circuits are responsible for managing and executing specific functions (NIDA, 2019). Networks of neurons send signals back and forth to each other and throughout the brain, the spinal cord, and nerves in the rest of the body (the peripheral nervous system). To send a message, a neuron releases a neurotransmitter into the gap (or synapse) between it and the next cell. After the neurotransmitter crosses the synapse, it attaches to receptors on the receiving neuron, producing change in the cell receiving the neurotransmitter (Fowler, Volkow, Kassed, & Chang, 2007). After neurons have interacted with each other, neurotransmission is complete unless some molecules do not make it across the synapse successfully. In this case, other molecules called transporters recycle neurotransmitters, returning them to the neuron that released them. This action limits and shuts off the signal between neurons (Fowler et al., 2007). Typically, when drugs are not present, the cycle of release, breakup, and neuron re-entry maintains the amount of neurotransmitter in the synapse, and hence neurotransmission, within certain limits. Most of the time, when an addictive drug enters the brain, it causes neurotransmission to increase or decrease dramatically beyond these limits, which can cause detrimental effects (NIDA, 2019).

**Heroin: Neurological Underpinnings**

Regular neuronal functioning is interrupted by the consumption of heroin. Drugs restrict the way neurons send, receive, and process signals through neurotransmitters. For example, marijuana and heroin activate neurons due to their chemical structure that mimics that of a natural neurotransmitter in the body. This allows the drugs to attach onto and activate the neurons. Unfortunately, these drugs do not mimic the brain's own chemicals and activate neurons in the same way as a natural neurotransmitter. The consequences of stimulating opioid

receptors through the use of external opioids such as heroin, as opposed to naturally produced chemicals, depend on a wide range of factors, including quantity of consumption, how strongly it binds and how quickly it gets there. This eventually leads to abnormal messages being sent through the network (NIDA, 2019).

Heroin is a highly addictive drug that is four to eight times more potent than morphine (Encyclopædia Britannica, 2018). Although heroin and morphine are similar in structure, heroin is acetylated, making it more lipophilic than morphine. This leads to an increased potency due to its ability to dissolve in fats faster. Due to this, it quickly passes through the blood–brain barrier as a result of acetyl groups (Tschacher, Haemmig, & Jacobshagen, 2003). The blood-brain barrier acts as a permeable physical and biochemical barrier that contributes to the maintenance of the stable environment required for proper neuronal function in the central nervous system (Schaefer, Tome, & Davis, 2017). This type of barrier has been deemed crucial for regular development and function, as seen throughout many evolutionary studies on complex brains in vertebrates (Bundgaard & Abbott, 2008; Mayer, Mayer, Chinn, Pinsonneault, & Bainton, 2011). The blood-brain barrier also plays an important role in protecting the central nervous system from pathogens and toxins in the bloodstream (Schaefer et al., 2017). The euphoric effects of heroin are reliant upon opioid transport across the blood-brain barrier and into the central nervous system (Yaksh & Wallace, 2011). Once heroin enters the brain, it attaches rapidly to mu-opioid receptors (MORs) (Goldstein, 1991) and is metabolized with the chemical 6-monoacetylmorphine (6-MAM) and subsequently to morphine in the blood, significantly impacting the central nervous system (Selly et al., 2001). Even after the initial use of heroin, morphine and 6-MAM remain in the brain for long durations of time. Heroin continues to attach

to opioid receptors for multiple hours, likely causing prolonged effects that are milder than the initial high caused by heroin (Gottås et al., 2013).

Multiple physiological and pathophysiological activities, including the regulation of membrane ionic homeostasis, cell proliferation, emotional response, epileptic seizures, immune function, feeding, obesity, respiratory and cardiovascular control, as well as some neurodegenerative disorders, are widely associated with opioid receptors (Feng et al., 2012). Studies reveal that heroin targets proteins associated with multiple types of receptors and hormones, thus eliciting alterations in multiple neurotransmitters in the hippocampus, a brain structure that regulates motivation, emotion, learning, and memory (Wang & Han, 2009). Humans contain naturally occurring chemicals called neurotransmitters that attach to the opioid receptors throughout the brain and body to regulate pain, hormones, and feelings of well-being (Waldhoer, Bartlett, & Whistler, 2004). When MORs are activated in the reward center of the brain, dopamine; a neurotransmitter responsible for a wide range of roles in the brain and body including emotional responses, is stimulated, causing a reinforcement of drug consumption (Johnson & North, 1992). When the chemicals from heroin attach to opioid receptors, the same biochemical brain processes that reward people with feelings of pleasure when they engage in activities that promote basic life functions, such as eating and sexual activity, are triggered. When opioids activate these reward processes in the absence of significant pain, they can stimulate repeated drug use for pleasure. Specific areas of the brain generate a lasting record or memory, called conditioned associations, that links these good feelings with the conditions and environment in which they occur. Drug cravings emerge when drug users re-live these memories, motivating them to seek out more drugs in spite of many obstacles (Kosten & George, 2002).

After a single dose of heroin, short-term effects arise and last for a few hours. Users can feel peak effects after 7 to 8 seconds after intravenous injection, providing the greatest intensity and most rapid onset of effects. Intramuscular injection, on the other hand, produces a euphoric high within 5 to 8 minutes, and when the drug is sniffed or smoked, effects are felt within 10 to 15 minutes (Centre for Substance Abuse Research, 2013). Typically, heroin users report feeling a surge of pleasurable sensation, known as a "rush". The intensity of the rush is dictated upon the quantity of heroin consumed and how rapidly the drug enters the brain and binds to the opioid receptors. In combination with the rush, users experience feelings of a warm flushing of the skin, dry mouth, and a heavy feeling in the extremities. Additionally, users may experience nausea, vomiting and intensified itching. After the initial effects, users are usually drowsy for numerous hours, mental function is apprehensive, heart function decreases and breathing is also much slower, sometimes enough to be life threatening; potentially leading to coma and permanent brain damage (National Library of Medicine, 2018).

Frequent heroin use alters the physical structure (Wang et al., 2012) and physiology of the brain, producing long-term imbalances in neuronal and hormonal systems that are very difficult to reverse (Ignar & Kuhn, 1990; Kreek et al., 1984). Research has indicated that white matter within the brain deteriorates over time due to heroin use, which may impact decision-making abilities, behavioral regulation and ability to respond within stressful situations (Li et al., 2013; Qiu et al., 2013; Liu et al., 2011). Overwhelming degrees of tolerance and physical dependence are also produced overtime due to heroin usage. Tolerance occurs when excessive use of the drug is required to achieve the same affects. With physical dependence, the body adapts to the manifestation of the drug and withdrawal symptoms begin if usages decrease (NIDA, 2019).

It is highly possible for withdrawal to occur within a few hours after the last time the drug is used. Restlessness, muscle and bone pain, insomnia, diarrhea, vomiting, cold flashes with goose bumps ("cold turkey"), and leg movements are some of the symptoms experienced during withdrawal (NIDA, 2019). Major withdrawal symptoms peak between 24-48 hours after the last dose of heroin and diminish after about a week. However, withdrawal symptoms have also been prolonged for several months for some users (Liu et al., 2011). Heroin use disorder, a chronic relapsing disease extending beyond physical dependence, is often a result of repeated heroin use. This disorder is characterized by uncontrollable drug-seeking, no matter the consequences (Kreek et al., 2012). Although heroin can be administered in several ways, routes of administration that allow it to reach the brain the fastest such as injection and smoking, increase the risk of developing heroin use disorder. Once the disorder is developed, pursuing and using the drug can becomes a user's primary purpose in life (NIDA, 2019).

**Methadone Maintenance Treatment**

Although not within the scope of this study, I have included a section on methadone maintenance treatment due to its relevancy within current research on heroin use. Neonatal abstinence syndrome (NAS) is a clinical diagnosis, and a consequence of the sudden discontinuation of chronic fetal exposure to substances that were used or abused by the mother during pregnancy. NAS is a multifaceted disorder, mainly involving the central and autonomic nervous systems, as well as the gastrointestinal tract. Severe neonatal withdrawal may occur due to prolonged maternal opioid use and significant illness can arise (Kocherlakota, 2014). In 1964, methadone was introduced as a supplementary management of opioid dependence (National Consensus Development Panel, 1998). Obstetricians have become more willing to use methadone treatment throughout pregnancy due to its ability to reduce illegal drug consumption

and produce healthier fetal outcomes (Alaedini, Haddadi, & Asadian, 2017). Unfortunately, methadone usage continues to lead to high occurrences of NAS (Kaltenbach et al., 2011). It was also originally believed that maternal methadone use, as opposed to heroin use, would not lead to neonatal withdrawal, which was later denied by research (Reddy, Harper, & Stern, 1971). Buprenorphine, another opioid used to treat opioid addiction, was also introduced and accepted as a substitute to methadone (Auriacombe, Fatseas, Dubernet, Daulouede, & Tignol, 2004). Buprenorphine produces similar effects as methadone but can also lead to NAS, influencing patients to suddenly discontinue after initial usage (Auriacombe et al., 2004). Despite being classified as treatment, both methadone and buprenorphine cause various behavioral problems for children of women obtaining this type of treatment. Increased internalizing and externalizing behaviour problems have been documented at age 2 ½ for methadone and buprenorphine exposed children compared to non-exposed children (Sarfi, Sundet, & Waal, 2013). At four years old, they experience less effective executive functions compared to their peers (Konijnenberg & Melinder, 2014). During preschool, children exposed to maternal opioid maintenance treatment have been reported more aggressive, more depressed, less responsive and struggle with both peer and adult relationships and interactions (Baar, Soepatmi, Gunning, & Akkerhuis, 1994; Salo et al., 2009). When attending elementary school, special assistance for behavioral and academic problems are required more often than non-exposed children (Rosen & Johnson, 1985). However, the long-term effects on the child after methadone use during pregnancy has been undocumented.

**Heroin Use During Pregnancy: Risk Factors and Learning Outcomes**

The fetal blood-brain barrier is penetrated by active metabolites during maternal heroin use and interferes with early neuronal cell development, potentially causing neuronal death (Lee

et al., 2008). Heroin use can harm the fetal hippocampus by changing the circulating levels of maternal hormonal factors and damaging the developing cells in the fetus (Wang & Han, 2009). Factors such as weight, nutrition and development of the fetus are at harm due to these changes in maternal hormones. Other difficulties emerge as well, such as first trimester spontaneous abortion, premature delivery, meconium stained liquor, maternal, neonatal infection and neonatal abstinence syndrome (NAS) (Chasnof, 1986; Rivers, 1986). NAS, places the infant under physiological stress, increasing the risk of health and developmental difficulties (Minnes et al., 2011). Furthermore, perinatal morbidity and mortality rates are also associated with maternal opiate abuse (Sinha et al., 2001). Withdrawal symptoms appear in approximately 60-80% of newborns prenatally exposed to heroin or methadone (Patrick et al., 2012). All of these risk factors are the result of key apoptotic genes within the hippocampus becoming altered due to direct heroin-induced impairment of the developing cells (Wang & Han, 2009). A neurocognitive study found that the right lateral orbitofrontal cortex and right anterior cingulate cortex were thinner for children who were prenatally exposed to opioids. These areas are strongly associated with attentional and social difficulties (Walhovd et al., 2007). Heroin also causes vasoconstriction, which restricts the fetal oxygen supply (Minnes et al., 2011). Prenatal drug exposure increases activation within the mother's hypothalamic-pituitary-adrenal axis (HPA) (Shonkoff, 2012). The HPA axis releases chemical products (glucocorticoids), which the fetus is exposed to for a prolonged amount of time, having the ability to alter neurological and cognitive development (Lupien, McEwen, Gunnar, & Heim, 2009; Davis & Sandman, 2006).

Cognitive functions operating within the brain's hippocampus, such as learning, are known to be more vulnerable to detrimental stimuli, such as heroin. The hippocampus is also more susceptible to malformation during neurogenesis (Emeterio, Tramullas, & Hurle, 2006).

