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I, David E Carter , hereby submit this original work as part of the requirements for the degree of Doctor of Philosophy in Criminal Justice.

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A Meta-Analysis of Early Life Influences on Behavior

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A Meta-Analysis of Early Life Influences on Behavior

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by

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ABSTRACT

Over the last several decades, groundbreaking advances have occurred across multiple fields of human sciences. These advances have had the largest effect in the medical field. Current understanding of human development over the life course is more comprehensive, and even more complex. These advances have also nudged the field of criminology toward a more complete model to explain individual behavior, including the influences of early life problems and their effects on behavior.

To this end, this research examines factors contributing to behavioral problems early in life, which may assist in the development of antisocial behavior. Utilizing a meta-analytic approach, a synthesis of current perceptions of inducers to antisocial behavior is analyzed. Specifically, this dissertation examines the role of prenatal effects, birth complications, and other early life trauma, onto problematic behavior and aggression. Implications for inclusion of these important times in the life course into theoretical discussion are presented.

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CHAPTER I

INTRODUCTION

Sociology has a strong tradition within criminology. In fact, many of our current criminological theories are largely based on sociological principles, like bonds to society (Hirschi, 1969), and even the influence of the environment itself (Shaw & McKay, 1942). Moreover, because of this sociological influence, many of the prominent theories in criminology limited or not allowed individual factors to play a part in our conceptions about criminal behavior. One of the reasons for not including individual (biological) influence, is because they are seen as deterministic, thus, removing the influence of any sociologically-based factors.

However, there have been advances within the discipline to incorporate more individual factors in our understanding of criminal behavior. The inclusion of biological influence has helped to create a section within the criminological discipline known as biosocial criminology. This inclusion of biological influence does not discount the influence of environmental factors. It does, however, attempt to examine the intersection of individual factors and the environment (Raine & Mednick, 1989; Walsh & Ellis, 2003). Additionally, theoretical frameworks have been introduced, using individual factors, to demonstrate the importance of a more complete understanding of human development in antisocial behaviors. For instance, Moffitt (1993) describes a potential causal path of persistent delinquent behavior may have roots in the abnormal brain development. Specifically, Moffitt states "[n]eural development may be disrupted by

maternal drug abuse, poor nutrition, or pre- or postnatal exposure to toxic agents" (p. 680). These particular problems (as described by Moffitt) are the core items of inquiry in this dissertation. That is, are individual factors such as prenatal, peri-natal, and postnatal complications affecting behavioral problems?

Statement of the Problem

There is a general assumption in the criminological discipline that people start out the same; and it is only later in life when factors begin to influence behaviors that we see problematic behaviors forming. This concept, termed *Tabula Rosa*, essentially means that people start out with a blank slate, and behaviors are then products of environmental influence. However, a large body of research, form diverse fields (including psychology and medicine) suggests that individuals may not all start out equally. In the medical field for instance, there are volumes of research to suggest that substances that a mother consumes during pregnancy may have an impact on the development of a child. Specifically, the extant literature suggests potentially deleterious effects that smoking (by pregnant mothers) has on the healthy development of a child (Slotkin, 1998; Wakschlag & Keenan, 2001). Additionally, the deleterious effects of maternal drug and alcohol use have been identified numerous times in the literature (Aronson, Kyllerman, Sabel, Sandin, & Olegård, 1985; Streissguth, Barr, Bookstein, Sampson, & Olson, 1999). There are also plenty of empirical works that support the position that in-utero effects of drug and alcohol use harm a baby (DeCubas & Field, 1993; Fishbein, 2001; Lifschitz, Wilson, Smith, & Desmond, 1982; Wilson, 1989). Moreover, these insults may create behavioral differences, to include problematic or antisocial behavior.

There are also problems that can occur at birth, which may alter the healthy development of the brain. Some of these problems include anoxia, eclampsia, and others (Boog, 2004; Hodgins, Kratzer, & McNeil, 2001; Kandel & Mednick, 1991). These problems may restrict oxygen levels in the brain, which may diminish the functioning of the brain. Finally, there are other factors that may influence a child's behavior shortly after birth. Specifically, toxins, or deficits in nutrition may have an impact on healthy development at this early stage in life. In total, these problems may affect children shortly after birth, and may have lasting behavioral consequences (Bennet & Haggard, 1999; Onalaja and Claudio, 2000; Werbach, 1992). Collectively, these insults affect what Luria (1980) describes as executive cognitive function. This is the concept Moffitt was addressing in her term of neurological development (1993, p. 680).

Thus, examining prenatal, peri-natal, and postnatal problems, and how they affect behavior, is the core concept of this dissertation. The incorporation of individual differences early in life may enrich our overall criminological perspective and provide insight to future theories. Therefore, this dissertation aims to evaluate the literature in this area, in a meta-analytic fashion. A description of how this material is presented follows.

Dissertation Plan

The major influences of early life influences on behaviors are outlined in chapter two. These influences on behavioral outcomes include prenatal, peri-natal, and postnatal complications. It begins with a discussion of the effects of prenatal influences on behavior. Specifically, while still in the womb, there are factors that can affect the healthy development of the fetus. These include ingestion of smoke, alcohol, or drugs, by

the pregnant mother. Thus, a discussion of each of these three is presented. This is followed by a discussion of some of the research on the effects of multiple or poly-substance use/abuse during pregnancy. The next section of chapter two involves a discussion of the peri-natal complications that can occur. These include problems at birth, like anoxia, eclampsia, and meconium aspiration syndrome (MAS). These problems at birth can produce long-term complications in healthy brain development. This is followed by a discussion of birth weight, and how it may affect behavior. This is due to the overall prematurity and smallness of the infant, and how that may affect the levels of oxygen that are received in the brain; thus how the brain is limited in its capacity to develop. Third, there is a discussion of events that may happen after birth that may have an effect on the physiological nature of the newborn. For instance, high levels of lead exposure may alter the development of the brain, causing malformations of executive cognitive functioning; thus reducing normal cognitive development. Chapter two concludes with a synthesis of the research. This is done by a brief overview of how the brain is compartmentalized into sections, including the frontal lobe. There is then a discussion of the importance of the frontal lobe, and how it is the primary component of an individual's personality and is responsible for behavior. The chapter then describes how behavior is a product of the brain and brain development, which is ended with the integration of the aforementioned problems, and how they are primary contributors to problematic behavior.

The third chapter, methodology, begins with an introduction to the chapter, followed by a list of the items discussed in the methods section. A brief history of meta-analysis follows the introduction, describing how meta-analytic techniques have been used with more frequency within the field of criminology and criminal justice. Next a

discussion of the potential weaknesses of meta-analysis provided, which includes publication bias and the "apples to oranges debate." It is then followed by a discussion of the strengths of meta-analysis, specifically, how a large volume of information may be assessed. Afterword, a discussion of the sample is presented, to include a discussion of the dependent variable. The dependent variable for this dissertation is outcomes on behavioral rating scales of aggression and problematic or antisocial behavior. Some of the more commonly used scales in this dissertation include the Achenbach (1966) child behavior checklist, which is one of the most often used assessment instruments for aggressive displays of behavior worldwide. Additionally, the Rutter childhood behavior scale is presented (Rutter, 1967). Other scales used as measures of the dependent variable include the Conners parent questionnaire (Goyette, Conners, & Ulrich, 1978), and the Gordon diagnostic assessment (McClure & Gordon, 1984). This is followed by a discussion of the high level of relatedness of the instruments. Finally, a discussion of the independent and moderating variables is presented. The methods chapter concludes with a discussion of the statistical analysis that will be employed in the results section. These include a discussion of the methodological quality index, a measure of effect sizes, the binomial effect size display, the fail-safe *N*, the *Q* statistic, and the I^2 statistic.

Chapter four presents the results of the meta-analysis. First, basic characteristics of the data are presented for each of the three sections (prenatal, peri-natal, and postnatal). This is followed by models of the effect sizes, both fixed-effects (with and without outliers) and random-effects models. A review of the moderator effects for the prenatal section follows this. Then, there is a review of the moderator effects for the peri-natal section. This is followed by a review of the moderator effects for the postnatal

section. After this, a combined model is introduced, with moderating effects included. A discussion of ancillary statistics follows, including a review of the fail-safe *N*, the binomial effect size display (BESD), and the I^2 statistic. Finally, a regression analysis of age on the combined model is presented.

The final chapter, conclusions, summarizes the findings of this dissertation and describes how they may fit within the larger framework of criminology and the real world. It begins with a discussion of the limitations, such as the sample size. This is followed by important strengths of the findings. Next is a discussion of some of the key findings from the research. This is followed by a discussion on the potential theoretical impact these findings may have, followed by any real world applications that may be gleaned from these findings. Second to last, there is a discussion of potential future research. Lastly, closing remarks are presented.

CHAPTER II

RELEVANT LITERATURE

Criminological research over the last three decades has consistently shown that the development of antisocial behavioral patterns is apparent in youth around the time they are approaching ten years old. Some theorists suggest slightly earlier, while others do not formulate this relationship until the teenage years. However, there is a consistent pattern of an adolescent development of behavioral problems on later life outcomes. Notably, Gottfredson and Hirschi's (1990) general theory of crime suggests that the causal mechanism of all delinquent and criminal behavior is traceable to this time period in a youth's life (around the age of 8). Additionally, Akers (1973, 1998) would argue that a key time in the life of an individual is the formative age (around 10-13), and is largely a learning process of delinquent behavior from others. Moreover, these theories promote the study of external influence on individuals, and that this influence is beyond the formative years of an individual.

Much less research, however, has been performed on biological insults, and even fewer studies performed in this area, with regard to the formative years (0 – 5 years old). At this time in life, individuals may have much more susceptibility to these influences, and thus, a greater variation in their controls or coping mechanisms to regulate their aggressive behavior than once theorized. Additionally, they have had little time to formulate peer groups (prosocial or antisocial) at such a young age, for the purposes of emulating behaviors. Therefore, the primary goal of this dissertation is to assess how

complications around the time of birth may shape behaviors at an early age. Specifically, these three areas of focus are: 1.) the prenatal stage of development, which is while the baby is still in the womb, 2.) the peri-natal or during birth stage, and 3.) shortly after birth, or the postnatal stage. Individually, these effects found in these three stages may have long-term deleterious effects, to include antisocial behavioral outcomes. This is largely due to the changes in cognitive ability of an individual because of these detriments. In turn, this promotes the potential for variability of individuals (across behaviors) at this early stage in life. There are volumes of research in multiple disciplines to suggest that individuals may not all start out equally. In the medical field for instance, there a significant amount of research to suggest early life issues may influence behavior in these three main areas of development.

Therefore, this chapter is divided along these three main stages of development, and reviews evidentiary literature for each. The prenatal stage is divided into three categories of influence, smoking, alcohol use, and drug use/abuse. Collectively, these influences would be considered biological insults that occur during the womb, and include a host of deleterious effects onto the unborn child. Additionally, a discussion of poly-substances is also included.

Next, there is a discussion on the influences of problematic birthing. Specifically, certain categories of problems within the birthing process may lead to changes in cognitive ability/structure at birth. This includes eclampsia/preeclampsia, meconium aspiration syndrome (MAS), premature birth, distressed birth, low, very low, or extremely low birth weight, anoxia/hypoxia, or fetal asphyxia.

The third section of the early life influences focuses on extreme or non-natural natal conditions that exist after the infant is born. These insults may also have strong, long-lasting negative effects on the child. This includes extreme malnutrition, and high exposure to toxins, such as lead. The nature of the stimuli or toxin alters the physical composition of the body, thus altering the development of the brain. Through the exposure-to-brain alteration process, behavioral differences occur. This is substantively different than adaptations of behavior due to inconsistent disciplining of youth, poor peer relations, or bad coping mechanisms. While they may affect behavioral outcomes, and it is argued here they do; the causal process of these interactions works through physical changes in brain composition and structure.

Finally, this chapter concludes with a synthesis of how these effects may have lasting results on problematic behavior across a child's life. Specifically, there is a discussion on the causal process of these effects on behavioral outcomes. This includes a description of how these problems change brain formation and functioning, thus, changing the adaptability and cognitive maturational process of these youth.

PRENATAL INFLUENCE

Recently, criminological researchers are beginning to study the effects of prenatal issues, and these various risk factors that can contribute to delinquent/criminal outcomes (Brennan, Grekin, & Mednick, 1999; Chasnoff et al., 1998; Sood et al., 2001). Wakschlag and Keenan (2001) reinforce this concept, providing support that maternal problematic behaviors may affect their offspring. For the purposes of this research,

prenatal influence is parceled into three areas: smoking, alcohol, and drug use/abuse. It is understood that it is the mother that is consuming one (or a combination) of these items, which is having an effect on the child's behavioral outcomes later in life. The remainder of this section discusses these three prenatal influences, and how they affect behavior.

Prenatal Smoking and Developmental Outcomes

In the prenatal stage of development, substances that a mother consumes during pregnancy may have an impact on the development of a child. The medical literature is full of suggestions about types of vitamins and minerals a mother should take to help ensure a healthy baby. Conversely, there is extensive literature on the deleterious effects of other materials or chemicals that may be ingested during pregnancy. Specifically, the extant literature strongly supports the potentially deleterious effects that smoking (by pregnant mothers) has on the healthy development of a child. Slotkin (1998, p. 933) offers some of these with an overview of the many negative effects of smoking during pregnancy, to include: an increased risk of learning disabilities, behavioral problems and attention deficit and hyperactivity disorder. Orlebeke, Knol, and Verhulst (1999, p. 15) also discuss how smoking by pregnant mothers affects their unborn child.

Essentially, increases of nicotine in the mother create a reduction of intrauterine partial pressure of oxygen, and an increase in carbon monoxide. This change in the proportions of oxygen to carbon monoxide can produce neuropsychological deficits, including reductions in the functioning of the cerebral cortex. It is at this point where cognitive setbacks manifest. Using a sample of 1,377 pairs of 2- to 3-year-old twins, Orlebeke et al. (1999) examined the behavioral outcomes of youths between smoking and

non-smoking mothers. Controlling for socioeconomic status and age of mother, they found a significantly higher amount of aggressive behavior (as measured by the Child Behavior Checklist, the CBCL) in the children of smoking mothers, versus the non-smoking mothers $t(1,235) = -2.85$, $p = <.005$ (p. 17). From their research, it does appear that smoking does have a direct effect on the behavioral outcomes of youth.

In a similar study, Maughan, Taylor, Caspi, and Moffitt (2004) also studied the relationship between maternal smoking during pregnancy and antisocial problems in youth. Also using a sample of twins (ages 5 and 7), Maughan et al. examined both the direct effect of smoking, and the contextual effects that smoking mothers may differ from non-smoking mothers. Their results were similar to Orlebeke et al.'s (1999) work, in that, they found a significant direct effect $F(3, 1030) = 13.92$, $p = <.001$ (Maughan et al., 2004, p. 839). Moreover, even when incorporating parental behaviors, maternal depression, and socioeconomic status, at age 7 there were still negative effects of smoking on behavioral outcomes for youths of heavy smokers, $b = 0.17$ [0.02, 0.32], $p = <.05$ (p. 840). Even though much of the initial effect was explained in this model, heavy smoking was still found to have the most explanatory power when predicting children's conduct problems.

Lastly, Wakschlag, Pickett, Kasza, and Loeber (2006) also examined the association of maternal smoking during pregnancy, and its relationship to conduct problems and delinquency in young children. Using a sample ($N = 448$) of youth from Pittsburgh, Wakschlag et al. found significant differences in youth behavioral outcomes in children whose mothers smoked during pregnancy, versus those that did not. The odds ratio difference of oppositional defiant disorder for the children exposed to smoking

mothers to no smoking mothers during pregnancy was *OR*(448) 2.61 [1.14, 5.97], $p = <.05$ (p. 464). This significant effect was found even controlling for race, drug use, and police contact. Moreover, the time of onset for a significant delinquent act was much earlier for the youth exposed to mothers who smoked during pregnancy. They found that the hazard ratio of these youth was *HR*(443) 1.35 [1.04, 1.76], $p = <.05$ (p. 465). This was also controlling for the contextual variables.

Collectively, there is strong support that smoking during pregnancy does damage the health and welfare of a child. Additionally, it does appear that these effects may extend beyond just health, and does include behavioral outcomes of youth. Further, as Olson (2000) and others posit, these studies add to the body of literature that suggests that problematic behaviors may formulate, at least in part, in the earliest years. Another contributor to the formulation of problematic behaviors is alcohol consumption by pregnant mothers, which is now discussed.

Prenatal Alcohol Use and Developmental Outcomes

Alcohol consumption is arguably one of the most studied phenomena in the development of youth. Further, alcohol ingestion by pregnant mothers, especially in larger quantities, has been shown in the research to have negative effects on a baby. This is a well-established deficit, and was identified in the medical field in 1973, as fetal alcohol syndrome (FAS). Numerous studies have identified the multiple deleterious effects of FAS, "which includes pre- and postnatal growth retardation, malformations and prenatal stigmatization, and developmental delay with persistent mental retardation and neuropsychiatric symptoms" (Aronson, Kyllerman, Sabel, Sandin, & Olegård, 1985, p.

27). Streissguth, Barr, Bookstein, Sampson, & Olson (1999, p. 186) describe the three key features of FAS as: "prenatal-onset growth deficiency, a characteristic pattern of dysmorphological characteristics read most explicitly in the face, and evidence of central nervous system (CNS) dysfunction." Not only does FAS show immediate effects on the newborn, these effects are typically life-long. As Streissguth et al. found, there are long lasting neurobehavioral cognitive detriments that may manifest because of persistent alcohol consumption by pregnant mothers. This includes measures of problematic and antisocial behavior.

For the purposes of this dissertation, four independent pieces of research that match the inclusion parameters were found, and are now discussed. First, Brown et al. (1991) found behavioral display problems in a sample ($N = 228$) of 7-year-old youth. Using the child behavior checklist (CBCL), Brown et al. found significant differences across the groups of youths within the sample. For instance, the children of the drinking mothers were much more likely to display destructive externalizing behavior, $F(2,60) = 4.38$, $p = .02$, and also display significantly higher levels of aggressive behavior, $F(2,60) = 6.00$, $p = .005$ (1991, p. 372).

Fried, and his colleagues (Fried, Watkinson, & Gray, 1992) found similar results in their review of ($N = 128$) youths from birth to 6 years old. Using data from the Ottawa Prenatal Prospective Cohort Study (OPPS), women were parceled into differing groups based on intake of toxins, to include alcohol. At age 6, children whose mothers drank during pregnancy (≥ 0.14 ounces per day) were significantly more likely to display impulsivity/and hyperactivity problems on the Conners' (Conners, 1989) Rating Scales, $X^2 (4,126) = 18.9$, $p = <.001$ (Fried et al., 1992, p. 306).

Clearly, there is a pattern of behavioral problems that children display when mothers consume persistent doses of alcohol during pregnancy. Sood and her colleagues (Sood et al., 2001) also researched lower levels of alcohol consumption in their work on dose response exposure and the adverse effects of alcohol. This was performed on a sample of children ($N = 501$) of children ages 6 to 7 years old. They found significant differences in the behavioral outcomes of children (assessed as aggressive behavior and delinquent behavior on the CBCL), when mothers had lower doses of alcohol, compared to mothers who had no alcohol. When comparing the three classes of mothers (*No alcohol, Low dose, and Moderate/Heavy*) on the percentage of children whose score was above the clinical range of the delinquent component of the CBCL, significant differences were found for both the low group, *OR*(501) 3.0 [1.3, 7.3], $p = <.05$, and the moderate/heavy group, *OR*(501) 3.3 [1.3, 8.7], $p = <.05$, respectively (p. 6). While this supports the former findings on heavy alcohol consumption by mothers during pregnancy, it also demonstrates even lower doses of alcohol consumption can have deleterious effects on behavioral outcomes of youth.

Lastly, in a study of binge drinking by mothers and cognitive outcomes of children at age seven, Bailey and her colleagues examined a sample ($N = 537$) of youth in East Tennessee. In their bivariate findings, being exposed to alcohol in the womb attributed to children that were 2.5 times more likely to display delinquent behavior. After controlling for confounders, such as race and socioeconomic status, the exposed children scored significantly higher on a standardized scale of delinquent behavior $t(497) = -2.70$, $p = < .01$ (Bailey et al., 2004, p. 1040). They also examined a dose response similar to Sood et al.'s (2001) research; although, this was in a binge-drinking

component. That is, Bailey and her colleagues measured the number of drinks per drinking episode, when comparing across child groups and their behaviors. When the mothers had consumed five drinks or more per session, and at least two sessions per week during pregnancy, the youths in this category displayed significantly higher levels of delinquency by age seven, $X^2 = 7.75$, $p = <.01$ (p. 1041). This also supports the notion that alcohol consumption by pregnant mothers may have negative effects on behavioral outcomes of their children.

There is an overwhelming amount of support that consumption of larger quantities of alcohol during pregnancy does have negative impacts on a child. Additionally, it does appear that these effects may extend beyond just health, and can include behavioral outcomes of youth. As Abel and Sokol (1987) relate, FAS (from maternal alcohol abuse during pregnancy) is recognized as the leading cause of mental retardation in the world. Moreover, FAS may also affect brain structure and ability, which is directly representative of cognitive ability. In turn, this is directly related to the behavioral display problems manifested and displayed in these previous studies. For a more detailed review of this process, a review of Riley and McGee (2010) is essential.

Since the early 1970s, when FAS was first identified as a medical condition affecting youths globally, many researchers have articulated the process and physical display characteristics of the syndrome. For nearly 20 years, Riley and McGee (2005) have conducted magnetic resonance imaging (MRI) and functional magnetic resonance imaging (F-MRI) on children who were exposed to alcohol in the womb. Through these brain scans, they have found some marked differences in the exposed children, versus controls. For instance, there is a reduction in the cranial vault and an overall reduction in

the brain size. Notably, they found a general 15% reduction in the size of the cerebellum in the exposed youth, versus controls. More importantly, they found a substantive difference in the Corpus Callosum, the region of the brain responsible for the transmission of millions of signals across the different components of the brain.

Riley and McGee (2005, p. 361) further describe the detrimental effects by stating: "Heavy prenatal alcohol exposure is associated with a wide range of neuropsychological deficits, including impairments in overall IQ, memory, language,… executive functioning, fine and gross motor skills, and social and adaptive functioning." They expand on the social and adaptive functioning by describing particular detriments from which these children suffer. They relate that studies have consistently shown that exposed children are much more likely to suffer from behaviors that interfere with participation in home, school, and other environments. Specifically, these children display much higher levels of aggressive, impulsive, and delinquent behaviors (p. 362).

In sum, there are similarities in the causal process of FAS and smoking by pregnant mothers. That is, changes in the brain structure and cognitive ability greatly affect the way these children interact with their world. Further, this starts at the beginning of their lives, and is long-lasting. This is also similar to the effects that are present in the children of mothers that use/abuse drugs during pregnancy, which is the next section discussed.

Prenatal Drug Use and Developmental Outcomes

The third main section of prenatal issues that may lead to biological insults in children focuses on the ingestion of drugs by the mother during pregnancy. While there is

a seemingly endless list of narcotics/illicit drugs, much of the literature on the combination of prenatal drug use and developmental outcomes of newborns focuses on three main drugs, marijuana, heroin/methadone, and cocaine. Therefore, these three drugs are now discussed.

Marijuana. Clinical studies of delta-9 tetrahydracannabinol (THC) use by pregnant mothers has shown to have deleterious effects in newborns. This includes low birthweight, congenital abnormalities, peri-natal complications, and behavioral problems (Fried, 1982; Greenland, Staisch, Brown, & Gross, 1982). Yet, other drugs that are seen as more dangerous to fetuses have filled the bulk of studies on effects on newborns by drug-dependent mothers. One study of the effects of THC ingestion during pregnancy on developmental scores was performed by Astley and Little (1990). In this research, Astley and Little examined the effects of marijuana on the motor and mental development of newborns up to one year after birth. They found that exposure to marijuana had a significant effect on the motor development of the newborns $F(2,87) = 7.3$, $p = .001$ (1991, p. 165).

When assessing behavioral outcomes directly, O'Connell and Fried (1991) did find an association with prenatal exposure to cannabis. Using the Conners Parent Questionnaire to assess conduct problems in the sample of youth ($N = 56$), O'Connell and Fried found differences in conduct problems between the sample of children whose mothers smoked marijuana during pregnancy and those children whose mothers did not (control group). They found a direct relationship $r = .26$, $F(1,52) = 7.39$, $p = .01$ (1991, p. 635) in the mothers that used cannabis during pregnancy.

As stated, fewer studies have been performed on the effects of marijuana use during pregnancy on the behavioral outcomes of the children. Even though there is evidence to support a direct effect, much of the research on drug use during pregnancy and developmental/behavioral outcomes has been performed on other drugs, such as heroin and cocaine, which are now discussed.

Heroin and Methadone. There are numerous studies that have helped to provide a general understanding of the damaging effects of heroin use during pregnancy on infants (Wilson, McCreary, Kean, & Baxter, 1979; Lifschitz, Wilson, Smith, & Desmond, 1982). Essentially, heroin use by the mother during pregnancy produces intrauterine growth retardation and neonatal abstinence syndrome (Zelson, Rubio, & Wasserman, 1971). Zelson et al. refer to this latter problem as a dysfunction of the central and autonomic nervous system. This places the fetus at a high risk of neurodevelopmental dysfunction. This was reaffirmed in Wilson et al.'s (1979) work. They found a consistent pattern of lower functioning in a heroin-exposed group of children, in regards to IQ, speech, perceptual ability, and behavioral problems. Similar to this work, Olofson, Buckley, Andersen, and Friis-Hansen (1983), found 56% of their sample ($N = 72$) displayed behavioral abnormalities (aggressiveness, hyperactivity, and a lack of social inhibition). This was over a 10 year follow-up period from birth, displaying the lasting effects of heroin-exposed children.

In another longitudinal study of the effects of heroin-exposed infants, Wilson (1989) examined the developmental and behavioral outcomes of heroin-exposed and methadone-exposed children (with a matched control group) through 5 years old. During the longitudinal study, the heroin-exposed ($n = 20$) and the methadone-exposed ($n = 12$)

children displayed substantively higher rates of behavioral problems (75% and 75% respectively), than the control group (n = 10, 48%).

DeCubas and Field (1993) also found similar findings of aggression in their study of methadone-exposed children. Using a methadone-exposed group (n = 20) and a control group (n = 20), they examined the children using the CBCL. DeCubas and Field found a significant difference in both the aggressive behavior rating and delinquent behavior scale between the two groups (the means were 56.7 for methadone group and 48.1 for the control group on aggressive behavior, $p = \leq .01$, and 63.8 to 56.4, $p = \leq .001$, respectively for delinquent behavior) (p. 272).

Across these studies on heroin and methadone-using mothers, we do see another consistent pattern forming; children of drug-dependent mothers (during pregnancy) do appear to have problems early in life. Moreover, these problems tend to persist well into the child's formative years. And while there appears to be a growing amount of research in this specific area, in terms of heroin/methadone-dependent mothers and the long-term effects on their offspring; the bulk of research on a single drug has been performed on cocaine, which is now reviewed.

Cocaine. Few would refute the damaging effects of cocaine, and the politically charged arena of its offshoot, crack cocaine. This drug (in either form) is considered one of the most "hardcore" drugs in mainstream use in the United States. Some estimates suggest that cocaine was being used regularly by upwards of 8 million people in the 1980s (Delaney-Black et al., 1998). Its popularity is largely due to the effect or high it produces, and is often noted as the "party drug" (in the powder cocaine form), and the "blue-collar drug" (in the smoke-able form of crack). Thus, it comes as no surprise that

this illicit drug is the most often studied single drug, in terms of its effects on infants by drug-dependent mothers. In addition, it is seen as one of the more damaging drugs to this defenseless group. As Snodgrass (1994) explains, fetal cocaine effects, in the form of anomalies, should be expected. It may also cause vascular deficits in the infants, intrauterine growth retardation (similar to heroin), as well as behavioral problems in infancy and beyond. This is due to the ability of cocaine to metabolize into cocaethylene, a dopamine uptake blocker.

Dopamine, a neurotransmitter, acts as a mood regulator in the brain. When this chemical is not absorbed (the uptake blocking action of the cocaethylene), it has been shown in the research to be linked with higher levels of aggression and violence (Fishbein, 2001). This is due, in part, to the higher excitability and poorer state regulation of cocaine-exposed children (Tronick, Frank, Cabral, Mirochnick, & Zuckerman, 1996). When studying a sample ($N = 251$) of mother-baby dyads using the Neonatal Behavioral Assessment Scale (NBAS), Tronick et al. found that higher doses of cocaine during pregnancy did have an effect on the behavioral outcomes of the youths. When controlling for confounders like mother's age, marital status, education, and ethnicity, there were still significant differences in infants on state regulation ($p = .02$) and excitability ($p = .007$) (1996, p. 80). In utero cocaine-exposed infants were much more fussy and irritable than controls, and these differences were measureable after three weeks. These two deficits directly affect an infant's ability to modulate arousal and stabilize behaviors, which could lead to later life behavioral dysfunction.