Apoptosis (programmed cell death), occurs more frequently during heroin use, which leads to neurobehavioral defects of learning. Cognitive development and behavior are effected by drug metabolites that have entered the fetal bloodstream (Minnes et al., 2011). Children who are exposed to maternal heroin use reveal a delay in cognitive function at 3 years of age (Wilson, McCreary, Kean, & Baxter, 1979), lower verbal ability, reading and math skills (Ornoy, Segal, Bar-Hamburger, & Greenbaum, 2001) and delayed acquisition of motor milestones (Hans, 1989). Monnelly et al. (2018) report that prenatal exposure to heroin is associated with altered microstructure in major white matter tracts of the newborn brain. Studies have revealed an improvement in developmental scores for these children with the advancement of age (Chasnoff, 1988), but others did not (Herjanic, Barredo, Herjanic, & Formelleri, 1979; Wilson, 1992). In addition, a large proportion of children contain behavioral difficulties such as inattention, hyperactivity, aggressiveness, and lack of social inhibition (Olofsson, Buckley, Andersen, & Friis-Hansen, 1983; Ornoy, Michailevskaya, Lukashov, Bar-Hamburger, & Harel, 1996). Attention-deficit-hyperactivity disorder (ADHD) has also been reported as a common association between substance abuse during pregnancy (Ornoy et al., 2001).

It is well documented that maternal heroin use is heavily associated with lower birthweight (Creanga et al., 2012; Mactier, Shipton, Dryden, & Tappin, 2014). It has been found that low birthweight is a predictor of later cognitive abilities (Leitner et al., 2000), socio-emotional functioning (Hediger, Overpeck, Ruan, & Troendle, 2002), executive functioning, academic achievement (Aarnoudse-Moens, Weisglas-Kuperus, van Goudoever, & Oosterlaan, 2009) and neuroanatomical characteristics (Walhovd et al., 2012). It is evident that research has found preliminary evidence that suggests an association between maternal heroin use and

learning development, but research must begin to look elsewhere in order to fully understand the phenomenon.

**Animal Studies**

Researchers often conduct heroin testing on animals due to the closely related genetic, biological and behavioral characteristics. Studies on rodents reveal significant impairments on learning due to exposure to heroin (Steingart et al., 2000). Prenatal opioid exposure within studies on animals have shown alterations within the myelin sheath in the developing brain (Sanchez, Bigbee, Fobbs, Robinson, & Sato-Bigbee, 2008). Neuronal migration and/or cell survival can potentially be disrupted due to these alterations (Harlan & Song, 1994) and affect genetically programmed cell death in the hippocampus by influencing specific proteins in the apoptotic signal-transduction pathways (Wang & Han, 2009). Furthermore, prenatal opioid exposure within animal studies have shown decreases in dendrite length and branch numbers in pyramidal neurons in the somatosensory cortex (Lu, Liu, Long, & Ma, 2012) and several important neurotransmitter systems are disrupted (Konijnenberg & Melinder, 2011). It is therefore highly likely that maternal opioid use has a negative neurological effect on human fetuses. This is why it has recently become a concern as both maternal heroin use and neonatal abstinence syndrome have increased heavily (Manchikanti, Fellows, Ailinani, & Pampati, 2010; Patrick et al., 2012).

**Long Term Outcomes**

Although much of existing research suggests a negative effect on long term developmental outcomes, there is research that suggests that prenatal drug exposure has subtle and measurable consequences on children's behavior and development through adolescence (Lester & Lagasse, 2010; Buckingham-Howes, Berger, Scaletti, & Black, 2013). But, there is

evidently a lack of literature on long-term learning outcomes for children exposed to heroin in utero. Nygaard et al. (2015) claim that there is almost no knowledge of how these children fare as they get older. This is very problematic as prenatal and early childhood adversities are not solely confined to early development. Furthermore, this is concerning because the few existing studies suggest that drug-exposed children do not catch up with children comparable to their age (Nygaard et al., 2015). The minimal studies of older children and youths indicate worse cognitive scores and increased attentional problems for these youths than for comparable control groups (Davis & Templer, 1988; Ornoy et al., 2010). It is possible that children's earlier vulnerability within these fields becomes more serious along the developmental path as their environment places increasing demands on these complex executive functions. This may be especially true at the age when young adults normally move away from their parents and other support systems that have followed them throughout their upbringing. Thus, it is troubling that virtually no studies document the development of children into young adulthood who were exposed prenatally to opioids and multiple drugs (Nygaard et al., 2015). An individual's functioning throughout their lifespan may be affected through early life factors. This is concerning as it appears children of drug-exposed mothers do not catch up to comparable children as they age (Crea, Barth, Guo, & Brooks, 2008). Studies on older children and youth do indicate lower cognitive scores and more attentional problems in contrast to comparable control groups (Davis & Templer, 1988; Ornoy et al., 2010) but do not control for extraneous factors. Self-regulation and concentration for these children may become more serious as they become adults (Nygaard et al., 2015). Nevertheless, available reports suggest significant evidence that prenatal heroin use is associated with increased risk for learning impairment over time, if not properly supported.

It is important to recognize that the relationship between maternal heroin use and subsequent child development is complicated. In a recent extensive review, the American Academy of Pediatrics concluded that there is no agreement on the effects of prenatal opiate exposure on cognitive abilities (Behnke & Smith, 2013). Although there is considerable evidence on the effect of maternal heroin use on learning for children, Ornoy et al. (2001)'s study suggests that if children are not born with significant neurological damage, normal intellectual potential remains, even with being exposed to heroin during pregnancy. According to this study, a child exposed to heroin during pregnancy will likely demonstrate average thinking and reasoning skills if raised in a supportive environment, uninfluenced by factors such as neglect and low socio-economic status. The reports also revealed that the cognitive development for children of drug-dependent mothers were mainly influenced by the environment. Children in their study revealed normal scores on the verbal WISC–R and on the Bender (Ornoy et al., 2001). Home environment becomes significantly important to catch children up in their cognitive delay (Weisglas-Kuperus, Baerts, Smrkovsky, & Suer, 1993). Postnatal development is heavily influenced by the environment in which children are raised and can ultimately have a positive effect on the long-term outcomes (Ornoy et al., 2001).

On the other hand, it has been hypothesized that optimization of the postnatal environment may counteract the biological vulnerabilities of exposed children (Mayes, 1999; van Baar & de Graaff, 1994). In a study conducted on children born with fetal alcohol syndrome, a stable and nurturing home was found to be the most important protective factor to avoid future difficulties (Streissguth et al., 2004). Thus, children with early placement in good foster or adoptive homes may experience positive development over time (Julian, 2013). The environments in which children are raised seems to be one of the most important factors that

determine their developmental outcome. In children born small for gestational age (SGA) the parental socioeconomic status (SES) influences development, especially during the early years of life (Orney et al., 2001). “Family factors” actually have the ability to overshadow the relative impact of the clinical and biological factors in exposed children (Escalon 1982, Teberg et al. 1988). A similar claim was repeatedly described in very-low-birthweight infants, where the major factors affecting cognitive development were the home environment and the neurological score (Ella et al. 1992, Weisglas-Kuperus et al. 1993). Moreover, a close relation between parental SES and academic performance was found in a recent study on the developmental outcome of children born to mothers with diabetes; the higher the SES, the more improved function of the children (Ornoy et al. 1998). Given this information, it is safe to claim that given the proper “family factors” in an early-enough stage of life, children exposed to maternal heroin use may have a more probable chance at a typical developmental trajectory. It is suggested that proper support, love and respect can revise existing long-term predictions dictated in literature.

**Adoption**

Exploring adoption is an important element to the current research project. As described in the previous section, the developmental outcomes of prenatal exposure to heroin can be complicated. One of the complicating factors can be whether the child exposed to heroin was fostered to another family, coupled with the time at which any adoption took place. This is particularly relevant to the current study, as Benjamin (the current case study) was adopted by Michelle at 5 weeks of age. This fact adds to the complex and multi-faceted framework of the current study. There has been a large concern throughout research on whether or not adoption leads to a greater risk of psychological, educational and behavioral problems. It has been documented that adopted children have been more susceptible to learning difficulties, ADHD,

school-related behavior problems, lower academic achievement and lower social competence (Taichert & Harvin, 1975; Deutsch et al., 1982; Brodzinsky, Schechter, Braff, & Singer, 1984; Stein & Hoopes, 1985). An at-risk perspective is also present throughout the limited literature on adoptive parents (Wegar, 1995). Some research suggests that adoptive parents may struggle with confidence, constant comparison to biological parents and difficulties with bonding (Borders, Black, & Pasley, 1998). Furthermore,, multiple studies have indicated that a change of caregiver may be associated with a wide range of secondary effects, such as behaviour and mental health problems, in addition to prenatal drug exposure on cognitive and fine motor functions (Streissguth, Barr, Kogan, & Bookstein, 1996; Streissguth et al., 2004). Ornoy et al. (2010) also suggests that more noticeable, manifested symptoms emerge throughout infancy, early childhood and adolescence.

In contrast, children exposed to maternal opioid use, who retrieve early placement in strong foster or adoptive homes, may have positive development over time (Julian, 2013). Unfortunately, there is a limited amount of research on the long-term aid of adopted children exposed to opioids prenatally. Existing longitudinal studies suggest that these children can catch up but continue to have problems throughout their life (Crea et al., 2008; Moe & Slinning, 2001). Nygaard et al. (2015) found that an earlier, rather than later, caregiver change indicated a positive effect on cognitive outcomes. There are transactional processes between nature and nurture features over time that facilitate how children develop (Sameroff, 2010). For example, heritable factors (Rimol et al., 2010) and environmental factors both before (Dörrie et al., 2014) and after (Zatorre, Fields, & Johansen-Berg, 2012) birth influence a child's brain. Children are both influenced by, and have an influence on, their caretaking environment due to their constant interaction with their environment (Nygaard et al., 2015). Earlier adoption allows for these

positive interactions and influences to occur earlier, preventing difficulties to emerge and prolong. A child who is exposed to a change in caregiver before one year of age is a very significant milestone of development (Bowlby, 1982), and will combat against biological vulnerabilities more smoothly than a later caregiver change.

**The Reading Process**

Benjamin was first introduced to me through his involvement with the Spring Reading Program at Brock University (described in Methods section). One of the primary concerns of Benjamin's mother Michelle was his difficulties with Reading. Benjamin was assessed as being two to three years behind in his reading level. As such, a primary focus of this thesis was Benjamin's reading. Following this, it became important to describe and understand the reading process more generally. The reading process is complex and multi-dimensional, containing a variety of components including Attitude/Motivation, Reading Fluency, Comprehension, Vocabulary and Phonological Awareness/Phonics (Professional Development Service for Teachers, 2019). These ideas are explored here.

*Attitude/Motivation:* Motivation refers to a child's eagerness and willingness to read. Positive attitude and motivation are vital for progression in literacy and numeracy. A safe, supportive classroom environment is required for motivated readers in which both the physical and cultural aspects create opportunities to use and combine a variety of texts. An environment which allows students to feel confident in taking risks, share texts, respond openly and work collaboratively is very beneficial (Literacy and Numeracy for Learning and Life, 2011). Furthermore, research has found a correlation between levels of motivation and engagement with academic achievement (Baker & Wigfield, 1999). Motivation and engagement act as critical predictors towards ensuring children develop both the skill and the will to engage in literacy

activities. Beers (2003) adds that social and emotional confidence almost always improves as cognitive competence improves.

*Reading Fluency:* Reading fluency refers to the process of reading aloud with intention to demonstrate an understanding of the passage (Department of Education and Training in Western Australia, 2004). McKenna and Stahl (2009) suggest that the three components of reading fluency are accurate word recognition, automaticity and appropriate rhythm and intonation of speech. Accurate word recognition involves the ability to read at the appropriate instructional reading level with 90%-95% accuracy in order for reading to be fluent. Automaticity involves the ability to read words without conscious decoding, which allows fluent reading, so concentration is spent comprehending the text. Mental energy is required for decoding meaning into comprehension, which makes it difficult if a significant amount of time is spent decoding words. Rhythm and intonation of speech involves the ability to understand the parts of speech contained in a sentence, which is also seen as a primary function of comprehension. Unfortunately, Beers (2003) suggests that improving a student's reading rate does not guarantee improvements in attitude or overall comprehension.

*Comprehension:* Reading comprehension, or reconstruction of meaning, is typically referred to as the ultimate objective of reading. Not only does comprehension occur throughout an initial reading, it often begins before reading and continues after reading is complete. This may involve pre-reading strategies such as previewing the text as well as post-reading strategies like summarizing, in addition to the strategies that are used throughout the "reading" itself. Pardo (2004) explains that by dividing comprehension into pre-reading, reading and post-reading, teachers can design a variety of strategies at each stage to ultimately strengthen comprehension. Strategies have to be introduced and mastered individually at the earliest levels of elementary

school across a variety types of genres and modalities. Such comprehension strategies include predicting, comprehending, inferring, comparing, summarizing and re-reading. Children require opportunities to practice and consolidate these strategies across a wide variety of texts.