State regulation and excitability/emotional arousal are important components of cognitive ability, as Mayes (2006) relays. In her analysis of the effects of cocaine use by

mothers on their unborn children, she found linkages between the dopaminergic and adrenergic regulations and the neural system. Specifically, when cocaine is introduced to the fetus, it can directly affect the amygdala and hippocampus, which directly regulate behavior through the stabilizing neurotransmitter chemicals like dopamine (p. 178). When these neurotransmitters are blocked, or overproduced, there is instability in the behavioral regulation of the amygdalar system, which directly results in behavioral differences among these exposed infants.

In another study, also looking at state regulation and behavior, Delaney-Black et al. examined two groups of infants (n = 23 cocaine-exposed, and n = 29 nonexposed). They found a higher concentration of cocaine in the meconium stools, suggesting affirming that there was ingestion by the fetus of the cocaine. Delaney-Black et al. also used the Neonatal Behavioral Assessment Scale (NBAS), and there was a significant differences between these two groups on the state regulation of the infants (r = -.40, p = .029) (1998, p. 737). This study is an important improvement upon prior studies, in that, using the meconium stools, Delaney-Black and her colleagues were able to quantify the amounts of cocaine ingestion that the infants were being exposed to in utero. This dose-response effect is an important step in understanding the etiology of the effects of cocaine on infants.

In a similar dose effect study, Eyler, Behnke, Conlon, Woods, and Wobie (1998) also studied the longitudinal effects of prenatal cocaine exposure on health. Using a matched sample design (n = 154 prenatal cocaine users, and n = 154 controls), Eyler et al. found a greater risk for health issues within the infants of the prenatal cocaine users. Using the Hobel Risk Index, a summation of multiple health measures of the infants at

birth, the mean Hobel score was significantly higher for the in utero cocaine-exposed infants versus the controls (94.2,72.1 to 78.5,48.2, $p = .03$) (1998, p. 232). Additionally, this significant difference was primarily due to the higher prenatal risk score, which was due to the cocaine exposure. While not directly testing problematic behaviors, Eyler et al. did support the concept that is commonly accepted in the medical field; cocaine exposure in utero does increase the risk for health and other related problems.

Bendersky and Lewis (1998) also examined cocaine exposure in a longitudinal design. However, their focus was more on behavioral outcomes, specifically impulsivity. In a sample of infants ($n = 51$ prenatally exposed, $n = 26$ unexposed), they found significant differences in impulse control. In their controlled experiment, the cocaine-exposed children reached for their token significantly faster than the controls $F(1,70) = 7.1$, $p = .01$ (p. 366). As Bendersky and Lewis state, "the findings suggest that impulse control is a function of brain biology" suggesting that the prenatal cocaine exposure is associated with poorer impulsivity at two years old (p. 367).

Impulsivity, aggression, and delinquent behavior were the outcomes assessed in Delaney-Black et al.'s (2000) study. Also a longitudinal design, their sample was comprised of ($N = 451$) six-year-olds, some of them being born to cocaine using mothers (during pregnancy). Also using Achenbach's (1991) Child Behavior Checklist (CBCL), Delaney-Black et al. found differences in behavioral outcomes in the cocaine-exposed youths($n = 270$), versus the controls ($n = 201$). More important, when they only used the boys within the sample, the cocaine-exposed boys were significantly more likely to score in the clinical range on the aggression and delinquent behavior scales, versus the unexposed boys. (17% versus 11%, $p = <.05$). This adds to the body of longitudinal

research on the effects of cocaine-exposure in utero, suggesting that long-lasting effects are present due to the ingestion of the drug by the mother during pregnancy. Exposure in utero may stunt brain development, and most likely affects inhibitory control and emotional regulation, which may lead to the aggressive and delinquent behavior (Dow-Edwards, 1991; Mayes, 1999).

In another longitudinal study, Richardson (1998) explored the effects of prenatal cocaine exposure on infants, at one year, at three years, and at seven years. Her research also focused on the cognitive and behavioral development of these youths. Using an experimental and control group sample (n = 99 for cocaine exposed, and n = 124 for not exposed), Richardson examined multiple facts of development to assess differences, if any. She found little differences in initial health at birth, as heights, weights, and head circumferences of the babies were not significantly different across the two groups. However, at three years of age, there were significant differences in behavioral outcomes. Using both the Child Behavior Checklist, and the Stanford-Binet assessment, Richardson found that when the mothers used cocaine during pregnancy, the child's behavior was worse, displaying more problematic behaviors.

In total, there is ample evidence to support the notion that intrauterine cocaine exposure has damaging effects. Additionally, these biological insults to the fetus are most certainly multifaceted, and may last a lifetime. As Harvey and Kosofsky relate:

> It should come as no surprise that human studies that indicate that there is not one cocaine-exposed phenotype, but many cocaine-exposed phenotypes…. Data also were presented indicating that persistent deficits may be evident in cocaine-exposed children as they get older and are increasingly challenged to master the more complex demands of their environment. Some concern was expressed over the

> deficits that appear to be occurring in the more formal settings and constraints placed on the behavior of children. These deficits included delayed language expression, cognitive impairment, and behavioral abnormalities including difficulty modulating attention, impulsivity, responsivity, and other behaviors that are challenged in classroom settings (1998, p. *xi*).

This passage summarizes many of the damaging effects cocaine may have on the fetus during pregnancy. Additionally, the research presented suggests that intrauterine cocaine exposure can have diverging effects, including developmental and societal. So far, the pieces of research presented here in the prenatal drug use/abuse section with one drug at a time. A more complex issue is when multiple substances are used, which is most common. The next session discusses research on poly-substance use/abuse and fetal outcomes.

Poly-Substance Use/Abuse and Developmental Outcomes

Thus far, the research presented here has focused on one particular influence at a time. This section discusses the relevant literature when there is a combination of multiple substances used/abused by the mother during pregnancy. It was during the 1970s, when the medical field became increasingly aware of the damaging effects of smoking, alcohol use/abuse, and drug use on health. Moreover, there was an increasing awareness on the deleterious effects of these substances, when taken by pregnant women, on their unborn children (Erikson, Larsson, & Zetterström, 1979, p. 228). Additionally, it is widely acknowledged that these substances are typically not taken individually. More often, pregnant women that are using one substance are as likely to use a combination of

substances. For instance, Linares et al. (2005) found that roughly 86% of the cocaine using mothers smoked and drank, suggesting that these substances may be interacting within the womb. Thus, as this section discusses, the combination of multiple insults on the fetus in utero may have increased toxic outcomes, in terms of the child's health and behavior.

In Fried and Makin's (1987) research on neonatal behavioral correlates, they found prenatal exposure to marijuana, cigarettes, and alcohol, to be quite damaging. In their sample of women ($N = 700$), using the Brazelton Neonatal Behavioral Assessment Scale (NBAS) (Brazelton, 1973) they found a significant amount of behavioral problems correlated to the use of marijuana, cigarettes, and alcohol by the mothers. In a multivariate analysis, the combination of the drugs accounted for 11% of the variance in the NBAS, suggesting that neonatal effects are manifesting from intrauterine exposure to these toxins (p. 6). This included a significant difference in irritability, tremulousness, habituation to sound and light. Additionally, this was found to present at mere days after birth.

Extending beyond birth, Chasnoff et al. (1998) found behavioral differences in a sample of children ($N = 160$) at four and six years old. Comparing a group of mothers who used cocaine and other drugs ($n = 95$), to a control group ($n = 75$), Chasnoff and her colleagues found a direct effect on the behavioral outcomes of these children at four and six years old (p. 314). Also using Achenbach's Child Behavior Checklist (CBCL), they found that the children exposed to poly-substances were significantly more likely to fall into the highest region (the clinical region) of behavioral problems, $X^2 = .292$, $p = <.03$, versus the control group (p.319). When assessing delinquent behavior and aggressive

behaviors, the drug exposed children were significantly more likely to display these behavioral outcomes at ages four, five, and six (*t* tests between groups was $p = <.001$ for both delinquency and aggression). While this study does suggest that there is an inherent difficulty in dissecting the disadvantages of each contributing drug to the behavioral deficits; overall, their study supports the position that multiple substances used by pregnant mothers does have negative effects on youth beyond infancy.

As mentioned, Linares et al. (2005) found that multiple substance use was common amongst their sample of cocaine-using mothers. When assessing the behavioral outcomes of youth ($N = 322$) at six years old, they found a significant difference between the two groups. The exposed group was significantly more likely to display oppositional defiant behaviors, *OR*(322) 2.15, $p = .02$ (p. 91). Additionally, when assessed on the CBCL, the exposed group was significantly more likely to reach the clinical range of aggressive behaviors, $X^2 = 4.94$, $p = .03$ (p. 92).

In one other assessment, Slinning (2004) also found behavioral differences in a group of poly-substance-exposed youths at two and four and a half years old. Also using the CBCL, Slinning found that the substance-exposed children were significantly more likely to display problematic behaviors, $F[1,92] = 11.16$, $p = <.005$ (p. 23). This research also supports the notion that there is a synergistic effect of multiple substances used by the mother during pregnancy.

Conclusion

Thus far, this research has focused on the behavioral effects that youth display as a result of exposure to a teratogen during pregnancy. As mentioned previously, since the

early 1970s, there have been large gains in the knowledge of the detrimental effects of intrauterine exposure to alcohol, cigarettes, and other drugs. The results of these studies are overwhelming in their collective position; exposure to the substances (either by one, or in combination) does have a detrimental effect on the fetus. These biological insults can be long-lasting, creating difficulties well into a child's school years. Moreover, these deficits display not only in the general health of the youth, but there is strong evidence to support behavioral differences. That is, prenatal exposure to substances is likely to increase the risk of behavior problems in youth, like aggression and delinquency. Therefore, it is a potential risk factor that should be assessed when studying behavioral outcomes of youth.

Unfortunately, this is not the only point in time early in the life of a child that may affect behavioral outcomes. Two more areas of interest need discussion, peri-natal influences, and post natal effects may also be problematic. Therefore, the peri-natal or at-birth time is now reviewed.

PERI-NATAL INFLUENCE

Although the medical field has known of the deleterious effects of prenatal substance use/abuse, and its effects on infants, there is another phase in the birthing process that may have a large effect on infants. This effect may be seen in the general health of children, and similar to the prenatal effects, there is the potential for these problems to affect behavior in these children. This stage in the birthing process is known as peri-natal, or at birth. And while this stage in life is seen as a special and wonderful

time, there are some complications that can occur, which may have long-term consequences. These effects may be broken down into two main areas, birth complications and birth weight.

First, the complications during birth that are most often associated with developmental problems are: eclampsia/preeclampsia, meconium aspiration syndrome (MAS), and anoxia/hypoxia, or fetal asphyxia. Hodgins, Kratzer, and McNeil (2002) found that obstetrical complications may have serious detrimental effects on the neural development of babies, concluding that these individuals may have a much higher risk of problematic behavior (both mental health and violent), due to these complications.

Second, premature birth, low, very low, or extremely low birth weight, comprises the other area in the birthing process for why problems may arise. This is commonly known as LBW, VLBW, or ELBW, and has similar (oxygen related) effects as the aforementioned birthing complications. LBW, VLBW, and ELBW, may cause complication in the infant's ability to breathe and take in oxygen. In turn, this directly affects the cognitive development of the newborn.

Collectively, these two areas of complications focus on the level and purity of oxygen intake within the baby during an important period, birth. Reduced oxygen intake during this vital stage may have damaging effects on healthy brain development. In turn, healthy brain development has been paramount to cognitive functioning and prosocial skill acquisition. Finally, cognitive functioning and skill acquisition are directly linked to behavioral outcomes, both prosocial and antisocial. Therefore, a discussion of the two main areas of peri-natal complications is now presented. This will begin with a discussion

of problems that occur during the time of birth, followed by the issue of low or very-low birth weight.

Obstetrical (Birth) Complications and Minor Physical Anomalies

Added to the large body of research on prenatal exposure, there is a growing body of research that suggests complications occurring during the birthing phase of an individual may have long-term effects on health and behavior. This section focuses on the complications that can occur during birth, which may lead to minor physical anomalies and health problems. The complications may be separated into different typologies, blood pressure (eclampsia/preeclampsia), oxygen deprivation (hypoxia/anoxia), fetal positioning (umbilical cord prolapse, fetal distress, irregular position of the fetus), and infection (meconium aspiration syndrome, MAS). All of these have a similar impact, in that; they may affect the physiology of the brain, which in turn affects development. This may result, as Arsenault, Tremblay, Boulerice, and Saucier (2002) suggest, in neuropsychological deficits caused by fetal brain damage may lead to behavioral problems (p.497). A discussion of these potentially damaging complications follows.

Preeclampsia/Eclampsia. This birth complication stems from an increased blood pressure in the expecting mother. In turn, this reduces the flow of blood to the baby, effectively reducing the amount of oxygen and nutrients to the baby. This is a form if intrauterine growth restriction, and may even develop into full oxygen deprivation. Therefore, the effects of preeclampsia/eclampsia, of fetal hypoxia may have dangerous impacts on the healthy development of the newborn. In a review of obstetrical complications and health outcomes, Boog (2004, p. 134) concluded, “The consequences

of OCs may lie on a continuum ranging from severe neurological abnormalities in some children to subtle cognitive and behavioural disturbances in other, according to the level of the hypoxemic stress…" This speaks directly to how the lack of oxygen can affect not only the healthy development of the brain, but also how the brain works in the central nervous system to regulate behaviors.

As Kandel and Mednick (1991, p. 519) elaborate, "Perinatal complications are early factors affecting CNS development." The central nervous system (CNS) deficits have been witnessed in offenders, and may "predispose affected children to aggressive or violent behavior." In their study roughly 20 years ago, Kendall and Mednick found that obstetrical complications significantly accounted for 1.6% of the variance in violent offending, $F(1,215) = 5.28$ $p = <.04$ (p. 523). This was found even when controlling for socioeconomic status, mother's age, gender, parental psychiatric diagnosis, and number of offenses, supporting the concept that obstetrical complications may affect behavioral outcomes.

Hodgins, Kratzer, and McNeil found evidence to support this when studying a large birth cohort in Sweden. They found that coupled with inadequate parenting (an interactive affect), pregnancy complications accounted for a 2.86 higher likelihood in violent offending in the men in the sample (2001, p.746). Eighty-six percent of these complications involved a form of eclampsia or fetal hypoxia.

When researching fetal brain damage caused by obstetrical complications (OCs), and how the OCs may affect behavior, Arsenault et al. also examined eclampsia and fetal hypoxia. While these researchers categorized the birth complications slightly different than the current approach, Arsenault et al. did model preeclampsia as a deadly risk

situation, warranting the dangerousness of intrauterine growth reduction. In their sample of (N = 849) youths assessed on aggression at age six, they found that the deadly risk situation (DRS) interacted with family adversity significantly when predicting aggression in boys. Moreover, these complications did increase the likelihood of family adversity above the main effect of family adversity, OR = 1.16, p = <.05 (Arsenault et al., 2002, p. 503). Thus, across the sample, when boys faced family adversity, their risk of aggressive behaviors increased by a factor of 1.16 when this type of obstetrical complication was present. Additionally, this level of aggression at age six was significantly associated with violent delinquency at age 17, OR = 1.63, p = <.005. This longitudinal finding also supports the lasting effects of problems that occur early in life, including the birthing process.

Hypoxia/Anoxia. Another complication that may arise during the birth process that reduces oxygen may occur even in the absence of preeclampsia/eclampsia. This category is labeled as hypoxia/anoxia, which is also oxygen starvation/deprivation. Hypoxia is the reduction of oxygen, and anoxia is the lack of oxygen all together. This can greatly damage organs within the fetus, including the brain, and may cause serious brain damage, and even death.

The effects of hypoxia/anoxia on behavior have been well documented for over 50 years. In 1957, Graham, Pennoyer, Cladwell, Greenman, and Hartmann examined behaviors of newborns that suffered anoxia, compared to a control group. Using a sample of anoxic newborns (n = 60) and a control sample (n = 62), Graham et al. found significant differences on their behavioral assessment scale, with a significant correlation of r = 0.59 on anoxia and behavior (1957, p. 188). While Graham et al.'s behavior tests

focused more on the health of these newborns; they did incorporate an irritability component on their scale, which has been discussed already as a potential link to impulsivity. Moreover, they allude to lasting effects of anoxia on the long-term development of the child into adulthood, and that anoxia may have lasting, damaging effects.

To understand the long-term neuropsychological deficits this biological insult may have, Mañeru, Junqué, Botet, Tallada, and Guardia (2001) examined a subset of children (n = 20) assessed as having peri-natal asphyxia (PA), which is another term for anoxia. Comparing these newborns to a group of healthy children (n = 28), Mañeru et al. examined neuropsychological functioning across an array of instruments. These instruments included the Wechsler Intelligence Scales (WISC-R), Rey's Auditory Verbal Learning Test (RAVLT), the Controlled Oral Word Association Test (COWAT), and others. Across almost all of the assessment instruments, the individuals suffering from PA scored significantly lower. Additionally, all tests were performed on the samples after they had reached their 12th birthday. This is important, as this research allowed for the formation of the frontal lobe, which is necessary to complete many of these assessments. In total, their research does support the continuing theme; hypoxia/anoxia may promote long lasting developmental deficits.

When directly assessing impulsivity, Beaver and Wright (2005) found a significant relationship between anoxia and low-self control. Using a sample of kindergarteners (N = 310), and controlling for race, gender, and parental involvement, they found anoxia to be the strongest predictor in the development of low-self control (p. 464). Beaver and Wright posit that the obstetrical complication of anoxia is a "severe

threat to the development of self-regulation" (p. 463). As others have noted (Mayes, 2006; Tronick et al., 1996), self or state-regulation is an important component of healthy prosocial development. Insults to this development, like hypoxia/anoxia, are likely to have lasting deleterious effects, which may manifest in a lack of ability to regulate behaviors.

Meconium Aspiration Syndrome (MAS). Although much less research has been done on the effects of behavior, this obstetrical complication also poses a risk of brain malformation. As Faranhoff (2008) explains, meconium aspiration syndrome (MAS) can cause respiratory distress via meconium-stained amniotic fluid (MSAF). It may cause respiratory failure, internal air leaks, and even death. Essentially, fecal matter that would normally be released after birth is prematurely released into the amniotic sac due to some form of fetal distress. In turn, this blocks the airways from receiving the proper levels of oxygen, resulting in another form of intrauterine oxygen deprivation, which is akin to hypoxia.

One of the common ways to treat this complication is through a process known as extracorporeal membrane oxygenation (ECMO). This process is designed to increase the level of oxygen the baby receives during birth, diminishing the effects of MAS. In a longitudinal study of the effects of MAS, Glass et al. (1995) examined a sample of children at five years old (n = 102) who were identified as affected by MAS (and subsequently treated with ECMO), comparing them to a control group (n = 37). On a behavioral adjustment scale (including the Conners Scale), the affected children were significantly more likely to display behavioral problems, including social problems (p = <.001), and attention problems (p = <.001) (p.454). Additionally, these children had

significantly lower maturity ratings than the controls (90, ± 12, vs. 97, ± 13, $p = <.01$), indicating a lower level of cognitive development. This longitudinal examination illustrates the deleterious impact MAS may have well after the birthing process.

Collectively, these insults may have lasting effects on youth. While not overly common, the ramifications of oxygen restriction during the birthing process do appear to have severe consequences. Another group of individuals that may be at risk of developmental delays or malformations arises in the form of size during birth. More specific, low, very low, or extremely low birth weight may also have lasting effects on newborns. This section is now discussed.

Low, Very Low, and Extremely Low Birth Weight

Signified as LBW, VLBW, and ELBW, these peri-natal insults may also affect the oxygen levels of the newborn, which in turn, affects the proper development of the brain. Within the medical field, two conditions create a sliding scale for newborns, gestation time, and birth weight. Generally, 38 to 42 weeks is considered as a normal term for human birth. The majority of infants are born during this time. However, there are infants born both prior to the 38th week and after the 42nd week. Thus, infants that are born prior to the 38th week of pregnancy are considered to be born preterm, or "preemies."

The second condition is weight. The most severe category, the extremely low birth weight (ELBW) is a baby that is born under 1000 grams (Intensive Care, 2004). This is the equivalent of a baby born under 2 pounds and 3 ounces. However, the survival rate for these infants is much lower, especially without the use of some form of

intubation. Intubation is the medical assistance of the cardiopulmonary system to aid the newborn in extra-uterine life.

The typical definition of very low birth weight (VLBW) is a child who is born weighing between 1000 and 1500 grams. Converted into pounds and ounces, this is the equivalent of 2 pounds and 3.2 ounces, up to 3 pounds and 4.9 ounces. Low birth weight, or LBW, is generally 1501 grams to 2499 grams (Intensive Care, 2004). The conversion of the upper limit here is equivalent to 5 pounds, 8 ounces. Above this range is considered as the normal birth weight, or NBW. The normal birth weight range tops out at around 4000 grams, or, 8 pounds, 13 ounces.

Together, the gestation period and birth weight have an impact on the overall health of the infant in the first stage of life. Babies born in the VLBW and ELBW range are ate a much greater risk of early life problems than babies born in the NBW range. Specifically, they are at a greater risk of developmental delay and mental retardation (Intensive Care, 2004). This is may be due to the fact that they are physically smaller, and may have physiological immaturity. Combined, these two aspects may reduce the amount of oxygen to the brain, which is directly related healthy cognitive development. Extrapolated over the life course, these individuals may experience a host of problems that may be contributed to the reduction of oxygen to the brain in their formative years. Boyce, Smith, and Casto (1999) support this concept in their research on the health and educational outcomes of children who experience neonatal complications. Birth weight, specifically, LBW is a significant predictor in attention problems, need for special education, and vision problems (p. 266).

Hoy, Sykes, Bill, Halliday, McClure, and Reid (1992) examined the social competency of VLBW children at 7 years old, to a matched sample of NBW children. These two groups were matched on values of parental social class, two-parent homes, and maternal age at birth, in order to provide a like control group. Using the teacher report form, and the parent rating scale, from of the Child Behavior Profile (Edelbrock & Achenbach, 1984), which is the composite form of the CBCL, Hoy et al. (1992, p. 142) found significant differences between the two groups. Most notably, Hoy et al. found the aggressive levels of the boys in the VLBW group to be higher than the control group of boys (2.78, $\pm$ 1.30, vs. 3.14, $\pm$ 1.27 $p = <.05$). Thus, even when controlling for social class, variability in *IQ*, and number of parents, VLBW was significant in predicting the difference in behavioral outcomes of these youth. Additionally, the VLBW children were also significantly less cognitively competent than the control group (19.64, $\pm$ 3.61, vs. 20.51, $\pm$ 2.27 $p = <.05$), and were less physically competent (18.67, $\pm$ 4.02, vs. 19.79, $\pm$ 3.25 $p = <.05$); suggesting that VLBW has multifaceted insults on the children's overall adjustment (p.141).

Taylor, Klein, Schatschneider, and Hack (1998) also conducted similar research on a group of VLBW youth, assessing their physiological and behavioral outcomes. Using a control group ($n = 65$) and a VLBW group ($n = 68$), Taylor et al. found differences in the behavioral problems section of the CBCL and the Vineland Adaptive Behavior Composite *OR*(133) 3.91 [1.69, 9.04], $p = <.05$ (1998, p. 240). Taylor et al. reinforce these findings by displaying the differences between these groups in neonatal complications. For instance, the VLBW group is significantly more likely to have suffered from prematurity complications (Septicemia, and Apnea), which are directly

linked to neonatal development. These problems, indicated in a neonatal risk index, are correlated to gestational birth time and birth weight.

The link of neonatal risks and later behavioral problems was also examined by Breslau and her associates (Breslau et al., 1996). Their research sought to examine the long-term sequelae of LBW and behavioral outcomes. Using a sample of $n = 473$ identified LBW children, and $n = 350$ NBW children, Breslau et al. examined behavioral outcomes measured on the teacher reporting form of the CBCL. Controlling for maternal education, population site, sex, and race, they found significant differences in the delinquent behavior portion of the TRF between the NBW and LBW children $t(801) = 2.67$, $p = .008$ (p. 394). Their research supports the position that LBW may influence behavioral outcomes into adolescence, even when controlling for environmental factors such as race, class, and social status.

Lastly, Horwood, Mogridge, and Darlow (1998) also examined the link of birth weight and cognitive, behavioral, and educational outcomes. In their research, Horwood et al. analyzed the differences of a group of VLBW children ($n = 298$), when compared to the remainder of NBW children ($n = 1092$) in a cohort of births in 1986, in New Zealand. When controlling for family sociodemographic background variables (gender, maternal education, parent family, and smoking during pregnancy), Horwood et al. found that VLBW had a significant effect on behavioral and educational outcomes, using the Rutters (1967) and Conners (1989) behavior scales. At 7 years old, the VLBW group was significantly more likely to have conduct problems $OR(1390)$ 2.1 [.90, 4.90], $p = <.0001$, and significantly more likely to have cognitive impairment (WISC-R Total $IQ<85$) $OR(1390)$ 6.3 [3.1, 12.9], $p = <.0001$, after adjusting for the sociodemographics (p. F16).

Horwood et al. relate that these findings are consistent with the body of research that demonstrates the long-term consequences of children that are born with LBW and VLBW. The problems that occur in the peri-natal stage remain evident seven to eight years later.

Conclusion

Studies, such as the ones presented here, have consistently found the negative effects of problems that occur during the birthing phase of development. These peri-natal insults can come in the form complications (anoxia, eclampsia, or MAS), or through the difficulty of physiological immaturity. Collectively, peri-natal problems deal mainly with the restriction of oxygen to the brain. In turn, this reduces, inhibits, or delays the healthy cognitive development of the infant. Thus, the peri-natal deficits that these youth experience appear to have both short-term and long-term effects. Additionally, these affects appear not only in the health of the child, but are also displayed in their behavioral problems.

Once again, the prenatal and peri-natal problems are not the only points in time that may affect behavioral outcomes of youth. A final area of development that may also affect behavioral outcomes very early in life is the postnatal stage of development. Thus, a discussion of postnatal complications is now presented.

POSTNATAL INFLUENCE

The early or formative years in a youth's life are often filled with caring and nurturing individuals, which helps foster healthy human development. However, there are problems that may happen in these formative years that may create lifelong adversity. In addition, while these factors may not be viewed as directly biological insults, they are considered this way in this research, because they have the potential of changing the physiological composition of a youth. Additionally, these complications may be parceled into two main sections: initial differences in physical/physiological composition, and direct interaction with environmental forces that change composition. Differences in physical composition refer to the variation in the characteristics of humans at birth. Largely, there is great similarity across individuals at birth, yet there is also a great deal of variation, which may have deleterious outcomes on behaviors. Examples of this include physical anomalies, serotonin levels, and Otitis Media Effusion (OME). OME refers to ear infections types that may lead to behavioral problems, due to neurophysiological changes based on the infection. Second, the direct interaction of the environment on the youth may alter the neurocognitive development of the youth; hence changing their physiological ability to adapt to their social environment. Thus, each of these is discussed in this postnatal influence section.

Differences in Physical/Physiological Composition

The medical field has long understood that there are differences across individuals, which are due to genetic differences of these individuals. These differences

are amassed to create scales, allowing the medical field to track normal development. Then, newborns plotted within these scales to assess healthy normal development. For instance, Tanner (1978) created the Tanner scale, which was used to track changes in growth of puberty in youth. This scale would track the growth rate of an individual, compared to a population. Tanner noted that physical anomalies might create differences amongst individuals that may change the development of a youth. In a review of biosocial interactions and behavioral outcomes, Raine (2002) also found minor physical anomalies (MPAs) to have an impact on behavior. His review reported how these MPAs could be markers for maldevelopment (p.316).

Minor Physical Anomalies (MPAs). One study that examined the influence of MPAs was performed by Waldrop, Bell, McLaughlin, and Halverson Jr. (1978). In their study, Waldrop et al. describe how these anomalies are developmental deviations, and that they may create deviations in the development of the nervous system (1978, p. 563). Their investigation of the influence of anomalies included items such as high steeped palate, a curved fifth finger, partial syndactalia of the toes, and ear malformations. In their longitudinal research Waldrop et al. tracked a sample of youth through from birth through three years old (n = 59), assessing the impact of the MPAs on impulsivity and aggression. Waldrop et al. found a significant relationship (r = .32, p = <.01) between MPAs and aggressive behavior (p. 564). Thus, it is useful to assess physical anomalies in youth, as they may affect short and long-term behavioral outcomes.