*Vocabulary:* Vocabulary development refers to the enrichment and extension of an individual's word knowledge and understanding. Vocabulary consists of receptive vocabulary, words that are heard and read, and expressive vocabulary, words that are spoken or written. Vocabulary is built through hearing and reading words, especially through direct instruction from teachers and professionals. Learning, as a language-based activity, relies heavily on vocabulary knowledge – knowledge of words and word meanings (Mehigan, 2009). There are four types of vocabulary that are mentioned by researchers: Listening Vocabulary (words required to know in order to understand what is heard), Speaking Vocabulary (words used when speaking), Reading Vocabulary (words required to know in order to understand what is read) and Writing Vocabulary (words used when writing) (Mehigan, 2009). Studies have shown a strong correlation between vocabulary and reading comprehension. Children who enter pre-school with a strong vocabulary tend to have a better understanding of texts and as comprehension increases, their vocabulary knowledge expands. On the other hand, children who struggle with reading comprehension are at risk for limited vocabulary advancement. Jalongo and Sobolak (2010) suggest that even in the early years of education, vocabulary instruction can influence a child's reading ability across subjects and throughout their future schooling.

*Phonological Awareness/Phonics:* Phonological awareness refers to the ability to recognize, combine and manipulate the different sound units of spoken words (Department of Education and Training in Western Australia, 2004). This skill is both aural and oral, entirely unrelated to intelligence, differentiating Phonological Awareness and Phonics. This involves the

sounds that are heard in words as opposed to letters on a page. Phonological awareness is a significant part of learning to read (Adams, 1990; Goswami, 1986; National Institute of Child Health and Human Development (NICHHD), 2000). Although phonological awareness is different than phonics, it is an important forerunner to learning phonics effectively. Phonological awareness can also be broken down into three levels: Syllabic Awareness, Onset and Rime, and Phonemic Awareness. Syllabic awareness involves syllable blending, segmentation and isolation. Onset and Rime involves breaking syllables down into different sections. Phonemic Awareness involves the knowledge phonemes (a single unit of sound) being manipulated to produce spoken language. Phonics, on the other hand, involves a correspondence between graphemes (letters) in written language and phonemes (sounds) in spoken language and how to combine these to read and spell (Professional Development Service for Teachers, 2019).

**Case Study Research**

The current study adopts an illustrative case study design. This approach was adopted in response to how this thesis research opportunity was presented, described in detail in the following Methods chapter. Case study research is a useful tool for studying a phenomenon in its natural context (Stake, 1995; Yin, 2003). They are known for their multiple sources of data collection, as well as providing a more convincing and accurate case (Yin, 1994; Casey & Houghton, 2010). Lincoln and Guba (1985) propose four approaches to rigour within case studies; credibility, dependability, confirmability and transferability.

*Credibility:* This refers to the value and believability of the findings (Lincoln & Guba, 1985; Leininger, 1994; Polit & Tatano Beck, 2006) and involves two processes: conducting the research in a believable manner, and being able to demonstrate credibility. Having the opportunity to spend a significant amount of time in a natural setting through engagement and

observation improves the credibility of research. This allows for researchers to gain a full, comprehensive understanding of the phenomenon being studied (Altheide & Johnson, 1994). Triangulation, which uses a variety of methods to study a single facet, enhances credibility as well (Polit et al., 2001; Holloway & Wheeler, 2002; Burns & Grove, 2005). Triangulation aims to "confirm" data and ensure the data is "complete" (Begley, 1996; Shih, 1998; Casey & Murphy, 2009). Confirmation is the process of comparing data from multiple sources in order to verify the results (Casey & Murphy, 2009). If data gathered through multiple methods align in consistency, credibility of the findings improves (Knafl & Breitmayer, 1991). Completion of the data ensures a holistic approach is taken in order to fully understand and represent a single phenomenon (Shih, 1998; Casey & Murphy, 2009). The ability to use multiple sources and methods within a study results in a stronger case.

*Dependability and Confirmability:* Much like reliability in quantitative research, dependability focuses on the stability of the research (Graneheim & Lundman, 2004; Tobin & Begley, 2004; Shah & Corley, 2006; Rolfe, 2006). On the other hand, confirmability refers to the accuracy of the data, strongly associated with dependability (Tobin & Begley, 2004). It is important for researchers to be transparent in their decision making and report their methodological and interpretive judgements (Houghton, Casey, Shaw, & Murphy, 2013). It is necessary in case study research to identify how the end product has been achieved through faithful descriptions that are recognizable and clear for all readers (Rubin & Rubin, 1995; Horsburgh, 2003). Reflexivity is another vital aspect within dependability and confirmability. The researcher is often considered part of the research instrument (Rodgers & Cowles, 1993), which is why decisions that are made and self-awareness of the researcher effect the credibility of a study (Stoecker, 1991; Rodgers & Cowles, 1993; Mantzoukas, 2005). A reflexive diary is a

very important expression of reflexivity (Rodgers & Cowles, 1993). Understanding a researcher's history and personal interests ultimately allows for clear interpretation on how theoretical perspectives influence data collection and research (Van Maanen, 1991; Toffoli & Rudge, 2006).

*Transferability:* Similar to generalizability, transferability focuses on whether or not observed findings can be transferred to another comparable context or situation, while maintaining the meanings and inferences from the finished study (Leininger, 1994). Extensive and detailed descriptions about the context and nature of the research are essential to allow for proper judgements and informed decisions on the transferability of the findings (Koch, 1994; Lincoln & Guba, 1985). For this particular study, a case study approach is absolutely necessary to gain insight into the apparent effects of maternal heroin use.

**My Position Within the Research**

Bentz and Shapiro (1998) claimed that, "most research textbooks and courses do not bring the living reality of you" (p. 4). Additional literature suggests that the location and monitoring of self in the research process is mandatory (Coffey, 1999; Denzin, 1997; Fine, 1994; Richardson, 1997). Many authors perceive the situation of self very differently and theoretically. Bentz and Shapiro (1998) situate the person at the centre of the process of inquiry and draw on the concept of a *lifeworld*; you as researcher are also an individual with a lived experience. Since our lifeworld is part of who we are, Bentz and Shapiro (1998) suggest we should view the research process as a journey between ourselves and the text, that is, something to be interpreted and reinterpreted in the social process of research (p. 42). Clandinin and Connelly (1994) describe the research process as the non-separation of a person's lifeworld and work world. Furthermore, Coffey (1999) describes it as not separating our fieldwork selves from our daily life

selves. She also noted that, “it is naïve and epistemologically wrong to deny the situatedness of the self as part of the cultural setting” (p. 22), further noting that, “the fieldwork self is always, to some extent, shaped by the cultural context and social relations of the field” (p. 30). These authors make valuable and convincing arguments as to why it is important to study ourselves as researchers within a study. While the main focus of this study is Benjamin, I play a crucial role in this case and it is therefore important for me to also study myself as the researcher. This case study is determined by my own interpretation of the situation through an analysis of interviews and data. I will be interviewing, interacting with and analyzing every piece of data and my values, education and biases are inevitably present within this process. Depending on the way I interpret the data given my own background, is the way that the Results section will be perceived.

**Working with Vulnerable Readers**

Complications can arise at any given stage within the reading process as a result of various causes such as a learning disability, learning barriers due to maternal heroin use, and so on, which may lead to vulnerability in reading. It is often difficult to distinguish between students who are struggling with early foundational reading skills as a result of a biologically based reading disability revealed through early reading behaviors or students who are struggling with reading due to poor instruction or additional extraneous factors (Solari, Denton, & Haring, 2017). Research has provided teachers with many strategies in supporting vulnerable readers with difficulties in early foundational skills such as alphabet knowledge, print concepts, phonological awareness, phonics, decoding, and text-reading fluency (Solari et al., 2017). Additional research suggests that attention should also be given to instruction in learning comprehension, even before students learn to read (Denton, Solari, Ciancio, Hecht, & Swank,

2010) as well as comprehension skills being taught alongside foundational skills (Denton et al., 2010). This research has emerged due to converging evidence that suggests a relationship between early listening comprehension and later reading comprehension (Nation & Snowling, 2004), suggesting that children are able to learn comprehension through oral skills before they are fluent readers. Foundational skills in early grades should be taught together with comprehension instead of viewing them as a prerequisite to more complex reading skills (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Both foundational skills and skills related to early comprehension are necessary for successful reading development (Gough & Tunmer, 1986; Hoover & Gough, 1990). Unfortunately, many common intervention practices for vulnerable readers focus on foundational skills or word-level instruction, with minimal time spent on comprehension, vocabulary or writing. Early vulnerable readers often have difficulties in comprehension and word-reading development, making these interventions problematic. Teachers often struggle with balancing these intervention practices in an effective and efficient manner (Solari et al., 2017). Reading difficulties persist over time if they are not adequately addressed in the early grades (Torgesen & Burgess, 1998). If the gap between vulnerable readers and average readers is addressed at an early age, this could lead to decreased, or at least severely reduced, effects of later-developed reading problems or reading disabilities (Denton & Mathes, 2003; Vellutino, Scanlon, & Lyon, 2000).

There are many early interventions that have produced positive benefits, with most of these interventions occurring outside of the classroom with specialized professionals (Vernon-Feagans et al., 2012). These programs often include explicit word identification instruction, intervention in early elementary school and small-group or one-on-one instruction (Elbaum,

Vaughn, Hughes, & Moody, 2000; Foorman & Torgesen, 2001; Schwartz, 2005). It has been revealed over the years that teachers' instruction to assist struggling readers have not been nearly as successful as using specialized teachers to deliver specific intervention (Al Otaiba & Fuchs, 2006). General education teachers and special education teachers must find ways to collaborate within the general education classroom in order to assist vulnerable readers early on. But, there is not always clear guidance on how to support vulnerable readers within a classroom as there are many competing views on how students learn to read (Solari et al., 2017).

Many vulnerable readers often experience a lack of motivation. How a child views themselves in comparison to others is often a crucial determiner of motivation (Wood, 1998). It is important to foster an enjoyment in reading, which can be achieved in a variety of ways and using a number of techniques, such as, (1) Providing a wide range of reading material aligned with the child's development and interests (Lipson, Mosenthal, Mekkelson, & Russ, 2004), (2) Providing the child with choice and control over the reading material (Professional Development Service for Teachers, 2019), (3) Encouraging challenge with the intention to move beyond the child's zone of proximal development (Vygotsky, 1978), and (4) Providing the child with opportunities for collaboration and social interaction (Guthrie, et al., 2007). There are also many ways to support vulnerable readers in general, including; creating a warm and supportive interpersonal relationship with the child, showing a personal interest in the child, manipulating the environment to foster success, and providing opportunities to take risks (Professional Development Service for Teachers, 2019).

Parental support during homework assignments for vulnerable readers is deemed significantly beneficial (Orkin, May, & Wolf, 2017) and parents of vulnerable readers are often more likely to employ controlling practices such as intrusive monitoring and helping (Silinskas,

Niemi, Lerkkanen, & Nurmi, 2013). There is a significant amount of evidence that suggests that a child's level of achievement is influenced by the quality, not quantity, of parental involvement (Hoover-Dempsey et al., 2001; Moroni, Dumont, Trautwein, Niggli, & Baeriswyl, 2015; Pomerantz, Moorman, & Litwack, 2007). Over controlling and emotionally rigid parental support can cause deleterious effects on children's motivation to learn (Baker, Mackler, Sonnenschein, & Serpell, 2001). Invasive monitoring and obtrusive forms of assistance emerge with highly controlling parents (Grolnick & Pomerantz, 2009), which tend to inhibit children's performance at school (Cooper, Lindsay, & Nye, 2000). On the other hand, parental support that fulfils a child's desire for autonomy within the learning process can increase motivation and satisfaction, eventually leading to enhanced academic performance (Cooper et al., 2000). Parents of vulnerable readers often believe their intrusion leads to positive results in their child's ability (Hoover-Dempsey et al., 2001). However, longitudinal studies have revealed that an increased quantity of parental support does not benefit a child's academic performance development (Levin et al., 1997; Silinskas et al., 2013). Instead, among vulnerable readers, including children with learning disabilities, amplified parental involvement with homework has caused children to perceive themselves as less academically efficient (Gonida & Cortina, 2014) and has also created increased tension between the parent and child (Levin et al., 1997). Therefore, it is critical that parents are given the proper tools to work with their children in a way that promotes a strong learning experience for both parents and children, without fostering helplessness in their children (Orkin et al., 2017).