Serotonin Differences. These physical differences may be visible to the naked eye, as in with the physical anomalies. However, other differences in individuals may not be visible. One of the most researched differences in early development is of hormones,

specifically serotonin. This is because serotonin has been demonstrated in the literature to be linked with negative behavioral outcomes, most notably aggression in boys (Constantino & Murphy, 1996). Specifically, 5-hydroxyindoleacetic acid (5-HIAA) is a serotonin metabolite, which helps to mop up increased levels of serotonin in the brain.

Clarke, Murphy, and Constantino (1999) used information on 5-HIAA collected on a sample of infants (n = 170), to assess its influence on behavior at almost 3 years of age. Clarke et al. (1999, p.34) did find a relationship (r = -.17, p = .08, one tailed) between the 5-HIAA levels and externalizing behavior scores (aggressive behavior) on the CBCL (Achenbach, Edelbrock, & Howell, 1987) at 30 months of age. Thus, differences in neurotransmitters in the brain at an early age may affect behavioral outcomes, and these differences may have lasting effects. Other differences may not be within the individual, but within the treatment of the individual. Therefore, a discussion on medical application and/or treatment is presented.

Otitis Media Effusion (OME). Nearly 75% of children will visit a physician for an ear infection by age three, with almost children visiting a physician for an ear infection by age six. Rayner, Zhang, Gorry, Chen, Post, and Ehrlich (1998, p.296) support this concept, stating that Otitis Media is the most common reason for a child to visit a physician. This inner ear infection is largely due to a couple of issues. First, the Eustachian tube is smaller in children, so it is more easily blocked. Second, the immune systems of children are still developing; thus, youth are not as adept at fighting off infections. The extent of the complications of OME and behavioral outcomes have been evaluated, and indications are that there is a link between ear infection and problematic behavior.

Bennet and Haggard (1999) examined this relationship using the British birth cohort study (N = >15,000). Using the Rutters (1967) scale, Bennet and Haggard examined youth at five years old. They found that children with higher levels of ear infections and OME had significantly higher antisocial scores, that children with lower levels of ear problems OR(12,534) 1.44 [1.18, 1.76], p = <.001, after controlling for socioeconomic status, sex, and maternal issues (p.31). Bennet and Haggard conclude that the use of such a large controlled cohort study makes it "difficult to doubt that there are OME sequelae in cognition and behavior" (p.33).

Wilks, Maw, peters, Harvey, and Golding (2000) also examined the effects of OME, when they studied glue ear and behavioural problems in a sample (n = 182) pre-school children. However, Wilks et al. used the application of corrective surgery and reviewed the reduction in behavioural problems in the youth. This was done with a randomized trial of children who received early surgery for treatment of OME, versus a control group who were watched for problematic behaviors. Using the Richman behavioural problem scale (Richman, Sevenson, & Graham, 1975) Wilks et al. found that nine months after surgery to correct for OME, behavioral problems decreased by 33% (p = .031) (p. 213). Although there were short-term benefits from the surgery, there were some returns to earlier levels of behavioural problems on the Richman scale, suggesting that some permanent physiological change to neurocognitive development may be present, due to the ear infections.

Non-Chosen Environmental Factors

The second area of influence on behavior in the postnatal stage may come in the form of environmental factors that a newborn is exposed to during this delicate stage in life. In turn, these complications may change the physiological makeup of the brain, thus setting the youth on a differential life path, than previously prescribed. For instance, extreme levels of malnutrition have been demonstrated to have adverse effects on brain development (Fishbein & Pease, 1994).

Malnutrition. Both malnutrition and vitamin and mineral deficiencies have been linked to aggressive behavior within youth. Werbach (1992) and others posit that it is low iron and zinc levels that increase the externalizing behaviors within children (Rosen et al., 1985). It is suggested that malnutrition inhibits neurocognitive functioning of the brain, thus allowing for increased levels of externalizing, aggressive behavior (Liu, Raine, Venables, & Mednick, 2005, p. 2005). Liu et al. examined this using a birth cohort study ($N = 1795$). At age three, a subgroup, identified as having higher levels of malnutrition ($n = 353$) were assessed using multiple instruments, including the CBCL (Achenbach & Edelbrock, 1983). Controlling for gender and race of the individuals, malnutrition still significantly predicted aggressive behaviors at age eight $F(2, 933)$ 4.58, $p = .04$ (Liu et al., 2005, p. 2008). These individuals were followed later in life, and at age eleven, the malnourished children still displayed significantly higher levels of aggression. At seventeen, significantly more conduct disorders were present for the youth who experienced malnutrition as a child. From this research, Liu et al. affirm that malnutrition promotes neurocognitive deficits, "which in turn predispose to persistent externalizing behavior problems throughout childhood and adolescence" (p. 2005).

Lead Exposure. Another environmental insult that may change the physiological composition of the brain comes in the form of lead. The medical field has known about the damaging effects of exposure to lead (Pb) in children. Of importance here, is that it is known to be a causal factor in delinquent behavior. In fact, lead poisoning was found to be the strongest predictor of criminality in a Philadelphia cohort study (Denno, 1990). Lead exposure/poisoning have multiple effects on the body. As Onalaja and Claudio (2000) report, these damages can include kidney problems, encephalopathy (global brain dysfunctioning), and changes in the cognitive development of children (p. 23).

In a longitudinal study, Dietrich, Ris, Succop, Berger and Bornschein (2001) examined the impact of lead on delinquent behavior. Using the Cincinnati Lead Study, Dietrich et al. tracked lead levels and delinquent behaviors. At six and a half years old, the youth were given the self-report of delinquent behavior (SRDB), an instrument designed to assess delinquent conduct, from lower levels to higher violent levels. After adjusting for parental *IQ*, socio-economic status (SES) and HOME scores, the relationship between levels of lead concentration and delinquency (SRDB) was significant $\beta = .193$ (S.E. .061, $p = .002$) (Dietrich et al., 2001, p. 515). When separated into dose quartiles of lead exposure, children with higher levels of lead concentration had 4.5 more delinquent acts than individuals in the lowest category. Dietrich et al. conclude their research by noting that not only were there intelligence and academic deficiencies in these youth, but there were also visible behavioral differences, in terms delinquency.

Conclusion

As stated in the beginning of this section, the postnatal time in life may be fraught with adversity. Neonates may display individual problems (Waldrop et al., 1978), be more susceptible to infections (Wilks et al., 2000), or be exposed to a variety of insults that may change their development (Dietrich et al., 2001; Liu et al., 2005). All of these may change the brain physiology/functioning, which in turn, can promote increases in antisocial and problematic behaviors. Collectively, postnatal problems deal mainly with changing of cognitive and neurocognitive functioning through structural change or deficiencies. Once more, these deficits, like the prenatal and perinatal insults, appear to have both short-term and long-term effects.

SYNTHESIS

Thus far, this chapter has demonstrated that there are insults that may affect the physiological nature of newborns. There are factors that may change the levels of oxygen intake in the brain while still in the womb (Fried et al., 1992; Mayes, 2006; Orlebeke et al. 1999; Slotkin, 1998), which may change the development of the brain. There are problems that can occur during the birthing period, which may also affect healthy brain development (Boog, 2004; Hodgins et al., 2002). Finally, there are insults that may occur early in life (Dietrich et al., 2001; Wilks et al., 2000), which may also change brain development. Of most importance here, there are demonstrated neurocognitive limitations or malformations that affect behavior. This section elaborates on the process

in which these insults may have lasting effects on behavioral outcomes because of their impact on the brain.

No Longer a Debate of Tabula Rosa

The medical literature is filled with research on the variability of the human starting point. That is, all aspects of humanity have variation, including attributes at birth. This includes personality, behaviors, cognitive abilities, and propensity for antisocial behavior. In this line, Gottfredson and Hirschi (1990) would agree with this assumption, in terms of population heterogeneity. That is, on a given aspect (in their case, impulsivity), there is variation on a trait that sets individuals on differing trajectories of behavior throughout their lives. Others, such as Moffitt (1993), have demonstrated that there are groupings of individuals, in relation to propensity of engaging in delinquent behavior, as well as frequency of engaging in delinquent behaviors. It is important to note that Moffitt posits that these differences are due, in part, to neuropsychological risks that can occur at birth, or even before birth. She continues that a possible source of the problem comes from the "disruption of the ontogenesis of the fetal brain (p. 680). Thus, it is suggested that there are differences that may occur early in life, which may affect behavioral outcomes. These differences may be developmental insults that can come in the form of minor physical anomalies, maternal drug use, poor nutrition, or exposure to toxic agents. At this point, the first three sections of this chapter have outlined such problems.

The Stability of Behaviors

Like the volume of medical research on insults to neonatal brain development, there is an extensive amount of literature on the stability of behaviors and personality within humans. Most notably, researchers have demonstrated this concept with the stability of intelligence throughout the life course. Mortensen, Andresen, Kruuse, Sanders, and Reinisch (2003) demonstrate the stability of IQ in their examination of a sample (n = 211) youth from a birth cohort of (N = 9,125) individuals born over a three year period. Using multiple intelligence assessment instruments, they found a high degree of stability in the level of intelligence in their sample over the course of adolescence into adulthood. Over the 10 year follow-up, Mortensen et al. found an r = 0.72 correlation in intelligence, suggesting a high degree of stability from childhood into young adulthood (p. 397).

Similarly, aggressive behaviors also display stability over the course of an individuals' life. One of the first to suggest the stability of problematic/aggressive behaviors was Olweus (1979). In his research, Olweus reviewed 16 studies on the stability of aggression, concluding that there are patterns of aggression that remain stable across an individual's life. Additionally, he argued that there are individual differences in aggression levels across individuals, and that these differences begin early in life. Huesmann, Eron, Lefkowitz, and Walder (1984), also studying the stability of aggression over time, tracked a sample of individuals (N = 622) over a 22 years. Huesmann et al. found a significant relationship r = .30, p = < .001 between aggression levels measured at age 8, to aggression measures at 30 years of age (p. 1124). Moreover, in a subsample of the males (separated by low, medium and high aggression levels), they found that the

aggression scores at age 8 significantly predicted aggression at age 30, $F(2, 132) = 9.60$, $p = < .0001$ (p.1125), suggesting that the youth with higher initial levels remained higher 22 years later.

Collectively, this research strongly supports the notion that behaviors may remain stable over time. Moreover, there is strong support that the stability of behaviors includes aggression and problematic behaviors. At this point, a discussion of the intersection of brains to behaviors is necessary, in order to demonstrate the interconnectedness of aggression and brain functioning.

Behaviors are a Product of Brain Structure and Development

The human brain is one of the most complex phenomena that humans have studied to date. While relatively small in size, the brain is comprised of billions of cells that work in patterns and use subcomponents, in order to produce thought, memory, mobility, action and reaction. These subcomponents are parceled into three main sections of the brain, the hindbrain, the midbrain, and the forebrain. The forebrain section is comprised of four components, or lobes, which are the occipital lobe, the parietal lobe, the temporal lobe, and the frontal lobe. Of most importance is the frontal lobe, as it is what is thought of when referring to the brain and thought. The frontal lobe is the last part of the entire brain to fully develop, and it was assumed that this section of the brain matured around the age of twelve (Wallis & Dell, 2004). However, using longitudinal studies, researchers more often support the notion that this is not completely developed well into adulthood (Begley, 2000).

It is within the frontal lobe where humans have a large, if not the most, amount of interaction with their world. This comes in the form of responses to stimuli that are presented to them. Also known as executive cognitive functioning, Luria (1980) defines ECF as a higher order process, which involves the planning, initiation, and regulation of behavior. Stuss and Benson (1984) reinforce this concept, outlining the role of executive cognitive functioning. They define frontal lobe activities "under the following headings: motor functions; sensory perception and construction functions; attention; abnormal awareness; flexibility-preservation; language; memory; cognition; personality; localization and hemispheric activity" (p. 3). Two of these, cognition and personality, are considered to be what lead to behaviors.

The stimuli that are processed through cognition, and thus react to, largely come from environmental interaction. While there are differing types of interactions (passive, active, etc…), the focus here is on the how the brain processes or "learns" from its environment. Visual and tactile signals are sent to the brain, which are processed via transferring events into signals. This process converts environmental stimuli into electrochemical signals that are processed through different parts of the brain. Based on memory, cognitive ability, and other factors such as personality experience, these electrochemical signals are interpreted, and subsequent reactions are performed. The reactions to the environment, based on this process are behaviors. Thus, behavior is the process of reactions to stimuli that are processed through the brain, mostly through the frontal lobe (for a more detailed discussion, see Luria, 1980; Shallice, 1982).

As stated, the frontal lobe is the portion of the brain that is the last to develop within an individual over the life course. Therefore, it is still in development, and needs

energy to mature. This energy comes in the form of nutrients, and oxygen. Thus, when changes to the neurocognitive developmental process occur, either from prenatal insults, peri-natal complications, or postnatal factors; the development of the brain (here the frontal lobe) is altered or diminished. The executive cognitive functioning may also be affected during this time. When ECF is lower, there may be problems responding to stimuli, ultimately leading to problematic behavioral displays. Giancola, Mezzich, and Tarter (1998) found this type of relationship, when examining a subsample of youth (N = 249) (p. 631). Separating into a lower ECF identified group (n = 159) and a control group (n = 90), Giancola et al. found a significant relationship between ECF and antisocial behavior. Controlling for age, SES, and vocabulary ability, they found ECF significantly predictive of antisocial behaviors $F(4, 242)$ 15.94, p = < .001, Cohen's d = .77 (p. 635). The large Cohen's d suggests a high relationship between ECF and antisocial behavioral outcomes, suggesting that there is a relationship with the level of executive cognitive functioning and behavior. Taken together, the preceding studies demonstrate a link between brain functioning and behavior.

SUMMARY

This chapter has traced the incorporation of biological insults into our understanding of problematic behavior. It has outlined the three main areas where biological insults may occur early in the life course, which include prenatal, peri-natal, and postnatal complications. In the prenatal section, a discussion of influences by the mother during the time when the child was still in the womb was discussed. This included

the effects of smoking, drugs, and alcohol. All of these were supported in causing changes in the oxygenation in the brain of the fetus. Second, in the peri-natal stage, complications of birth and birth weight problems both contribute to a change in the level of oxygen to the brain. Again, the reduction of oxygen to the brain diminishes healthy cognitive development, like the ingestion of chemicals by the baby in-utero. Finally, even after birth, there can still be insults to the child that have lasting effects. These include high levels of malnutrition, and high exposure to lead. Like the two prior sections, this also changes the neurocognitive levels within the child, altering their potential for healthy brain development.

Collectively, these problems may inhibit, alter, or change the maturation process of healthy brain development. In turn, these may lead to deficiencies in executive cognitive functioning, which can increase the likelihood of problems, not only health related, but also increase the likelihood of problematic behaviors, such as antisocial behaviors. Additionally, a discussion of the stability of behaviors has been presented to express how changes early on in the child's life may have lasting effects.

Therefore, the core position of this dissertation is that there are factors, early in life, which may lead to problematic behavior. Moreover, this problematic behavior may manifest and stabilize long before many of the current criminological theories would posit. To this end, a meta-analytic approach of the research in these three areas (prenatal, peri-natal, and postnatal) is presented. A lengthy discussion of the methodology of meta-analysis, and of the methods used in this dissertation is now offered.

CHAPTER III

METHODOLOGY

As stated in earlier chapters, the use of meta-analysis in the Criminology/Criminal Justice field is continuing to expand. This is largely due to its utility in understanding and assessing overall concepts; whether it be the discipline's understanding of a particular theory (Pratt & Cullen, 2000; Pratt, Cullen, Blevins, Daigle, & Madensen, 2008), the comparison of risk assessment instruments (Gendreau, Goggin, & Smith 2002), or even the assessment of correctional programs modalities (Lipsey & Wilson, 1993). A meta-analysis is able to reach these objectives, due to its function and purpose: to systematically quantify a body of literature on a particular sub-point, enabling the reader to see how individual pieces of research weigh not on or against each other, but as a collective group.

With this in mind, this dissertation concentrates on these central concepts. First, the medical research in these areas of early life behavioral problems has produced thousands of findings over the last 30 years, which supports the argument that there are factors early in life (prenatal, peri-natal, and postnatal) that influence behavior before environmental influences take hold. Second, the research suggests that these early-life problems may influence an individual well into their formative years, suggesting that there may be pre-existing problems that may be masked during the generally accepted time that sociological based variables are said to take hold in a youth's life. Third, compared to control samples, these conditions are severe enough that they may be

noticed at a young age. Lastly, there is a substantial amount of research in this field to demonstrate the effects of these early life influences. Collectively, these are the questions that will be quantitatively assessed through the use of meta-analysis.

The remainder of this section will discuss the methodology for this study. It will begin with a detailed description of meta-analysis, to include both strengths and weaknesses of meta-analysis. Next, a discussion of the sample used in this research. This will include the parameters used in the collection of the articles used in the meta-analysis. Third, a detailed discussion of the dependent variable will follow. This will include a discussion of each of the major assessment instruments that tap into the construct of early-life problematic behavior, specifically, overt aggressive behavioral displays in youth. The conclusion of this section will include a discussion on the actual analyses used in conjunction with meta-analysis, including the fail-safe *N* estimation, the *Q* statistic, and the I^2 statistic.

META-ANALYSIS: SYNTHESIZING RESEARCH

Brief History of Research Assessment

A cursory review of publications in the field of criminology and criminal justice reveals a substantive amount of meta-analytic pieces of research. Additionally, the frequency of publications using meta-analysis per year appears to be rising (Hunter & Schmidt, 2004, p. 24). Largely, this is due to their ability to provide a more systematic approach to assessing a particular phenomenon within the discipline (Lipsey & Wilson, 1993). This systematic approach to reviewing an issue is an improvement over previous

methods of assessing larger volumes of work. As Hunter and Schmidt (2004) discuss, previous methods include narrative reviews, and vote-counting, That is-- whichever side had the most pieces of research typically won the decision, and this was often decided upon by the subjectivity of the researcher (see Martinson, 1974).

As Wolf (1986) noted, these previous methods of assessing the status of a question were often left up to the subjectivity of the reviewer. Thus, if a researcher had a particular bias toward a question, or other researchers in the area, the result garnered from that particular review may be drastically different form conclusions drawn by other researchers. This is largely influenced by the decision to include, or exclude, materials to review. For instance, one scholar may choose to include a particular article in a narrative review, while another researcher may omit that particular work. Even if two scholars choose the same articles for inclusion in their respective reviews, there may also be a difference in how those particular works are interpreted individually, and as a whole. Moreover, depending on the popularity of the result from the review, such as the case of Martinson, in 1974, there could be lasting ramifications that stem from the publication of such a review.

A more systematic approach to synthesizing a collection of works is vote-counting. This is also known as a ballot box technique. As Light and Smith discuss, this is typically done by categorizing articles into three possible groups, ones that show significantly positive effect, based on the question, pieces of research that show a significantly negative effect, and ones that show no significant effect. Thus, a researcher would create a tally of articles that fall into the respective groups, counting up the totals of each group to assess the overall answer to the question (Light & Smith, 1971, p.433).

This simplistic counting system, however, assumes that every piece of research is identical in weight. In other words, it does not account for differences in statistical technique used (statistical power), nor does it account for differences in sample sizes across studies. For example, a study with a sample size of 30 would count just as much as a study that had a sample of 1,227. Even if multiple authors agree as to the box that these two studies fit within, there is certainly arguable difference as to the value of each of these studies. Thus, the problematic nature of narrative reviews and vote-counting, for the assessment of a phenomenon, has led to the creation of a more systematic method to assess a volume of work known as meta-analysis.

Research using meta-analytic techniques for the social sciences has often been attributed to Glass (1976, 1977), stemming from the field of education research. However, meta-analysis was used in other disciplines around the same time (e.g., medical field, and psychology). Essentially, meta-analysis is a systematic and quantitative approach to answering a question. Cooper, Hedges, and Valentine (2009, pp. 11-14) provide a structured list for the process of conducting a meta-analysis. For them, it is a 5 step process that includes: 1) problem formation, 2) literature search, 3) data evaluation, 4) data analysis, and 5) interpretation of the results. Cooper et al. do discuss a sixth step, public presentation. However, it is not necessarily instrumental in the process of acquiring the knowledge of a meta-analysis, but rather, it is merely the distribution of the findings.

Pertinent to our field, Glassian meta-analytic techniques typically use *t*-scores, *F*-values, means and standard deviations, and correlations, as point estimates across studies. These are standardized by converting test statistics into *z* -scores, and then

weighted by individual sample sizes (other weighting methods will be discussed later) to give point estimates with standard errors around each estimate. Typically, these estimates are compared across matched samples of specific populations in question, with the overall goal being-- are there differences (including the 95% C.I.) between groups, or between a preset level (usually set at zero, or no effect). From here, differences are more readily interpretable for practitioners, in relation to policies or practices. This may also include BESDs (binomial effect size differences), to show relative, or absolute differences across outcomes.

This method of inter-study assessment is useful when individual studies have smaller sample sizes. It allows for the individual variation of each study, while accounting for the weight of that study through the size of the sample. For example, numerous studies within psychology rely on critical clinical interpretations across small samples. Thus, the smaller samples yield higher levels of inconsistency regarding significance versus non-significance. In turn, this may lead to differing interpretations of similar study designs, ultimately leaving psychological researchers with no clear answer as to the effect of their experiments. Meta-analysis offers a way to quantitatively synthesize results from such studies, providing a richer and more meaningful answer.

Finally, as with most issues within any discipline, there is academic debate. As Kuhn (1962) posits, one of the ways a science evolves is through discovery and debate. Further, even though there are an increasing number of meta-analytic pieces of research, there are pockets of scholars that discount the utility of meta-analysis. For example, it is often noted that the use of meta-analysis for an overall assessment is like combining

"apples and oranges," in order to achieve an outcome (Hunter & Schmidt, 2004, p. 455). Thus, a discussion of the advantages and disadvantages of meta-analysis is warranted.

Potential Weaknesses of Meta-Analysis

Apples to Oranges Criticism. Of the criticisms of meta-analysis, one of the main issues is the "apples to oranges" debate. Specifically, the argument is that a meta-analysis combines differing studies, which include more than one dependent measure, and differing independent measures. Researchers, such as Rachman and Wilson (1980), have argued that comparing different studies provides no substantive meaning, as the different samples and measures used are incomparable. The reasoning behind this debate is twofold. First, some argue that two dependent variables that differ cannot be compared, even if the outcome of the variable is conceptually the same. Because of this difference, the second argument (an extension of the first) is that the heterogeneity of the effects of the two measures limits the true meaning of the outcomes of each study, and therefore, should not be performed.

Substantively, heterogeneity in effect sizes is simply the differences in values of each effect (for each dependent measure) across multiple studies. However, Hedges and Olkin (1985) and Hall and Rosenthal (1991) provide support for the utility of heterogeneous effects, through a discussion in methods of estimation. Essentially, when comparisons of outcomes are more uniform (homogeneous), it does lend support for the inclusion of multiple dependent variables that underlie the same construct. This would be a meta-analysis that would incorporate a fixed effects model. For a detailed explanation of the differences between fixed- and random-effects models, see Hedges and Vevea

(1998). Moreover, these differing outcomes can be heterogeneous, as this is what would be normally expected. Hedges and Olkin (1985) continue their discussion of heterogeneous measurement, by discussing minimum and maximum likelihood estimation. These two ways of estimating effects sizes are based on the logic of heterogeneous or homogeneous effect sizes. Once the underlying assumption of one central concept (dependent measure) or multiple concepts is addressed, the calculations to achieve the overall effect size account for the implied heterogeneity that should be expected in assessing across multiple outcome measures.

Still, others have argued that the characteristics of the studies themselves may affect the overall value of an outcome. This is what is referred to as the quality of a study (Hunter & Schmidt, 2004). Lipsey and Wilson (2001) offer that there are two solutions for this potential problem. The first is to only incorporate individual pieces of research that meet the highest level of rigor in research. That is, one should use only articles that are truly experimental, have the exact same outcome, and that the outcome is measured in the same fashion. While this would certainly be ideal, applied research is not typically this perfect. In fact, researchers such as Wolf (1986) and Slavin (1986) have argued that there is no perfect study. This leads to the second approach to dealing with similar (but not exact) outcomes, when incorporating them into a meta-analysis.

Slavin (1986) discusses the importance of evaluating not only the effect an article generates (within the scope of becoming part of the overall effect size), but also the importance of evaluating the value of the article itself. This last part, Slavin suggests, should be considered as the "methodological adequacy" of a study (1986, p. 7). That is, the reliability and validity of the measures they use within their own research is

something that can be coded within a meta-analysis. In turn, the rigor of a study is something that can be assessed, and quantified, when individual works are used in a meta-analysis.

Collectively, these assessments of methodological rigor form an index of methodological quality for a particular work. This value can then be used as an additional weighting system, providing a value level for individual works in a meta-analysis. As Lipsey and Wilson (2001, p. 10) suggest, when quality measures are implemented, it allows for the statistical adjustment of the overall input (weight) of each piece of research.

Bias of Published Materials. Another common attack on the utility of meta-analysis is the bias of only using articles that are published. This is also known as the "file drawer" problem (Rosenthal, 1979, p. 638). The problem suggested is that only articles with significant findings make their way into the journals. Therefore, there will only be significant findings that are reported, and nonsignificant findings tend to remain in the back of the file cabinet. Conceptually, according to the critics of meta-analysis, if one were to include all of those hypothetical pieces of research (ones with null findings) in with the published articles, it would essentially nullify the results of the meta-analysis (Pratt, 2002). However, it should be noted that this criticism affects any type of review, narratives included, but only seems to be given attention when discussing meta-analysis. Additionally, Rosenthal (1979) has developed a mathematical procedure to assess the "file drawer" issue. Known as a "Fail-Safe *N*," this estimate approximates the number of pieces of research need to be conducted (included in a meta-analysis), in order to nullify the results of a meta-analysis. Essentially, as Orwin (1983) relates, the standardized effect

size (overall *z*-score) is an accumulation of individual effects, which are divided by the square root of the number of studies involved. It is then possible to continue to add "0" value individual studies, in order to asses at what point the overall effect size becomes nonsignificant. Thus, the "Fail-safe *N*" becomes the actual number of null (file drawer) studies it takes to state that the particular body of research has no effect. This statistic is also calculated in this research, and will be presented in the results section.

While each of these critiques is not without cause, there have been numerous responses to them, suggesting that meta-analytic techniques do have utility. Whether in the rehabilitation field (Andrews, Zinger, Hoge, Bonta, Gendreau, & Cullen,1990; Gendreau, Little, & Goggin, 1996), or elsewhere, meta-analysis does appear to provide a synthesis of a vast amount of information. The advantages of this quantitative approach to understanding a particular research question is presented in the following section.

Benefits of Using Meta-Analyses

As described, one of the most useful products of a meta-analysis is the ability to produce a meaningful (weighted) numeric estimate of a body of research. This is due to the way in which it weights (standardizes) individual pieces of research, thus, creating an overall average of effect across studies. This is important, since in the past, ballot or vote-counting was a perceived method when attempting to weigh the validity of an issue (see Whitehead & Lab, 1989). This assessment of averaging can be likened to a T-test. Simplistically, it is completed by computing the combined effect:

1. $$M = \frac{\sum w_i T_i}{\sum w_i}$$

2. $$w_i = \frac{1}{\text{variance of } Ti}$$

In formula one, we see that the overall effect size of a distribution of studies (*M*) is a function of the summation of the weighted estimation of score differences of experimental to control groups, standardized by the variance (formula 2) of the studies included. This quantitative process of review provides a way of more systematically estimating the overall effect of a collection of research. Additionally, when the values of prior pieces of research are used, it allows for the replication of data, to include newer pieces of research.

Lends Itself to Replication. As stated, when a meta-analysis is performed, it allows for replication. This is due to the physical nature of the data that is produced. Like this meta-analysis, when individual pieces of research are coded, these values are normally displayed. This "open" format of research allows other researchers to double check the validity of the initial findings, and to extend the list with more recent works. Much like Green and Hall (1984, p.47) note, "the validity of quantitative reviews can be best evaluated by comparison with other reviews." When a meta-analysis is performed, the information is the available to be validated by other researchers. This naturally lends itself to replication. Other researchers are able to view findings of individual pieces of research, based on the parameters of each meta-analysis. In turn, researchers may add newer pieces since the last collection point, also another form of replication.

A large Volume of Research May Be Synthesized. Continuing with this concept of replication, a meta-analysis approach lends itself to assessing a large volume of information. As Lipsey and Wilson (2001) note, narrative reviews often struggle with comprehending a large volume of works. Instead, it is often left to the reviewer to select pieces that the individual finds to be valuable, thus, discarding many pieces of research.