**Present Study**

The present study explored the effect of maternal heroin use on long-term neonatal learning outcomes. Benjamin, a nine-year-old boy, will be the sole focus of the study. Through

interviews and a data analysis of years-worth of medical records and academic report cards, a claim into the association of maternal heroin use and learning outcomes will be made.

## The Current Study

### Research Questions

*Based on previous literature, what are the apparent effects of Benjamin's (pseudonym) prenatal exposure to heroin?*

Based on the literature, it was hypothesized that there would be a correlation between Benjamin's prenatal heroin exposure and several areas of development, most significantly, a delayed academic response, specifically in the areas of reading and writing. Preliminary research provides a wide range of evidence that suggests strong associations between the effect of drug metabolites entering the fetal bloodstream impacting multiple areas surrounding cognitive development over time. This research provides a strong basis for the probable outcome of Benjamin's long-term learning development based on previous literature.

*What are the lived experiences of Benjamin's adoptive mother (Michelle) regarding Benjamin's development?*

Based on the literature, it was hypothesized that, due to Benjamin's strong and supportive home environment, the anticipated negative long-term effects of prenatal exposure to heroin would be moderated. Although a significant amount of research predicts the detrimental effects of maternal heroin use, it is important to address Benjamin's home environment as a supportive and very influential protective factor moderating these apparent outcomes. Adoption research has mentioned that if a child is adopted earlier rather than later, a positive effect on cognitive outcomes is possible. Benjamin's adoption at five weeks old may have set the foundation for a

strong and supportive network of individuals around him that could have potentially combatted against the neonatal effects of maternal heroin use.

# CHAPTER 3

# METHODS

## Benjamin's Background

Benjamin was born in a small town in Southern Ontario on August 19th, 2010, making him nine years old at the time of the current study. He was a small child, weighing around 49 pounds at the time we met. He was very kind, happy and motivated. His willingness to learn and persevere was extremely evident. He was in Grade Four, with two Individualized Education Plans (IEPs) specific to the areas of reading and mathematics. He was reading at a 10th Percentile Grade Two level, recognizing Grade 2 sight words and struggling with Consonant Blends within Phonics, as mentioned within Brock University's Spring Reading Program Report. His challenges in mathematics were not as evident as his reading difficulties, although due to his struggles with reading, solving mathematics word problems became difficult. Questions that involved reading comprehension was his biggest challenge. He had participated in multiple tutoring initiatives over the past few years and continued to receive additional support outside of the classroom.

During Benjamin's biological mother's pregnancy, both her and Benjamin's biological father were regularly inducing heroin. This resulted in Benjamin being born addicted to heroin and experiencing withdrawal symptoms immediately after birth. He was also born with a right sided tibial torsion and 5 degrees femoral anteversion (an inward twisting of the shinbones and thighs causing a child's feet to turn inwards) (Sass & Hassan, 2003). His biological mother was 47 years of age when she was pregnant with him and refused to visit a doctor for medical attention during her entire pregnancy. Even throughout her pregnancy at the hospital, she would leave the hospital bed to induce heroin outside. Medical staff had to escort her back to her room

multiple times. Benjamin's biological father was in and out of jail on accounts of violence and has since passed away. She solely used heroin, and did not consume alcohol or other drugs throughout the pregnancy. Benjamin was the youngest of six siblings, whom custody was also sought but these attempts failed. His siblings have not made any contact or communication with Benjamin since. Throughout his biological mother's pregnancy, Benjamin did not move in the womb, causing him to be born with "frog legs", formally known as "bow legs" and "genu varum", due to his permanent and un-attended leg positioning in the womb. Bow legs is when legs curve outward while the feet and ankles touch (Sass & Hassan, 2003). This also affected his back, as it became longer than his legs. This resulted in him spending a significant amount of time in the local hospital. He was also taking Fenobarb (seizure medication) and Morphine immediately after birth. Benjamin spent most of his first month of life in the hospital for neonatal abstinence syndrome. At 7 months of age, his bloodwork tested positive for Hepatitis C. Due to these medical complications, he remained in the hospital and progressed to a registered nurses house two weeks after birth and into the care of Michelle, his current adoptive mother, two weeks after that. Benjamin spent most of his first month of life in the hospital for neonatal abstinence syndrome. At five weeks old, he was discharged to the care of Michelle on September 14th, 2010. A doctor agreed to take on Benjamin as a patient while in his foster home and Benjamin was seen within 7 days of his placement into his foster home on September 21st, 2010.

## Initial Recruitment

Benjamin was initially enrolled in the Spring Reading Program in 2019 at Brock University, operated and designed by my supervisor Dr. John McNamara. The Spring Reading Program was a 5-week tutoring program held at Brock University every spring, designed to support and assist children aged 5 to 12 that were encountering reading difficulties. Each Brock

University student was paired with a child and worked on the areas of phonemic awareness, phonics, sight words, reading fluency and reading comprehension. Informal, needs-based reading assessments were initially administered to all of the children in order to determine each child's personal reading strengths and needs. Then, individual needs-based programs were designed for each child and direct instruction of core reading skills, complemented with fun hands-on activities and games, take place. Benjamin's adoptive mother, Michelle, approached Dr. McNamara after a tutoring session informing him of Benjamin's unique medical history and background. She was concerned with the long-term learning developmental outcomes for her son, and asked if Dr. McNamara could provide her with the correlation between maternal heroin use and neonatal learning outcomes. This is when my supervisor had reached out to me and we had discussed looking into this specific case to try and provide her with the answers to her questions.

## Research Design

The current study adopted a naturalistic case study research design. As described above, this approach was deemed an effective way to describe and interpret Benjamin's and Michelle's experience. This four-month long illustrative case study included a variety of qualitative methods including interviews and analyzing previous academic and medical records. Interviews with Benjamin and his adoptive mother, Michelle, were administered. These interviews allowed me to assess the apparent effects of prenatal exposure to heroin, the home environment and Benjamin's response to additional academic support. Interviews were conducted during the winter semester in my laboratory located in the Plaza building at Brock University. Interviews took approximately 30 minutes each and an audio recording and written notes were taken throughout the interview. When the interviews were analyzed, no names were used and qualitative data from

the interviews were used anonymously. The interview with Benjamin allowed him to have a voice regarding the way he perceives himself as a student and a learner. With respect to child rights, I thought it was absolutely necessary that Benjamin was included in the study. Children's participation in research has been limited over the years due to their rights being overlooked (Bell, 2008). It is important to treat children as moral agents of their own rights and have them speak to things that affect their everyday life. The interview with Benjamin's adoptive mother, Michelle, contained specific questions directed towards the home environment, early childhood experiences, his responses to developmental milestones, his experiences with formal schooling and her understanding of the effects of maternal heroin use.

In addition to the interviews, I conducted an extensive review of Benjamin's medical records throughout the early years of his life and reviewed his previous report cards from Kindergarten to Grade 4. This process included a review of significant documents that were vital to understanding Benjamin's development in relation to current literature around prenatal heroin use. For the purpose of this study, I had access to over twenty documents beginning from Benjamin's birth to five years of age. These documents included medical overviews from Family and Child Services (FACS) on identity, health, education, self-care, family and social development and emotional and behavioral development mandated from a variety of doctors. I was also provided reports from Infants and Child Services, and assessments including Speech and Language Assessments, Occupational Therapy Assessments and GAIT Analysis Assessments. All of the medical documents I received provided past and present information on Benjamin, as well as short term and long term plans derived from a team of doctors and supported by his mother, Michelle. In addition, I had access to three report cards from Kindergarten to Grade Four, including an Elementary Progress Report Card in November,

Elementary Provincial Report Card in February and an Elementary Provincial Report Card in June, each school year beginning in 2015. These documents provided me with significant information on a variety of Benjamin's learning skills and work habits such as Responsibility, Independent Work, Initiative, Organization, Collaboration and Self-Regulation as well as information on Benjamin's progress in subject areas including Language, French, Mathematics, Science and Technology, Social Studies, Health and Physical Education and The Arts. Once again, these documents contained information on past and present capabilities as well as future goals and plans created by the teacher. I also had access to Brock University's Spring Reading Program Report, that provided me with Benjamin's current reading ability through extensive analysis and assessments conducted by his tutor. This was extremely beneficial in further understanding Benjamin's academic abilities.

In general, the data from interviews with Michelle and Benjamin, alongside the history of Benjamin's medical and school reports, enabled me to explore Benjamin's development through multiple lenses. This data allowed me to uncover the apparent effects of maternal heroin use on Benjamin's learning, and when these learning deficits arose. After data collection was completed, I compared the interview data and the data analysis of the academic and medical records to current research to attempt to gain insight into the potential effects of maternal heroin use on neonatal learning development.

# CHAPTER 4

# RESULTS

After analyzing several years of medical documents and report cards and reviewing the interview transcripts, the findings of this study provided insight into my research questions. While the hypotheses I proposed were generally supported, the data also pointed to several contradicting ideas. Through the data analysis of medical and academic records, and the interviews with Michelle and Benjamin, it was evident that home environment, enrollment in tutoring and additional educational support had produced significant improvement and combated the presumed effects of maternal heroin use. There were interesting and unexpected results that arose from Michelle's interview as well as the data analysis. Three significant domains were revealed within the analysis and interview process including: physical development, cognitive development, and social development. For the purpose of clarity, I am organizing this chapter into three developmental life periods which address these significant domains and answer both research questions pertaining to this study.

## Early Years *(0-2 years)*

### *Physical Development*

It was apparent after analyzing a multitude of medical documents and reviewing the interview transcripts that Benjamin was impacted physically as a result of his exposure to maternal heroin use. However, there were also findings that were unexpected given the literature in this domain. The first apparent effect of maternal heroin use discussed is birth weight. Benjamin was born at seven pounds, five ounces and was nine pounds by the time he was in Michelle's care, which is typical for these developmental milestones. This contradicts the idea of low birth weight being a common result of maternal heroin use (Creanga et al., 2012; Mactier et

al., 2014). Low birthweight has been found as a predictor of later cognitive abilities (Leitner et al., 2000) which, based on previous literature, I hypothesized that it would have been a contributing factor to Benjamin's delayed academic performance. Michelle even claimed,

> "They were actually very, very shocked at what he'd went through, that he was actually at a pretty normal birth weight. It should have been like, you know, four, or three, all she (biological mother) did was drugs, she didn't even eat. She didn't even know she was pregnant until she was like 6 months".

Benjamin's average birthweight could have been a mere result of coincidence and genetic susceptibility. Research suggests that low birthweight is typically a result of factors including women of advanced maternal age (Roth, Hendrickson, Schilling, & Stowell, 1998), birth parity (Yang, Greenland, & Flanders, 2006), and pregnancy intention (Orr, Miller, James & Babones, 2000). Furthermore, birthweight is also related to genetically determined body size, and additional environmental variations such as maternal stress (Monk, Spicer, & Champagne, 2012), maternal food intake (Stein, Saenger, Susser, & Marolla, 1972) and maternal substance abuse (England et al., 2001) and alcohol use (Dörrie et al., 2014). The biological plausibility of Benjamin being born with low birthweight was extremely high. His biological mother was 47 years of age, it was her sixth child and she did not monitor her pregnancy. I truly believe it was a coincidence that he was born with an average birthweight. A lower birthweight may have been a significant predictor of later cognitive abilities, and this could have been investigated further. However, with Benjamin's average birth weight, it was believed by Michelle and Benjamin's

physician that his birthweight was not a significant factor which contributed to his learning difficulties.

Another apparent effect experienced by children born to maternal heroin use is withdrawal symptoms. Patrick et al. (2012) and Kocherlakota (2014) both deem this effect highly probable. Benjamin, in fact, experienced withdrawal symptoms immediately after birth, which developed into neonatal abstinence symptom. It is evident that, because of this, Benjamin faced a multitude of health and developmental difficulties immediately after birth (Minns et al., 2011). Many authors noted this risk of altered neurological and cognitive development due to the release of chemical products (Lupien, McEwen, Gunnar, & Heim, 2009; Davis & Sandman, 2006), which may have contributed to Benjamin's lower achievement levels in reading and mathematics later on in his life. Michelle had noted that he was also regularly being prescribed Fenobarb to combat against potential seizures and Morphine to reduce the withdrawal effects of heroin. Due to these medications, he remained in the hospital for two weeks after which he progressed to a registered nurses' house for two weeks before being released into Michelle's care two weeks after that. She explained,

> "When he was born, they had him on Fenobarb for seizures and Morphine to wean him off of the heroin. So, he stayed in the hospital for two weeks then went to an RN's (registered nurse's) house for two weeks afterwards and then he came into my care a week later".