Meta-analysis allows for a larger volume of works to be assessed by incorporating as many as can be discovered into a database. This quantitative conversion process of individual works allows a meta-analysis researcher to not have to decide which articles to discuss in a narrative review. This "all-in" ability of a meta-analysis provides a more precise estimate of the state of a particular research topic, allowing for researchers to see the breadth of studies involved (Pratt, 2002). Again, this coincides with the replication idea. As Pratt noted, since the information is open, or "public," it allows for the replication of information. Additionally, as answers to research questions are often malleable, new pieces of research can be added to existing works, promoting the idea of replication and continuation a disciplines assessment of a question (p. 26).

SAMPLE

As the title of this dissertation indicates, this is a systematic review of early life problems, and their impact on problematic behavior at a young age. More specific, this meta-analysis is reviewing research over a three-decade span (1976-2006), in the areas of prenatal, peri-natal, and postnatal complications/issues. The specific parameters for a study to be included in this meta-analysis are: 1) Work published (or made available) between 1976 and 2006, 2) includes some measure of prenatal, peri-natal, or postnatal complication (defined within this chapter), 3) has a minimum of two measurement waves that are in adolescence, 4) a comparison group, and 5) has an outcome measure of some form of aggression, delinquent, or other form of readily identifiable antisocial behavior. Collectively, these parameters created keywords that were used in searching through

databases for articles/pieces of research. As Lipsey & Wilson (2001) point out, this review of relevant research is typically the first step in generating the research in a particular area of study.

The literature searches for these items were performed in the following databases: Criminal Justice Abstracts, Criminal Justice Periodical Index, Dissertation and Thesis Abstracts, Google Scholar, PubMed, and PsycINFO. Additionally, when relevant articles were found, secondary searching was performed by reviewing the references section of relevant articles, in order attain a more comprehensive list. This is commonly known as the ancestry approach. After cross-listing items, several thousand documents were generated from the search process. Listings of these results across the search engines/platforms are found in appendix A. The next stage of the process involved a topical level review of these pieces of research, in order to establish which ones would ultimately be used within the meta-analysis. This decision process created two groups of research, a non-usable group and the usable group of research. The usable group of research consisted of 56 pieces of research, which were identified as fitting the larger parameters (listed above). From this list, the pieces of research were split into the three main categories, prenatal, peri-natal, and postnatal. The third stage of the process involved a systematic review of each of these pieces of research, at which time, the coding process began. Appendix B constitutes an operational description of the items that comprise the coding guide.

DEPENDENT VARIABLE

Aggression and Problematic Behavior Displays at a Young Age

For this research, the dependent variable is the assessment of problematic behavior. As previously discussed, maladaptive behavior, also considered as early aggressive behavior, has been consistently shown in the literature to be linked with later delinquent and adult antisocial behavioral problems (Moffitt, 1993; Olweus, 1979). Moreover, as Loeber (1991, 1992) posits, there is a high level of stability of antisocial behavior that may manifest (display) at relatively young ages. Additionally, for individuals displaying higher levels of antisocial behavior at an earlier point their life (age of onset), these behavioral patterns become increasingly more stable over time. Thus, this research uses the assessment of maladaptive behavior, specifically, overt types of aggressive behaviors.

Aggressive behavior was captured by a variety of assessment instruments, to include: the Child Behavior Checklist (CBCL), the Achenbach report form (a variation of the CBCL), the Rutter Childhood Behavior Questionnaire, the Richman Behavior Scale, The Mannheim Parent Interview (translated from German), the K-SADS, the Conners Parent Questionnaire, The Gordon Diagnostic Assessment, and 6 other composite scales (a combination of the above scales). Conceptually, these assessment instruments all capture an assessment of aggressive-maladaptive behavior. Additionally, these assessment instruments categorize youth, along the behavioral outcomes, into no-low risk, moderate risk, moderate-high risk, and a clinical or high-risk range (for most scales). In most cases, the research pieces used in the meta-analysis are comparing scores of

youth in the clinical ranges on these assessment instruments, and comparing them to another group across the scale of aggression, the behavioral outcome. As stated, in these assessment instruments, the behavioral problem is typically an overt display of aggression. However, a further discussion of the major assessment instruments used in this meta-analysis is warranted.

The Child Behavior Checklist. As Schmitz, Fulker, and Mrazek (1995) explain, the CBCL is one of the most widely used assessment instruments when tapping into behavioral problems children display. The CBCL itself originates from the work of Achenbach (1966), as part of a larger assessment system (Moretti & Obsuth, 2010). Achenbach further revised this instrument in his approach to a more thorough understanding of childhood adjustment (Achenbach, 1991). The CBCL measures problematic behaviors across 9 domains; however, for the focus of this research, only two of these are used, D*elinquent Behavior,* and *Aggressive Behavior*.

In fact, the CBCL has been parceled out into age-specific instruments, which do show high across-age stability (CBCL 1 ½ -5, and the CBCL/6-18). For example, Dutra, Campbell, and Westen (2004) consistently found significant cross-item correlations when assessing the CBCL in a hierarchical analysis. Most notably, the normed fit index (NFI) was .92 for aggressive behavior (NFI = .86 for delinquent behavior), suggesting that the overall reliability and validity of the assessment instrument is strong. Additionally, the CBCL has been used for over four decades, suggesting that it is a premier assessment instrument for measuring maladaptive behaviors.

The Rutter Childhood Behavior Questionnaire. Similar to the CBCL, the Rutter Childhood Behavior Questionnaire has been in use for close to 40 years (Rutter, 1967). It

is also a screening tool used to assess behavioral disorders in young children, and also includes a section on aggressive behaviors. Additionally, Hinshaw (1987) found that the domain of aggressive behavior/antisocial behavior in the CBQ was similar to the aggressive domain on the CBCL. Fombonne (1989) found similar results when comparing the two assessment instruments. He found a high correlation across the two instruments as a whole, and as high of a relationship as $r = .96$ within individual items.

The Richman Scale. While still focusing in on behavioral problems, the Richman scale incorporates a linguistic component within its causal processes towards problematic behaviors (Richman, Stevenson, & Graham, 1975). This included items such as having a temper, being difficult to control, and having an unhappy mood. According to Moffitt (1993), verbal ability, which may be affected by both environmental factors, as well as individual adversity, may have strong effects on the aggressive displays within youth. The verbal ability differences were found to be a consistent factor across the experimental groups in the Richman scale. In a follow up evaluation of these $N = 705$ families, Stevenson and Richman (1978, p. 311) found a strong pattern of verbal ability and behavioral patterns. They note that the child with language delay problems in their sample was roughly four times as likely to have behavioral problems. This relationship was noticeable in three-year old children, suggesting that the relationship may begin early in life, and have lasting effects.

The Conners Parent Questionnaire. This screening instrument also taps into the domain of overt aggressive behavior, and includes items such as stealing, bullying, fighting, destructive, and disobedient behaviors (Goyette et al., 1978). Similar to the CBCL, these items fall into a conduct problem domain, and regardless of sex or class

differences, was found to have a high degree of internal reliability across parent and teacher ratings (p. 235). This is important, as it demonstrates that underlying problems may not be rooted in environmental factors, rather within individual differences.

The Gordon Diagnostic Assessment. Modeled after the teacher rating scale (a component of the CBCL), the GDA focuses on the impulsivity levels of children. This instrument was found to have a high degree of reliability with the TRS, when assessing scholastic performance and impulsivity (McClure & Gordon, 1984). Additionally, Fried, Watkinson, and Gray (1992) found a strong relationship to impulsivity/behavioral problems and maternal substance. In a study of 190 children, they found a strong relationship $F(2, 123) = 3.6$ $p < .05$, in the responsivity of children whose mothers had smoked frequently during pregnancy (Fried et al., 1992, p. 304). Finally, in a factor analysis, Fried et al. found a that both the Gordon Diagnostic and the Conners Parent Questionnaire fell within the same scale, suggesting that the construct of the assessments are similar.

Relatedness of Instruments

The underlying construct of all of these instruments is problematic behavior. Specifically, it includes acts of aggressive behavior or conduct disorders. According to the American Psychiatric Association (*DSM-IV-TR*), the behavioral displays along all of these assessment instruments do fall within the domain of conduct disorder and antisocial personality disorder (2000). These have both been strongly related to delinquent behavior in the literature (Deckel, Hesselbrock, & Bauer, 1996). Deckel et al. found a high degree of consistency in behavioral problems and delinquency. Moreover, as they note, these

behavioral problems relate directly to neuropsychological functioning, and are recognizable at a very young age. Collectively, each of these instruments assesses components of aggressive behaviors, including: stealing, bullying, being destructive, and hurting others, which fall within 312.8 of the DSM-IV-TR. While each of these assessment instruments may use different verbiage, the construct is highly similar. Several of the studies include comparative instruments, as validity and reliability checks. While this does not guarantee that these questionnaires are tapping into the same domain, researchers such as Champion (2006) would assert that the high degree of reliability across instruments does support that they are tapping into the same idea. With relationships across instruments in the $r = .76$ to $r = .96$ range (Fombonne, 1989), it would support that these assessments do have an underlying theme of behavioral problems.

INDEPENDENT VARIABLES

The primary question in this research is, to what effect do prenatal, peri-natal, and postnatal birth complications have on behavioral problems early on in life? To this end, each of the three stages of early life serves as an independent variable, with a final question amassing all three categories:

1. What is the effect of prenatal conditions on early behavioral problems?
2. What is the effect of peri-natal complications on early behavioral problems?

3. What is the effect of postnatal complications on early behavioral problems?

4. What is the overall effect of early life issues on behavioral problems?

The first independent variable centers on issues before birth. The main item captured in this variable is the influence of the mother. That is, there are vast amounts of research on the deleterious effects on a fetus when the mother smokes, drinks, or uses/abuses drugs during pregnancy. When coding articles, if the inclusion parameters were met, articles were labeled as prenatal if they measured some form of substance use/abuse of the mother during any of the trimesters. Additionally, this independent variable is also broken down further into smoking, alcohol, drugs, or a combination of these substances.

The next independent variable focuses on complications during birth (peri-natal complications). Specifically, it includes measures of eclampsia/preeclampsia, meconium aspiration syndrome (MAS), premature birth, distressed birth, low or very-low birth weight, anoxia/hypoxia, or fetal asphyxia. Hodgins, Kratzer, and McNeil (2002) found support for the effect that obstetrical complications may have on the neural development of babies, concluding that these individuals may have a much higher risk of problematic behavior (both mental health and violent), due to these complications. Collectively, these complications all focus on the level and purity of oxygen intake within the baby during an important period, birth. Reduced oxygen intake during this vital stage may have damaging effects on healthy brain development. In turn, healthy brain development has been paramount to cognitive functioning and prosocial skill acquisition.

The last independent variable in this analysis is early life trauma, or postnatal complications. While this does include variables that are somewhat environmental in

nature, they have more of a physiological effect on youth. That is, the nature of the stimuli or toxin alters the physical composition of the body, thus altering the development of the brain. Through the alteration, behavioral differences occur. This is substantively different than adaptations of behavior due to inconsistent disciplining of youth, poor peer relations, or bad coping mechanisms. While they may affect behavioral outcomes, and it is argued here they do, the causal process of this independent variable works through physical changes in brain composition and structure.

Collectively, these variables assert change on the dependent measure, and are the core component of this dissertation. For a more detailed listing of the values of each of these independent measures, see Appendix B. In addition to these main variables are moderating variables, which are now discussed.

MODERATORS

Moderators, as Lipsey (2003) points out, are strengths of meta-analysis. Much like personal characteristics, they can be used to examine how an outcome, in this case an effect size, has influence on the overall effect size in a meta-analysis. Items such as sample demographics (gender, race, and age), methodological rigor of a sample (heterogeneity, attrition rate, etc...), and when a study was performed (published), can be included as moderators, in order to assess the overall value of each study. Appendix B contains a detailed list the moderators to be used, however, an overview of the main moderators follows.

Characteristics of Studies Included

As stated before, the majority of the research in this area stems from the medical and psychological fields. One moderator used is the discipline of the authors, specifically, the first author, and the number of authors. Also included as a potential moderator is the year (also collapsed into decades), which may have some bearing on the analytical quality (statistical power) of the research performed. Type of publication and peer-reviewed publication are also moderators assessed, for the overall value of contribution. Location of the study is another moderator used, which includes North America, Europe, South America, and other global zones.

Sample Demographics

As there is variation within the characteristics of types of studies, there is also variation within the samples themselves. Thus, variation in the sample demographics was coded. These include items such as gender of the sample (male, female, or mixed), race of the sample, span of age between time 1 and time *k*, and waves of measurement used in the study.

Methodological Quality Index

As discussed in the "apples to oranges" debate, one of the advantages of meta-analysis is that the scientific rigor of each study can be compiled into a metric, and this metric can be used as a weight for each of the individual studies (Hunter & Schmidt, 2004; Lipsey & Wilson, 2001). Also as noted, this dissertation does asses the

methodological rigor (quality) of each piece of research included. Specifically, these include: 1) comparative samples (control to experimental), 2) a detailed description of the sample overall, 3) a discussion of the biosocial measure used, 4) a discussion about the statistic/statistical technique used in the analysis, 5) response rate at time 1, in regards to the initial sample, and 6) response rate of the sample at time *k*. Each of these quality measures were coded individually (dichotomously), and a subsequent overall quality measure was then calculated (summation of the measures), in order to create a quality index.

STATISTICAL ANALYSIS

To assess the relationships of prenatal, peri-natal, and postnatal influence on behavior, a multistage process of evaluation was performed. First, the characteristics described above were garnered from each study. This included the characteristics of a study, the demographics of the samples, the independent variable(s), sample sizes, the statistic used within the study, moderators, and quality index measures. Next, an individual effect size for each study was calculated from the relationship of the independent to the dependent variable, or the difference of the experimental to control group (on the relationship of the independent to dependent variable). This was followed by a calculation of the mean or overall effect size for the collection of studies. Following this, a binomial effect size display was calculated. Next, an estimate of the fail-safe *N*, the *Q* statistic, and the I^2 were computed. Last, the inclusion of moderators on the model(s)

was performed, to assess their overall impact. These statistical techniques are now each discussed in detail.