Michelle noted that, by the time she had received Benjamin in her care, there were no medications to be given and no seizures occurred. The only medical visits at this time were for

Benjamin's hips because they were bowed, *"frog legs",* but they corrected themselves over time. She explained,

> "There were no seizures, thank God. Um, by the time he got to me, there were no medications to be given. They were all given at the RN's house to wean him off. But he was always a pretty good baby. And I had him at the doctor's too for the hips. Cuz I guess when he was growing inside the womb, his hips, uh, he didn't move. So, his hips were a bit bowed in. I guess his, uh, his legs were bowed. And that corrected itself over the years".

Overall, the medications that Benjamin was given could have in fact altered his neurological and cognitive development, and potentially impacting his processing rates in the future. This may have eventually led to a delay in brain functioning, which evolved and became more apparent as he grew older and entered school. It is extremely difficult to pinpoint the exact causation of his cognitive difficulties due to withdrawal symptoms, but there may have been an apparent negative effect due to these experiences that withheld Benjamin's future cognitive abilities.

Testing positive for Hepatitis C is another apparent result of maternal heroin use suggested in the literature (NIDA, 2019). Medical records show that Benjamin did test positive for Hepatitis C at seven months old, but it was washed out of his system and is now gone; several follow up tests revealed negative results years later. The doctors did not raise any concerns, as they noted it was simply the drug antibodies from his biological mother and, subsequently, there were no problems at birth. Michelle added,

> "When he was born, he went through all that, and then when he was 2, I couldn't put him into day care. And then he got three negatives. And after that, that's when they usually say they're done. He got his Hepatitis B shot. Usually they give that in high school, but they gave it to him early. So that's all, he's had no problems. The doctors seem to think it's okay, it was just the antibodies from her still inside him. Thank God. The medical aspect of it wouldn't be very good".

Medical documents stated that Michelle ensured that health professionals stopped by periodically to check up on him as well. Family and Children Services (FACS) reports containing information on Benjamin's Education, Family and Social Relationships, Health, Identity, Emotional and Behavioral Development and more, all indicated that Benjamin achieved typical development for Benjamin at two months, four months, six months and one year of age. The follow up appointments, procedures and plans were met quickly and significantly due to Michelle's commitment to her son's health and future, as several clinicians had indicated in their comments. Most of the Plan of Care meetings involved many individuals including therapists, doctors, adoption workers, Michelle and her mother. It was apparent within the medical documents that this was truly a team effort when Benjamin was younger and still remains as such. Infant and Child Development Services did not indicate any concerns at the one-year check-up. The only minor indication, as noticed by a physiotherapist from a local children's centre, was Benjamin containing a slight "C" curve to both of his feet and very mild genu valgum (knock knees) in his legs; a lower extremity abnormality when the knees are touching while the ankles remain apart (Sass & Hassan, 2003). These could have been a result of being

born with bow legs, but Michelle indicated that this had corrected itself over time. There is little to no existing literature on maternal heroin use causing a curve to feet or frog legs. This effect could have simply been due to the lack of "responsibility" of the biological mother during her pregnancy, which resulted in little to no medical attention to the fetus. It could be hypothesized that, if Benjamin's biological mother attended regular medical-visits and proper scans were administered, doctors would have found the fetus in a position where he was not moving his legs around the womb, ultimately preventing frog legs to occur. Other than that, all other facets of Benjamin's health seemed regulated. Michelle mentioned,

> "His walking is okay, his breathing is okay, his heart is okay. I had him checked out, because one time at school he went completely pale and I took him to get an ECG done and everything's perfect. Everything's good".

From the tone and sense of certainty in Michelle's voice, Benjamin appeared to develop appropriately, despite several medical occurrences at birth. It almost appeared as if Michelle expected the outcomes to be more severe than what they were, as she explained that his physical development was relatively normal. Again, while it is difficult to explain why that was the case for Benjamin, there is reason to suggest this outcome was a result of Michelle's support.

*Cognitive Development*

Another apparent cognitive effect of maternal heroin use in relation to Benjamin's development is the delayed acquisition of motor milestones for exposed children (Hans, 1989), for which Benjamin did not display any signs of. Early Infant and Child Development Services (ICDS) reports, and Nippissing Screening assessments both noted that Benjamin developed age

appropriately, indicating that his motor, social, cognition, language and speech skills were meeting most of the developmental milestones appropriate for his age. Benjamin essentially developed age appropriately until two years of age, with no significant warning signs predicted by literature. His comprehension of language, speech sound production skills and emergent literacy skills up until this point did not reveal any concern. An interesting aspect that I found in his Speech and Language Initial Assessment Report at two years of age, was the initial concern of delayed academic performance. His expressive language was below the 200+ word expressive vocabulary with combination of two-three words into sentences considered typical for a child of his age. He completed items on the Rossetti Infant-Toddler Language Scale at the 15-18 month range, as well as items at the 18-21 month age range, but only 2 of 8 items at his age range of 21-24 months. This is where moderate delays in development appeared and the monitoring began. Recommendations and follow ups were set in place and a one-year follow up report indicated some growth, after which time no concerns arose after this and his gross motor skills remained at age-level functioning. Once again, Benjamin contradicted the apparent effects suggested by Hans (1989), but it is difficult to explain the reasoning behind it. The delay in his expressive language may not even be a predictor or connection to his current learning difficulties, and could have simply been average child-like variance. Michelle's support and resources seem to be the underlying reason for his positive trajectory. Benjamin may have also been too young to display any significant cognitive difficulties within some of these tests, and it was not until later when schooling made them more noticeable. Benjamin's average acquisition of developmental milestones and evidence of reading enjoyment contradicts all of the research listed above. I can confidently claim that Michelle's overcompensation and constant overarching support for her son was a significant combatant against the presumed effects dictated in the literature. Had

Benjamin not received the tremendous support from Michelle, perhaps he would reveal the apparent effects that the authors noted above but, given his support systems, he revealed rather stable development during this time.

*Social Development*

Benjamin's social development was not as recognizable and evident in this developmental time period in comparison to the physical and cognitive domains. Throughout the interviews and data analysis, there was a lack of information during this time period on Benjamin's social development, although Michelle did note that, given his medical history, he was a quiet baby and did not display any noticeable symptoms of maternal heroin use. Given the early developmental period, social tendencies may have not been as evident as they were when he grew older, which is common for children. Given this information, no specific and accurate claims about his social development could be made within this developmental period.

**Childhood (3-6 Years)**

*Physical Development*

The majority of Benjamin's physical development was a primary focus in the early years of his life. After these years, he appeared to develop accordingly in comparison to average developmental milestones. A physiotherapy screen at a local Children's Centre report at three years old did not indicate any new concerns to his development. Additionally, an Occupational Therapy Assessment at four years of age indicated no concerns as well. As Benjamin grew older, the emphasis seemed to shift from physical development to cognitive development. After his early years, I was provided with little to no more information on his physical development, which directed my attention to an abundance of documents related to his cognitive development.

*Cognitive Development*

Benjamin's Junior Kindergarten and Senior Kindergarten report cards did not provide letter grades, and the comments were extremely subjective. Instead, the report cards contained a few sentences on Personal and Social Development, Language, Mathematics, Science and Technology, Health and Physical Education and The Arts. Most of the comments indicated positive reinforcement and tips to improve in subject areas, without any significant concern, averages or objective class or student comparisons. As Benjamin transitioned into Grade One, Michelle noticed his reading and writing difficulties emerge. She explained,

> "In Junior and Senior Kindergarten, you're told to sit on a carpet, in a circle, in your own spots, that's your spot, that's my spot, they play. And then in Grade One, now you sit at a table and a desk. So, it kind of throws all these kids that are in Kindergarten behind. So, I didn't find out about reading and writing until about Grade One, Grade Two. And everything was done on tablets too. They don't even make you hold a pen anymore or pencil. It's insane. So that kind of confused him a lot too. Cuz I'd come home and be like here's a pen or pencil, this is how you hold it and then at school on a tablet he's doing this and that kinda put him behind even more. We worked on it a lot."

She expressed how the transition from Kindergarten to Grade One was problematic, as it was a significant difference in regard to learning and it can cause learning gaps between students. This may have been a result of Benjamin's learning difficulties which would not be discovered until later grades. In Grade Three, Benjamin was placed on an Individualized Education Plan (IEP). After the IEP was developed and put in place, Michelle began seeking additional support and tutoring for Benjamin immediately. The transition between Kindergarten and Grade One

may have even been a significant risk factor for Benjamin's development as Michelle suggested. This challenging transition may have delayed Benjamin's cognitive growth, already placing him at a disadvantage as he entered Grade One. Interestingly enough, current literature suggests that children who are exposed to maternal heroin use reveal a delay in cognitive function at 3 years of age (Wilson, McCreary, Kean, & Baxter, 1979), lower verbal ability, reading and math skills (Ornoy, Segal, Bar-Hamburger, & Greenbaum, 2001) and delayed acquisition of motor milestones (Hans, 1989). In Grade One, Benjamin was receiving approximately a C average in Language and Mathematics, and about a B average in everything else, with little to no improvement term to term, identical to his Grade Two report cards. Benjamin's learning difficulties could have emerged due to a variety of different factors. As Michelle mentioned, the transition from Kindergarten to Grade One could have been extremely problematic. At the same time, early testing may have not recognized any cognitive delays due to his young age. Even further, the effects of the maternal heroin use may have not even appeared until three years of age as Wilson, McCreary, Kean, and Baxter (1979) had mentioned. There are so many factors that could have introduced Benjamin's learning challenges which makes it difficult to arrive at a single claim during this time period. Regardless, I do feel that these authors make a claim that aligns with Benjamin's situation.

*Social Development*

Another apparent effect within a social essence that has been noted suggests that children exposed to maternal opioid use reveal increased aggression and depression, and struggle with peer and adult relationships (Baar, Soepatmi, Gunning, & Akkerhuis, 1994; Salo et al., 2009). In addition, the literature suggests a large proportion of children contain behavioral difficulties such as inattention, hyperactivity, aggressiveness, and lack of social inhibition (Olofsson, Buckley,

Anderson, & Friis-Hansen, 1983; Ornoy, Michailevskaya, Lukashov, Bar-Hamburger, & Harel, 1996). What appeared to be interesting to me was that Benjamin did not display any of these characteristics mentioned above. Early report cards state that Benjamin was a kind, respectful, and cooperative student who was mindful of his classroom environment and made a significant effort to use his words to solve a social conflict, having no difficulty with peer relations. When asked about aggressive and violent tendencies, Michelle answered,

> "Never violence. Never. He'll get frustrated. He'll do more of one of these, (sigh impression), but not like banging or breaking things."

The Occupational Therapy Assessment at four years of age indicated that areas such as self-care, play and preschool readiness seemed to develop age appropriately. The clinician did suggest that because Benjamin did not attend daycare, he should attend free community programs with more exposure to children and structured activities. Once again, Benjamin's social development within this domain contradicts the existing literature on social development for children exposed to maternal heroin use. It is easier to conclude that Benjamin's environment heavily shaped his social development due to the efforts of Michelle. It is extremely evident that her comfort, resources and support combatted against the apparent effects suggested above and ultimately allowed for Benjamin to successfully develop both socially and emotionally.

Although this is not within the scope of the study, Michelle mentioned that Benjamin was scared of activities involving movement. She explained,

> "He's scared of rollerblading, biking, tobogganing, he hates it. I bought him the BMX bike, GT sled, whatever. Sits in my garage. Always been like that. Even a tricycle, no. Nothing to do with it. At first, I thought it was the leg strength, trying to pedal, but no, they checked him all out for that kind of thing".

Furthermore, the GAIT analysis assessment reports also indicated that his anxiousness did not correlate with the frog legs. Early Physiotherapy reports at three years of age indicated an anxiousness around toilet training as well. Michelle had also noted something interesting, stating that sometimes Benjamin will shake his hands. She explained,

> "The only thing that he does do now is he shakes, like his hands. I think it's more of a tick, because he won't do it at school, he won't do it with this person but that person. So I'm not sure if it's selective".

Unfortunately, there is a lack of research aimed at prenatal heroin use and neonatal anxiety later on in life. Both of these occurrences did not alarm me as factors resulting from his past, nor did they alarm Michelle or medical professionals. These situations could quite possibly be ordinary child-like occurrences that will likely diminish in the future.

**Present (7-9 years)**

*Physical Development*

As mentioned earlier, Benjamin's physical development did not seem as urgent as his cognitive development as he grew older, and there was a lack of information in this area. Early

FACS reports indicated typical sleeping and eating patterns for his regular check-ups. But as he grew older, Michelle noted his eating patterns shifted. She explained,

> "Uh, sleeping.. good. Eating.. It depends. Sometimes he will eat, sometimes he will not. Always. Even for his lunch, I would buy a thing of fruit roll ups, I have a big bowl on my dining room table, full, of everything you could imagine, junk food. And he will not eat it. He will bring home the same fruit roll up for a week, it's crazy, he won't eat.

When approaching medical professionals for assistance on Benjamin's eating patterns, she disagreed with their advice. She noted,

> "They just basically said to give him what he wants. But he can't live off McDonalds, because that's all he wants is McDonalds. It's like not happening. But then sometimes he'll get into a spurt where he'll eat fine. I find it's getting better now as he's getting older, but when he was a baby it was very hard".

In relation to the anxiousness around movement, I also did not find his eating patterns alarming or relevant to his medical history. I found that there is a lack of literature on maternal heroin use and neonatal eating disorders, which may indicate that his eating is not problematic or a result of his medical history as medical professionals also indicated. This, as well as his anxiousness, may both be ordinary child development until otherwise noted.

*Cognitive Development*

Much of the data acquired and analyzed is present within this domain and time period. Benjamin's Grade Three report cards were the most interesting, which indicated his lowest marks in Mathematics (D+ average) and Language (C- average). When asked about the time Benjamin was placed on his IEP, Michelle answered,

> "I think it was Grade 3 they put him on it. She was an awesome teacher. Got him into reading programs.. That's when this all started".

As Michelle indicated in her interview, this was when he was placed on an IEP and his Grade Three teacher started to caution his development. As noted before, many early interventions produce positive benefits, mostly occurring outside of the classroom (Vernon-Feagans et al., 2012). His Grade Three teacher likely recognized the benefit of exterior intervention programs in comparison to typical teacher instruction, as noted previously by Al Otaiba and Fuchs (2006). His marks improved slightly by the final report card due to these cautionary measures such as tutoring and educational support programs. Currently in Grade Four and having attended multiple tutoring and additional support programs, Benjamin has been taken off his Mathematics IEP, and both his Mathematics and Language grades were gradually improving. An interesting finding to note is that Benjamin's highest grades each year were The Arts and Physical Education, which he did mention in his interview. When I asked Benjamin what his favorite subject was, he quickly answered: "Gym". It is common for students struggling with learning disabilities to excel in areas that include creative elements such as Music, Art and Dance due to right brain hemisphere overcompensation, which operates creative functioning (Abraham et al., 2012). Benjamin's overcompensation in The Arts could be used as an advantage

if teachers and support programs could cater their reading, writing and mathematics in a creative-like way.

Another apparent effect experienced by children exposed to maternal heroin use is the need for special assistance. Rosen and Johnson (1985) claim that special assistance for behavioral and academic problems are required for exposed children, which aligns with this situation. Almost all of Benjamin's teachers throughout the years suggested on their report cards that he would benefit from additional support, practice and resources to sustain his improvements, which Michelle took extremely seriously. This finding becomes difficult to diagnose though because Benjamin's first couple years of report cards did not contain letter grades, until he was in Grade One (six years old), with Language and Mathematics being his significantly lowest marks. The report cards align with the findings, but it is unclear as to where, when, how and why these subject areas were significantly lower, due to a lack of information for a few years. The last Speech and Language report I had access to that provided academic information was from when Benjamin was three years old, with no objective information until Grade One. This made it difficult to clearly define the causality between maternal heroin use and his report cards.

As noted above, current findings suggest apparent effects on several brain regions that are altered resulting in possible functional deficits in memory, learning and executive functioning (Shonkoff & Garner, 2012; Shonkoff, 2010; Lupien et al., 2009; McEwan & Gianaros, 2011) and many studies have reported executive control and attention as common functions that are effected as a result of maternal opioid use (Hans, 1996; Hickey, Suess, Newlin, Spurgeon, & Porges, 1995; Melinder, Konijnenberg, & Sarfi, 2013; Ornoy et al., 2001; Slinning, 2004; Wahlsten & Sarman, 2013) and behavior regulation (de Cubas & Field, 1993; Hans, 1996;

Sowder & Burt, 1980). Challenges such as developmental delay (Johnson et al., 1984; Chasnoff, 1988; van Baar, 1990), inattention, hyperactivity, aggressiveness, and lack of social inhibition (Olofsson, Buckley, Andersen, & Friis-Hansen, 1983; Ornoy, Michailevskaya, Lukashov, Bar-Hamburger, & Harel, 1996) and attention-deficit-hyperactivity disorder (Ornoy et al., 2001) did not appear as a result of Benjamin's prenatal heroin exposure, whatsoever within the medical records, report cards or interviews. In regard to attention and memory, Michelle noted that Benjamin's attention and memory were both pretty good. She stated,

> "Memory is pretty good from what I hear. Attention is actually pretty good. I've been complimented by teachers saying, 'he sits there and listens, he actually pays attention'. He's not the type that will drive you nuts, and you know, go off and do his own thing. He actually sits there and listens to what you have to say. Ever since he's been a baby, he's been like that. You put him in front of something and he'll just watch a whole movie, like other kids will be running around the house going crazy, he's not like that, even in my house now".

These compliments were also evident in report cards as teachers mentioned comments such as, "Benjamin followed daily routines and instructions with minimal supervision (Grade 2)", "He has an ability to remain focused during lessons and ask questions when he does not understand a task (Grade 3)" and "Benjamin never lets his attention be taken away where it was supposed to be focused (Grade 4)". She noticed that ever since he was a baby, he was always attentive, without having to teach him that. She reminisced,

> "I've only had to raise my voice maybe twice in my whole life. And once was for touching the outlet and once for going across the street. Nothing like 'oh my God sit down' or 'you're being bad you gotta listen to me'. Never".

It did not appear that Benjamin had any difficulties around attention and memory, as literature predicted was highly probable. His cooperation and listening skills seemed extremely well developed within his report card comments, medical records and even Michelle's own parental upbringing. When asked if Benjamin enjoyed tutoring and learning, Michelle explained,

> "Yea. He likes going to the programs. He likes all that kind of stuff".

Benjamin also stated that he enjoyed tutoring as well. When I asked him if he liked learning new things and being tutored, he answered,

> "Yes, I love it. I like working in programs because we have fun".

The effects of these programs must be apparent due to his strong memory sustaining the information learned and tutored. The evident effects have resulted in him being taken off of his Mathematics IEP. Once again, these findings challenge those presented in literature that suggest an association with prenatal heroin exposure and compromised memory performance and academic achievement in adolescence (Buckingham-Howes et al., 2013). This again could have been a result of Benjamin's post-natal environment. An adverse outcome could have existed given different circumstances and parental upbringing.

It is well documented that adopted children have been more susceptible to learning difficulties, ADHD, school-related behavior problems, lower academic achievement and lower social competence (Taichert & Harvin, 1975; Deutsch et al., 1982; Brodzinsky, Schechter, Braff, & Singer, 1984; Stein & Hoopes, 1985). Once again, it is difficult to say how fitting this is for the case of Benjamin, but it does not seem as severe. It is apparent that due to the very long and significant adoption process, that Michelle mitigated these potential susceptibilities due to her overcompensation and extreme ability to provide for her son. This finding is not unusual though, as it is documented that children exposed to maternal opioid use, who retrieve early placement in strong foster or adoptive homes, may have positive development over time (Julian, 2013). Furthermore, as mentioned previously, an earlier, rather than later, change in caregiver indicates a positive effect on cognitive outcomes (Nygaard et al., 2015). These findings could be contributing reasons as to why Benjamin does not display the presumed effects of maternal heroin use. If Benjamin was adopted later in life, negative effects may have been more prevalent, which ultimately could have resulted in greater tension between him and Michelle. Due to Michelle's early adoption, I strongly believe she mitigated the potential difficulties that could have emerged throughout Benjamin's development.

As mentioned earlier, many vulnerable readers often experience a lack of motivation and view themselves negatively in comparison with others (Wood, 1998). Again, this does not seem to be the case for Benjamin. He mentioned,

> "I like being at school.. Sometimes if I read, it can be like a video or a game, and it's important the games that I play, that I read".

A lot of his answers seemed very contradicting to current research. He had a very clear and positive wellbeing and did not present any negativity, self-confidence difficulties or other concerns. When I asked him how he overcomes learning challenges, he answered,

> "I just try a lot sometimes. Cuz I had a Lego thing that was hard. I got frustrated, stopped, my mom said take a break, but I didn't. I built it all.".

His willingness to learn and become a strong student was extremely significant and almost shocking given his medical history. He has now been removed from his Mathematics IEP and only requires assistance with problem solving questions because of his struggle to read and comprehend the questions. Overall, Benjamin's strong self-perception, self-efficacy and willingness to learn allow him to push himself and progress as a learner. This may be another contributing factor as to why he may not seem as behind as other exposed children. If he did display the apparent effects of lack of motivation and low self-esteem, Benjamin may have experienced more problems in the future or difficulty catching up to his peers. Luckily, he is in a position where he does possess the proper social and emotional foundations that will allow him to succeed in the future.

*Social Development*

Much of the social development domain appeared in this developmental period, as expected. As Benjamin grew older, he experienced more complications with social interactions. When discussing Benjamin's social development, Michelle noted,

> "I think he's got a conscious. Like two of his friends are fighting right now about Fortnite, but he feels bad. His one friend told him to pick and he was devastated, and actually didn't know what to do. So I think a lot of that, uh, life comes in where he has to decide like what's right and wrong. Got a very bad conscious. He'll even do something in my house and he'll be like 'I can't tell mom', then he'll be like devastated and I'll be like 'you need to tell me these things'. It's almost like he overthinks the consequences or 'oh my God mom will be mad at me'. He's got a lot of friends, but he also has a lot of issues where it's how you handle those everyday things of what's right and what's wrong. That's the kind of problem we're running into this week with his two buddies.

This situation seems like a typical child-like occurrence within ordinary development. When I asked about his behaviour in general, she said,

> "Uh, I'm pretty lucky. Pretty lucky. I have no issues with his behavior at all. Teachers, adults, babysitters, doctors, even other parents are like "oh my god like your child is so good, like how?" when their kids are running away. He's always been that quiet- I've always been complimented on how polite he is and that could be me too right, cuz I'm in nursing, I say 'please, thank you', I take care of the elderly, 'yes sir, thank you', you know.

Both Benjamin's behavior and consciousness seem ordinary and if anything, contradicting to what literature suggests. I do not see any concerns or correlations with maternal heroin use and adoption-related behavior as previously mentioned (Taichert & Harvin, 1975;

Deutsch et al., 1982; Brodzinsky, Schechter, Braff, & Singer, 1984; Stein & Hoopes, 1985). When I asked about his self-confidence and self-esteem, Michelle said,

> "Pretty good. He worries about being short. That's the only thing. Oh 'I'm that tall', that's why he hates basketball because he knows he's strong but not muscular and big. That's the only self-esteem, I think he has is his shortness. Cuz even with t shirts that he wants, they're hard to fit him, instead of like the "cool" stuff that they got from you know West 49, they don't fit him. Even the jeans.. That's the only problem we run into, especially this year as he's getting older"

Benjamin also displayed his subtle self-esteem concern when I asked him what he likes about school and he stated:

> "Um, I like gym and sometimes, I don't like gym. Like dodgeball I'm happy. Like today, I had to do basketball (sigh)".

Again, I do not think his self-confidence is a concern due to his medical history, as this will develop over time. Michelle stated that teachers over the years said he was a good kid, and they could not notice anything serious given the medical history, besides his reading and writing being delayed. Again, Benjamin's social development throughout this time period does not display any noticeable concerns or apparent effects due to maternal heroin use. Rather, Benjamin's social development evolved age appropriately and, if anything, due to Michelle's support, it grew very extensively.

**Summary**

Benjamin's current adoptive mother Michelle appeared to be significantly supportive and present in all aspects of her son's life. She spent a significant amount of time searching for answers on the long-term effects of maternal heroin use, but struggled finding clarity. She had asked several doctors, teachers and medical professionals if they were aware of the long-term effects of maternal heroin use and noted,

> "No one can tell me anything. They could say there are so many things for being addicted to alcohol, like what to expect and this or that, but no one could tell me the effects or outcome of drugs, like heroin. No one can tell me nothing".

As some studies mentioned, there is no agreement on the effects of prenatal opiate exposure on cognitive abilities. Multiple authors claim that intelligence can be "normal" if the children are raised in an environment without low socioeconomic status or neglect and cognitive development is mainly influenced by environment (Behnke & Smith, 2013; Ornoy et al., 2001), which is not always the case. Children's intelligence and cognitive development can be influenced by their environment, and a positive, supportive home and school environment is conducive to developing greater thinking and reasoning abilities. When I asked Michelle how often she spends time with Benjamin on academics, she interrupted me with,

> "All the time. I even set up outings, 'K we're going to go learn how movies are made', because he's into movies and knowing about things and want to know how things work. So it was a perfect opportunity. Any opportunity I can kinda jump at, even though I work

> full time midnights, I'm there. And if I can't be there, my mother is there-, we're very on top of teaching and learning. He doesn't even know I'm gone"

Since Benjamin was situated with Michelle, she always enrolled him in support programs and tried to provide him with ample resources as a young child, and continues to do so. She had always believed in the importance of engaging in everyday learning opportunities and activities to combat the presumed effects of the maternal heroin use and to maintain communication with individuals that could help her in the future as well. As Orkin, May and Wolf (2017) mentioned, Michelle's parental support during homework assignments for Benjamin, being a vulnerable reader, is deemed significantly beneficial.

Throughout the interview process, it was extremely evident that, because of the lack of answers, Michelle dedicated all of her efforts towards providing her son with any and all resources that medical professionals directed her towards. Michelle stated,

> "He's got everything. EVERYTHING a kid could want, I have it in the house. Like pencil crayons, I have a whole art station, I have woodworking tools outside like in the garage, like anything he wants to do, we have everything you could imagine. Always had it".

It was extremely evident through Michelle's quick answers that she was very present and resourceful throughout her son's upbringing. When I asked if the overcompensation of resources were a result of the medical history, she answered,

> "Yea, I think so. I feared when I got older, I didn't want him to come back and ask, 'why did you never help me', and that's part of the adoption to. And because I am single, I had to be the mom and the dad and kind of compensate. I do compensate a little bit. I wanted the best for him. 'Well, I gave you this, you did go here', I tried everything on the way. I just wanted to be on top of it". And my personality is like that too- very regimented".

This significant commitment is not unusual for parents of vulnerable readers (Silinskas, Niemi, Lerkkanen, & Nurmi, 2013). Michelle reinforced this strong dedication to her son by explaining how, ever since he was little, she would bring him to school, work with him on school work every day after school and at night, work full time midnights, and sometimes work additional day jobs when he was at school. She explained it as, "Benjamin not even knowing she was gone". When she was unable to take care of Benjamin, her mother did. She explained,

> "It was always family too because in the beginning, like I said, Hep C, no daycare would even consider because once you take a child in like that, you have to tell the other parents. And, they're worried about other parents pulling their children. So I always had family".

Benjamin's family was an extremely significant support system that evidently contested the presumed effects of maternal heroin use. As Weiglas-Kuperus, Baerts, Smrkovsky and Suer (1993) mentioned, home environment is extremely important for students experiencing cognitive delays to catch them up to their peers. Benjamin's family fulfilled and surpassed this finding. I thought it was extremely important to ask Michelle about the adoption process due to it being an

extraneous factor that could potentially affect Benjamin's development as well. She described it as,

> "Uh, long and stressful (laughed). I had to go back to school for fostering. I became a foster parent. So basically, from start to finish, it took me about a year. And all through that, I went to school to learn how to deal with certain things.. even they don't even know- what the outcome of drugs would be. It's always drugs and alcohol. So went through all of that and then after that, I kinda left that behind and started fresh. Because they, they wanted to stick with me, like barbecues and stuff like that but they honestly put me through a year of hell. I had five FACS (Family and Children's Services) workers, three lawyers… INSANE, for the adoption. I was the first person single-y to adopt. I'm not married, I'm single. So they've never done it before so it was only supposed to be like custody is trying this trying that and then all of a sudden I think they made a mistake and that's when I had to get all of these lawyers and all this because at this time he was only 6 months old. They dropped him off, out of a car seat, here's a baby. (laughs)… Then it took me a year to go through the certain stages. And then give her (biological mother) a chance to. Because she could have cleaned up and came back and fought me. Because they can't just do that. They can't just take a baby from someone. Which is insane that she'd be allowed. If you want to do drugs and put a child's life at risk, you shouldn't even be allowed to have that child. But she had the chance, she blew it. And that's why it kinda took me a bit. And then when I got the red seal, it was done. Took me a year, start to finish… cuz it's very hard for a husband and wife and even a husband and husband or a wife and wife- it's very hard. So for me, single-y, I was the first paper trail

of going that route with them, so it was just crazy how everything kinda worked out and how it all worked in my favor".

It became evident when asked about the adoption process that Michelle is an extremely hard working and caring mother and was frustrated with larger political systems not covered in the scope of this study. As a result of Michelle's frustration and work ethic, the reasoning behind Benjamin's upbringing became clear. Michelle never returned to any of the individuals from the early years of this journey for guidance due to the stressful connotation. She found her own friends, resources, doctors and programs. I think the complications surrounding Benjamin's medical past, as well as the negative experience Michelle encountered throughout the adoption process influenced Michelle's absolute determination to ensure Benjamin received all the support and resources he could to direct him on a positive trajectory. In addition, although Michelle did not agree with Benjamin's biological mother's drug use and parenting behaviors, this is not always the case. It can also be difficult to place blame on a drug user and determining what "good" or "bad" parenting is, depending on the situation.

Although existing literature on the effect of maternal heroin use often suggests a negative connotation towards developmental outcomes, there is an optimistic side that needs to be addressed. This case study could have unfolded much differently given alternative genetic susceptibility and biological difficulties. According to existing research, Benjamin should have displayed a significant negative developmental outcomes but, due to his post-natal environment, the apparent effects were severely mitigated. Studies have revealed an improvement in developmental scores for exposed children with the advancement of age (Chasnoff, 1988). As Ornoy et al. (2001) suggested, if children are not born with significant neurological damage,

normal intellectual potential remains, even with being exposed to heroin during pregnancy. Benjamin responded extremely well to his additional supports and tutoring over the years, and his mathematics IEP was removed during this research study. Teachers indicated this on his report cards as well claiming, “He loved his reading program at Brock University and was applying everything that he had learned. He was also motivated to go on RAZ kids daily as he entered the class, sometimes completing four lessons a day. The dedication would allow Benjamin to grow as a learner so much”. Longitudinal studies suggest that children catch up but continue to have problems throughout their life (Crea et al., 2008; Moe & Slinning, 2001). Although a clear pinpoint claim cannot be made about Benjamin’s future cognitive ability, I strongly believe that if he continues to enroll in additional supports and Michelle continues to provide the same quality and quantity of support and resources, he will eventually catch up to grade-level cognitive abilities. This will take constant monitoring and effort, but I do believe Benjamin has been born into a very strong and unique environment that fought heavily against the apparent effects of maternal heroin use, providing him with optimism for future positive learning development.

# CHAPTER 5

# CONCLUSION

The purpose of this thesis was to examine the relationship of maternal heroin use on neonatal development from the perspective of Michelle, Benjamin's adoptive mother, in relation to Benjamin's medical records and comparing these to the existing research around prenatal heroin use. Two research questions asked about the effects of Benjamin's prenatal exposure to heroin according to existing literature and also about the lived experiences of Benjamin's adoptive mother regarding Benjamin's development. The hypotheses I posed related to the first question predicted that Benjamin would be prone to several negative developmental outcomes. However, the data from this study contradicted much of the research on maternal heroin use. There was one important consistency between research and Benjamin's reality. It was hypothesized that there would be a significant association between Benjamin's prenatal heroin exposure and a delayed academic response, specifically in the areas of reading and writing, as suggested by the literature (Minnes et al., 2011; Wilson, McCreary, Kean, & Baxter, 1979; Ornoy, Segal, Bar-Hamburger, & Greenbaum, 2001; Hans, 1989). Benjamin's report cards and medical records, as well as Michelle's interview confirmed this hypothesis. It was evident that Benjamin's biological mother's maternal heroin use caused a wide range of difficulties immediately at birth that led to further complications as he grew older. Although it was unclear during his first few years of life, the difficulties became more apparent as he entered higher grade levels. For instance, his cognitive development seemed to develop age appropriately when he was younger. But, his Grade Three report cards indicated a D+ average in Mathematics and a C- average in Language. His Grade Three teacher identified his difficulties and recommended additional support. It was evident through the administration of an Individualized Education Plan

and his elementary teacher's report card comments that his reading, writing and mathematics abilities were delayed in comparison to average student outcomes.

Although no causal data was collected, the anecdotal evidence received aligns with the predicted academic outcomes based on existing literature on prenatal heroin use and academic development. Current literature suggests many difficulties for Benjamin's verbal ability, reading and math skills (Ornoy, Segal, Bar-Hamburger, & Greenbaum, 2001). Benjamin was assessed as being two to three years behind in his reading level which aligns to existing research. His reading fluency and comprehension are ultimately at risk, as he is having difficulties constructing the meaning of passages and reading efficiently. This is because his phonological awareness and vocabulary are lacking. These areas are the foundations of reading, and when struggling with them, reading comprehension and fluency are merely impossible. This is why he also struggles with understanding mathematical problems as he has difficulty recognizing and manipulating sounds and words, which means he is not fully understanding the questions. Interestingly enough, Benjamin contains the motivation and attitude that is vital for progression in literacy and numeracy (Literacy and Numeracy for Learning and Life, 2011), which can be used to mitigate future difficulties. Although Benjamin's reading is compromised, with continued support, it is expected that he will maintain his reading achievement gains and continue his development towards grade level learning. This would, in essence, begin to reverse what was deemed "the Matthew effect" in learning and development.

When exploring Benjamin's physical outcomes, there were no significantly concerning factors that Benjamin displayed. In fact, his physical development rather contradicts the first hypothesis stating that Benjamin would develop negatively as suggested by a wide range of literature (Creanga et al., 2012; Mactier et al., 2014; NIDA, 2019). His birthweight, gross and

motor milestones, sleeping, eating, walking, heart and overall physical growth seemed to develop quite normally. Although Benjamin experienced some early difficulties including withdrawal symptoms, testing positive for Hepatitis C, being born with frog legs and being rather tiny in physique, they have all either diminished with time or have not raised any concern to medical professionals. There were no signs of physical deficiencies or direct relations to the heroin use within the medical records and Michelle's interview transcripts. The emphasis of Benjamin's development was severely placed on his cognitive ability.

Benjamin's social outcomes seemed to contradict this hypothesis as well. Current literature suggests many difficulties for children exposed to maternal heroin use, including difficulties with socio-emotional functioning, executive functioning, aggression, depression and relationships (Hediger, Overpeck, Ruan, & Troendle, 2002; Baar, Soepatmi, Gunning, & Akkerhuis, 1994; Salo et al., 2009). Medical professionals, teachers and Benjamin's adoptive mother, Michelle, indicated that Benjamin did not display any difficulties in these areas since birth. In addition, this is also atypical social development for adopted children, which typically exhibit lower social competence (Taichert & Harvin, 1975; Deutsch et al., 1982; Brodzinsky, Schechter, Braff, & Singer, 1984; Stein & Hoopes, 1985). Being exposed to maternal heroin use, and being adopted, Benjamin contradicted what social development should occur as dictated by literature. The data portrayed him as a conscience, respectful, caring and motivated young boy, who wanted to learn and enjoyed receiving additional support. Although there seemed to be minor self-esteem and self-confidence remarks within the interviews, they seemed like ordinary child-like emotions. It was evident that Benjamin's physical and social developmental outcomes were inconsistent with existing research on maternal heroin use.

At the time of this study, Benjamin was developing well in advance of what might be predicted by research in this area. Benjamin's physical and social development were very much intact. Although Benjamin experienced some early physical symptoms of prenatal heroin exposure, his physical and health-related development has been typical. Michelle notes that, besides his shorter-than-average stature, Benjamin's physical well-being has been unaffected. This is true also with his social development. In speaking with Michelle and Benjamin himself, his social development is well within typically expected norms for a 9-year old boy. Benjamin's academic development, however, appears to have been significantly affected by his prenatal exposure to heroin. Michelle's anecdotal accounts, along with Benjamin's academic report cards, indicate that he is significantly behind in grade level in most areas of learning. This aligns with expectations posited by research in this area.

My second research question was related to Michelle's lived experience supporting Benjamin. It was hypothesized that due to Benjamin's strong and supportive home environment, the anticipated negative long-term effects of prenatal exposure to heroin would be moderated. Through interviewing Michelle and hearing her story of raising Benjamin, I found the level of support that Michelle provided Benjamin throughout his life played an important factor in Benjamin's overall development. The existing research on child adoption outlines the importance of early protective environments. Through exploring Michelle's experience with Benjamin, her support should be considered an important moderating factor in Benjamin's development. Overall, I draw the conclusion in this study that the environment that Michelle provided for Benjamin is compensating for the potential effects of prenatal heroin use as predicted by research in this area. When discussing the concept of "family factors" as described by Escalon (1982) and Teberg et al. (1988), it could be hypothesized that Michelle mitigated Benjamin's biological

vulnerabilities. This idea fits with several thoughts within the literature on the effects of environment on early development, particular during critical periods. Although beyond the scope of the current study, it is important to recognize the biological responses to adverse and favourable environmental conditions in early child development. Researchers have long recognized the importance of effective early environments in buffering against biological stressors. Specifically, neural plasticity is the potential for the nervous system to change in response to stimuli from internal and external environments. Evidence indicates that brain structures, even those that may be compromised, grow and mature in effective ways when children are experiencing and learning (Strominger, Demarest & Laemle, 2012). The impacts of early effective environments can improve brain functioning at a level that have long-lasting positive effects and as such is crucial during early child development (Huttenlocher, 2009). For a complete review of this research see McEwen, Eiland, Hunter, and Miller (2012).

In the case of Benjamin, although it may be difficult to predict any long-term academic or social outcomes, it is reasonable to conclude that Michelle's continued support and resources will at least moderate the effects of his biological mother's prenatal heroin use. As evidenced by his medical history, Benjamin had considerable biological complications that placed him at a significantly high risk for less than optimal developmental outcomes. Specifically, Benjamin had several risk factors that placed him at a higher risk for poor development, including developing prenatally exposed to heroin, being diagnosed with Hepatitis C, given a significant amount of Fenobarb and Morphine during a detrimental developmental period, and not attending daycare. However, the support provided by Michelle produced developmental outcomes for Benjamin that did not align with what research predicted for Benjamin. Michelle's environmental support is an

example of how early effective environments can have positive and long-lasting effects on development.

The above results hold a number of significant implications. The first implication is around Benjamin himself as a future learner. After conducting this research, Benjamin has a high chance of a positive learning outcome in the future if his environment continues to be as nurturing as Michelle's environment has been over the past ten years. It is inevitable that Benjamin will experience more difficult learning challenges and educational transitions as he grows older without Michelle's presence. This is when support in any form becomes extremely necessary. It is important that Benjamin receives continued support as he grows older and progresses through different life stages. If Benjamin continues to attend after-school tutoring programs, educational summer school programs and continues to work hard at home, it is highly likely that his reading, writing and mathematical abilities will strengthen and eventually catch up to students of his age. Additional support throughout high school and even at the post-secondary level is available and would be extremely beneficial for Benjamin. There is limited, if any research on this transition period for exposed children. Furthermore, it is difficult to predict whether or not new medical or academic deficiencies will emerge later on in his life as there are no available longitudinal studies that have monitored a child exposed to maternal heroin use. As mentioned above, this is what complicates the first hypothesis, as it is difficult to make a single claim on the trajectory of Benjamin's exposure and his learning outcomes in ten, twenty or even thirty years. But, provided with an extensive amount of resources and educational support, a child such as Benjamin, has a high chance of mitigating his biological vulnerabilities, allowing his reading, writing and mathematics to eventually develop age appropriately.

The second implication is around environment more broadly. This case study has extremely significant and interesting findings that directly apply to larger societal domains including foster care, parental support, policy in schools and health in general. Foster parents who may experience unique cases such as Michelle's, should be heavily informed and educated on these findings. They should be made aware that they are in a position where they have an extreme impact on an adopted child's life and previous experiences, an area that literature claims they do not fully understand (Lanigan & Burleson, 2017). Research suggests that foster parent experience is a key protective factor that contributes to positive child outcomes (Rock et al. 2015). This current study offers both foster parents and children a sense of reassurance that the child is not defined by their background and successful development and upbringing can and will occur. In regard to parental support, knowing that an adoptive parent like Michelle has a significant impact, more government support and resources should be allocated towards early childhood parenting. Not only does being informed and educated on these findings apply to foster parents and homes, but to parents in general. Caregivers should be informed of the power of the environment they create for their child and that it can indirectly control and influence their child's development. This may result in a need for even more financial support for parents and caregivers or support programs that offer educational resources and tutoring in a cost-effective manner. Not all children are granted with the opportunities that Michelle had provided for Benjamin, so maybe government financial aid needs to be redirected towards situations like this. Since opioid use is a widespread issue and now a crisis across the world, further research should be conducted to constantly update and educate caregivers. In regard to policy in schools, what is the most alarming is that Benjamin's learning difficulties and his Individualized Education Plan were not recognized until Grade Three. At that point, it may have been too late or at least more

difficult to catch him up to other students and provincial standards. Although it is beyond the scope of this research to make claims on educational provincial testing and diagnoses, it is absolutely necessary for such difficulties to be assessed and identified at an earlier age to avoid achievement gaps from growing to the point where it becomes difficult to catch students up. In the case of Benjamin, the late assessment and identification of his learning needs may have played a significant role in his lag in academic achievement related to his grade level. If Benjamin was recognized at an earlier age, support would have started even earlier, and maybe the gap between him and other students would be even smaller by now. In regard to health in general, this case is an extreme example of how the environment interplays very closely with the human body. It is very interesting that a few individuals in a child's life can mold and combat years of medical deficiencies. It just shows how powerful the environment truly is and how children are not solely defined by their genetic makeup.

**Limitations**

The present study has many interesting findings that will contribute to existing literature on maternal heroin use, but also has many limitations that could have skewed some of the data. It is necessary to address the many factors that could have impacted Benjamin's development including additional substance use, adoption and age. It is difficult to solely control for the effects of maternal heroin use, especially when other substances were most likely being used by his biological mother. It is also difficult to make claims when I did not have any contact with the biological mother and only had access to secondary data that I was given. It is also difficult to control for the effects of the adoption in general. It was extremely early at five weeks old, but this could definitely be a factor effecting Benjamin's development. Furthermore, I obtained Benjamin as a participant at nine years old. At this point, Benjamin already had learning

challenges and was functioning at multiple grade levels behind the provincial standard for his age. This made it difficult for me to truly determine whether Benjamin developed in a specific way due to the effects of heroin or any other extraneous factors in his lifetime.

It is also important to note that the transition from Kindergarten to Grade One, or even from home to formal schooling could have had a detrimental effect on its own and, as a result, impeded Benjamin's leaning, due to a potential lack of structure. Although Michelle spent a significant amount of time and resources on her son, it could have been a drastic change for Benjamin internally to attend a new institution around others and listening to direction with no prelude such as daycare. As mentioned previously, if vulnerable readers were addressed at an early age, this could severely reduce effects later-developed (Denton & Mathes, 2003; Vellutino, Scanlon, & Lyon, 2000). This situation could merely be a result of noticing the learning difficulties later than recommended.

Although this study was conducted with the intention to be an illustrative case study, acquiring as much detail as possible about one participant, there could have been value in using a larger sample. This could have been beneficial in a multitude of ways, including controls and comparing similarities and differences across a wide range of developmental backgrounds, upbringing, socioeconomic statuses and potentially gender. There could have been additional value of interviewing his teachers and tutors as well to gain some personal insight on Benjamin's learning in the classroom.

**Future Research**

There seems to be a lack of long-term research studies in this field of research, which seems very concerning. The developmental outcome of children exposed to maternal heroin use is a difficult path to generalize and make claims upon. Future research should use larger sample

sizes of children derived from a variety of backgrounds as early as possible. Following children at the earliest age for a variety of years would be extremely useful in this field. It is also important for future research to try controlling for heroin use as the sole substance being abused.

It would be beneficial to conduct longitudinal studies that follow children through a variety of developmental ages and milestones. It would be interesting to view the results after significant life changes and transitions in an exposed child's life. Transitions from daycare to Kindergarten, Grade Eight to Secondary School, Secondary School to Post Secondary School and into a potential career. Furthermore, future research should use multiple groups of children and control groups to attempt to control for sole effects of heroin in comparison to typical development. I had no other children to compare Benjamin's life trajectory with, which makes it a bit more difficult to make accurate claims.

Overall, there may always be a minor delay in academic functioning for Benjamin or a child exposed to maternal heroin use, but the severity of that effect could very well be relieved given the proper environment, as demonstrated by Michelle. An environment that provides an abundance of resources as well as spends a significant amount of time dedicated towards learning is absolutely necessary for children exposed to maternal heroin use. This study ultimately presents a very significant and unique finding that places an emphasis on the true power of environment. Although these findings cannot be generalized to every child, the theory of external factors and environmental influences could potentially be areas that should be discussed and applied to future cases.

As the sole researcher of this case study, it is extremely important to acknowledge my presence within the way I interpreted and transcribed the data. When looking at this case, as someone who specializes in learning development and learning disabilities, I align with a more

critical and optimistic interpretation of this data set. My educational background and experiences ultimately persuade the way I believe the data to be accurate. In this case, it was beneficial that I had access to many medical professionals' and teacher's comments that provided me with another voice different than my own to confirm or contradict my thought processes. I am a strong supporter of the concept of neural plasticity mentioned above and believe that Benjamin, and any child, can be continued to be shaped by their environment, and this is heavily embedded within my analysis. It has been proven that children with learning difficulties, who constantly practice and work at their difficulties, will show significant results. This is something that I have believed in and applied to my work over the years and is definitely evident throughout this paper. Overall, many of the medical professionals, teachers, tutors and even Michelle had also aligned with my philosophy as well, creating a very optimistic academic trajectory for Benjamin in the future.

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# Appendix

Brock University
Office of Research Ethics
Tel: 905-688-5550 ext. 3035
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Social Science Research Ethics Board

## Certificate of Ethics Clearance for Human Participant Research

DATE: 2/11/2020

PRINCIPAL INVESTIGATOR: MCNAMARA, John - Child and Youth Studies

FILE: 19-167 - MCNAMARA

TYPE: Masters Thesis/Project STUDENT: Jake Maiuri
SUPERVISOR: John McNamara

TITLE: Exploring The Effect of Maternal Heroin Use: A Single-Case Study On Long Term Learning Outcomes

**ETHICS CLEARANCE GRANTED**

Type of Clearance: NEW Expiry Date: 2/1/2021

The Brock University Social Science Research Ethics Board has reviewed the above named research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement. Clearance granted from 2/11/2020 to 2/1/2021.

The Tri-Council Policy Statement requires that ongoing research be monitored by, at a minimum, an annual report. Should your project extend beyond the expiry date, you are required to submit a Renewal form before 2/1/2021. Continued clearance is contingent on timely submission of reports.

To comply with the Tri-Council Policy Statement, you must also submit a final report upon completion of your project. All report forms can be found on the Office of Research Ethics web page at http://www.brocku.ca/research/policies-and-forms/research-forms

In addition, throughout your research, you must report promptly to the REB:

a) Changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) All adverse and/or unanticipated experiences or events that may have real or potential unfavourable implications for participants;
c) New information that may adversely affect the safety of the participants or the conduct of the study;
d) Any changes in your source of funding or new funding to a previously unfunded project.

We wish you success with your research.

Approved:

Lynn Dempsey, Chair
Social Science Research Ethics Board

Robert Steinbauer, Chair
Social Science Research Ethics Board

**Note:** Brock University is accountable for the research carried out in its own jurisdiction or under its auspices and may refuse certain research even though the REB has found it ethically acceptable.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of research at that site.