Effect Sizes

The mathematical advantage of meta-analysis is that it forms a common metric across studies, in order for quantitative interpretation. For this dissertation, the *r* (Pearson's product-moment correlation coefficient) is used. This was chosen as the common metric because of the ease of interpret-ability for not only researchers, but also individuals in the field. Additionally, as Rosenthal (1984) and Lipsey and Wilson (2001) provide, there are easy calculations to convert the common metrics like *t*, *F*, and *X*2, into *r* values. However, since *r* is does not have a normal distribution, these values were converted into *z* scores, known as Fisher's *r* to *z* transformation (Fisher, 1921), and is calculated as:

$$Z_r = .5 \log_e \left[\frac{1+r}{1-r} \right]$$

However, during this process, *r* is also weighted by the sample size it represents. Lipsey and Wilson (2001, p. 64) display the formula as a process of three formulae:

1. $ES_{Zr} = .5 \log_e \left[\frac{1+r}{1-r} \right]$ 2. $SE_{Zr} = \frac{1}{\sqrt{n-3}}$ 3. $\varpi_{Zr} = \frac{1}{SE_r^2} = n-3$

Thus, the effect size *z* is the product of the transformation of *r* with the weighting of the sample. From here, a mean effect size may be calculated, which is the average of all of

the individual effect sizes (Lipsey & Wilson, 2001, p.114). Here, *i* is each effect size, ω represents the inverse variance weight of the effect sizes

$$\overline{ES} = \frac{\sum(\omega_i ES_i)}{\sum \omega_i}$$

Once all of the effect sizes and mean effect size are calculated, a confidence interval can be computed around the mean effect size. This is confidence interval plays an important role in the overall understanding of the question asked. Put simply, if the confidence interval includes a zero value (passes through zero in a distribution), the value obtained would be considered nonsignificant (p. 114). However, if the confidence interval does not include zero, the mean effect size is considered significant, and warrants further exploration. Below is the calculation for the confidence interval at a ($\alpha = .05$ level for 95% confidence interval).

$$\overline{ES}_{LL,UL} = ES \pm_{z(1-1.96)} \left(SE_{\overline{ES}}\right)$$

This is performed by multiplying the standard error of the mean effect size by the critical value for the 95% confidence region of a distribution (1.96). It is then either added to or subtracted from the mean effect size, providing the range of values we would expect 95% of all values this mean effect size to fall within on a normal distribution. Again, if this does not include a zero value, we would expect that this value is significant. Finally, while this is a useful statistic for the researcher, it is often not seen as meaningful for

practitioners. Thus, a transformation to a binomial effect size display allows this estimate to more easily compared, which is now discussed.

Finally, as Lipsey and Wilson (2001) relate, there are several advantages of meta-analysis. Yet, there are certainly problems or limitations within it use. For instance, as discussed earlier, there are potential areas where a meta-analysis, such as not capturing all studies on a subject matter, or the range of variation that is found within the studies that are procured. For these reasons and others, a discussion about the steps taken to assess these potential flaws follows.

Fail-Safe N

One such criticism that often arises within meta-analysis is that all studies on a topic are not included. Rosenthal (1979) discusses the problem of the inability to gather every single piece of research on a topic, particularly the pieces that are in "file drawers," never to be seen. However, there is a procedure that assess, to what effect, they influence a current meta-analysis. As discussed earlier, this is known as the Fail-Safe *N*. This measure tests how many studies it would take (that are not included) in order to produce a nonsignificant finding from a meta-analysis. Thus, the overall effect size would be no different from zero. Mathematically, as Wolf (1986) describes, it is computed as:

$$N_{fs.05} = \left(\frac{\Sigma Z}{1.645}\right)^2 - N$$

Essentially, it is the square of the summation of all individual effect sizes divided by the significance interval (α = .05 one-tailed) , all subtracted by a number of studies. This *N* number is then increased until the Fail-Safe *N* is no longer significant.

Orwin (1983) has also created an estimate of this statistic, so that it can be used with multiple metrics, and its formula is:

$$N_0 = \frac{n(\overline{E}_0 - \overline{E}_m)}{E_m - E_n}$$

Rosenberg (2005, p. 464) articulates Orwin's Fail-Safe *N* as: "*n* is the number of studies, $\bar{E}_0$ is the mean of the original *n* studies, $\bar{E}_n$ is the mean of the additional N_O studies, and $\bar{E}_m$ is the desired minimal mean effect size." For the purposes of this dissertation, it will be set to (α = .05). Both of these measures will be discussed during the results section.

The Q Statistic

As stated earlier, one of the critiques of meta-analysis is the "apples to oranges" debate (Glass, 1978). That is, meta-analysis is discounted because it is said to collapse differing outcomes together. Specifically, the debate is over how meta-analysis compiles differing independent and dependent relationships across studies, ultimately combining these into a single metric. Mathematically, this criticism is due to the non-standardized variation in these relationships across studies. As Rosenthal (1991) articulates, the variation across these studies is useful, as it allows researchers to understand "what" is causing the variation. Moreover, by understanding (and measuring) this variation, we are

also able to account for it with the calculations of overall relationships. Essentially, Glass (1978) and Rosenthal (1991) are discussing the heterogeneity of the studies used within a meta-analysis. Additionally, there is a calculation that captures this variation, known as the *Q* statistic.

Hedges and Vevea (1998) interpret it as the ratio of the "between-study to within-study variances, meaning that *Q* can be interpreted as a comparison of between to within-study variance" (p. 490). The *Q* statistic is calculated for each of the three relationships of independent to dependent variables, to assess the variability (heterogeneity) of the studies to each other. The formulaic expression for the *Q* statistic is:

$$Q = \sum_{i=1}^{k} (n_i - 3)(z_{ri} - \bar{z}_r)^2$$

Here, k (n_i) is equal to the total number of effect sizes subtracted from 3. The z_r is the transformed correlation coefficient for each study, and is subtracted from the mean effect size. This is then squared to produce the variance of effect sizes. The *Q* statistic fits on a chi-square distribution with degrees of freedom of k-1. If the value reaches significance, the distribution of effect sizes is assumed heterogeneous, and outliers are then identified by assessing their standard deviations on this distribution. Once removed, all values within the distribution are reported as equal, or homogeneous. Typically, results are reported both with outliers included, and subsequently omitted.

The I^2 Statistic

While the Q statistic displays the presence of heterogeneity within a set of studies, it does not necessarily display the lack of heterogeneity. Thus, a more recently developed statistic is incorporated in this dissertation, the I^2 statistic. As Huedo-Medina, Sanchez-Meca, Marin-Martinez, and Botella (2006) explain, it is important to estimate the between-study variability, in order to assess its impact on the overall model (p. 3). While, the Q statistic only provides information if it is present, it does not necessarily provide any information about the lack of variability (heterogeneity). Thus, the I^2 statistic was designed to achieve this concept. Essentially, it is a complement to the Q statistic (Huedo-Medina et al., 2006, p. 1). The I^2 statistic does this by subtracting the degrees of freedom of the Q statistic (k - 1) from the Q statistic itself, and dividing it also by the Q statistic. It is then multiplied by 100 to represent a percentage of the total variability in the effect sizes due to the heterogeneity of the between studies variability (p. 5). Computationally, it appears as:

$$I^2 = \frac{Q - (k-1)}{Q}$$

If the Q statistic is smaller than the degrees of freedom of the Q statistic [$Q \leq (k$ - 1)] then the denominator in the equation is set to zero. Thus, when looking at the overall dispersion, the I^2 statistic displays what proportion of the dispersion represents true dispersion, versus sampling error. Taken together, the Q and I^2 statistic allow a researcher

to get a more complete picture of the homogeneity and heterogeneity of effect sizes across the studies within a meta-analysis.

Influence of Moderators

As noted earlier, moderators can be included in order to detect methodological differences across studies, when calculating the overall effect size. As Cooper and Hedges (1994, p.537) relate, moderators are conditions that influence the amount of a relationship, but is not a consequence of the relationship. Additionally, Cooper (1998, p. 30) suggests that there are two types of moderators, "low-inference" and "high-inference." That is, how much judgment is needed by the researcher to compute the value of the moderator? For the purposes of this dissertation, only "low-inference" type moderators were coded. Thus, only measures that were common sense evident were used, such as characteristics of studies, demographics of the samples, and methodological quality. These were examined in conjunction with the main independent variables.

As the goal of this dissertation is to assess the effects of prenatal, peri-natal, and postnatal birth complications on early behavioral problems, these basic moderating (conditioning) effects were included. This was accomplished by estimating the confidence intervals around the mean effect sizes for each type of moderator. Once the confidence intervals are calculated, if they are overlapping within categories of the moderator, they are not seen as influencing the outcome of the effect size. Lipsey (2003) goes into extensive detail on moderators, not only how they influence a meta-analysis, but also how moderators may be inherently correlated with the outcome of interest, which

could be problematic. Therefore, if the confidence intervals are not overlapping, further investigation into the effect of the particular moderator is warranted.

CONCLUSION

Noted at the beginning of this chapter, there is an ever increasing presence of meta-analysis within the criminology/criminal justice discipline. And while it is not without its critics, there has certainly been strong support for its continued use within the field. Specifically, some argue that it does not capture all of the potential articles on a particular subject. Others argue that it takes too broad of an approach to an answer, mixing outcomes ("apples to oranges"), effectively measuring nothing comprehensible. This chapter has reviewed these critiques, providing clear support to the contrary. Moreover, its pervasiveness in this field and others over the last 30 plus years suggests that meta-analysis does have value within our discipline. It allows researchers to synthesize materials to create new understandings to questions. In turn, this opens the door for more discussion, and future questions. That is the intent of this dissertation.

The questions asked in this dissertation are not entirely unique. For instance, many have questioned the effects of smoking on a baby's health. Others have asked what effects low-birth weight has on the healthy development of a child. However, they are asked here in a new manner, which has not been done within the several thousand articles that were reviewed on the subject matter. That is, what kinds of effects do these problems have on a child's development early in life? More importantly, does this adversity change the trajectory of behavior for these individuals? Thus, the overall goal of this dissertation

is to synthesize our understanding of these issues, bringing a new approach to our understanding of how lives unravel. Finally, the use meta-analysis is used to attempt to answer these questions. Results of this meta-analysis are now presented.

CHAPTER IV

RESULTS

The primary goal of this dissertation was to discern whether early life problems had an effect on behavioral outcomes at a young age. Specifically, this research has attempted to answer this larger question through the following sub-questions: 1) What is the effect of prenatal conditions on early behavioral problems?, 2) What is the effect of peri-natal complications on early behavioral problems?, and 3)What is the effect of postnatal complications on early behavioral problems? From the review of the literature across multiple disciplines, 252 articles were found that contained at least two of the parameters for inclusion in this meta-analysis. These parameters included: 1) Work published (or made available) between 1976 and 2006, 2) Includes some measure of prenatal, peri-natal, or postnatal complication, 3) Has a minimum of two measurement waves in adolescence, 4) Has a comparison group, and 5) Has an outcome measure of some form of aggression, delinquent, or other form of readily identifiable antisocial behavior. To be considered for inclusion into this meta-analysis, a piece of research needed to pass all five inclusion parameters. In total, 56 (22 percent) pieces of research met these inclusion parameters. Across the three areas (prenatal, peri-natal, and postnatal), 30 effect sizes (53.6 percent) were calculated for the prenatal complications section, 15 (26.8 percent) were coded for the peri-natal section, and 11 (19.6 percent) were recorded in the postnatal section.

As there are three distinct areas, where the lives of individuals may be influenced by potential insults, this dissertation will provide four parts for analysis. This includes each of the three areas mentioned, along with a combined measure of overall influence on behavior by early life problems. The following tables provide descriptive statistics for the studies that were used in the prenatal analysis. It begins with a table describing the publications themselves, a descriptive statistics table for the samples used in the study, followed by a table describing how the studies were performed. The fourth table displays the methodological quality index measures used to assess the studies used in the analysis. This is repeated for the peri-natal section and the postnatal section.

PRENATAL INFLUENCES ON BEHAVIOR

Characteristics of the Publications Used

Table 4.1 displays the study characteristics of the pieces of research included in this prenatal section of the meta-analysis. Of the 30 effect sizes created, 60.0 percent came from the 1990s, 36.7 percent from 2000s, representing the majority of all effect sizes. A much smaller amount were found useable from the 1980s (1, 3.3 percent), and the zero came from the 1970s (0.0 percent). As to the type of publication, the vast majority (90.0 percent) came from journal publications, while the other 10 percent came from thesis or dissertations.

The major affiliation of the lead authors for these studies came from the academic world (73.3 percent). Medical facilities or hospitals represented 13.3 percent of author affiliations. Approximately 6.7 percent of the lead authors were affiliated with

governmental agencies, while the remaining two (also 6.7 percent) came from other agencies.

As for the number of authors for each publication, seven or more authors was the most common. This occurred 10 times (33.3 percent). The next most often recorded count of authors was the three authors. This was recorded eight times, representing 26.7 percent. Two authors were coded six times (20.0 percent). Articles with six authors and solo publications both occurred four times each, representing 13.3 percent for each. Lastly, publications with six authors were coded twice (6.7 percent).

Finally, the majority of studies (23) were performed in the North America (76.7 percent). Seven (23.3 percent) of the studies were published in Europe, and zero studies were derived from Asia (0.0 percent).

Table 4.1. Descriptive Statistics: Characteristics of the Publications used for Prenatal Influences on Problematic Behavior

Characteristic	*k*	%
Decade of Study		
1970		
1980	1	3.3
1990	18	60
2000	11	36.7
Study Type		
Journal	27	90.0
Theses/Dissertation	3	10.0
Lead Author Affiliation		
Academic	22	73.3
Medical/Hospital	4	13.3
Government	2	6.7
Other	2	6.7
Number of Authors		
1	4	13.3
2	6	20.0
3	8	26.7
4	4	13.3
5		
6	2	6.7
7 or more	10	33.3
Lead Author Discipline		
Psychology	14	46.7
Medical	11	36.7
Psychiatry	4	13.3
Other	1	3.3
Location of Study		
North America	23	76.7
Europe	7	23.3
Asia		

Characteristics of Samples

Multiple characteristics of the individual samples were also coded during the meta-analysis process. Specifically, age of the youth at T_1, age of the youth at T_k, difference of age from T_1 to T_k, sex, race, and type of sample were all recorded. Table 4.2 displays these descriptive statistics of the samples.

The majority of the initial waves for the prenatal section began at or around birth (within one month). This represented 96.7 percent of all samples used. The only other mean age that was used was three months, which had one effects size (3.3 percent). All other months of waves that were recorded fell into the second and third concept question within the dissertation (peri-natal and postnatal).

The second age measure recorded was the wave used to assess the problematic behavior, and was considered as the T_k wave. Seventy-two months was the most common time that wave *k* was collected, representing 23.3 percent (7 counts). Next, 30 months, 36 months, 48 months, 70 months, and 120 months were coded each two times. Each of these represents 6.7 percent of the sample of in the prenatal section. There were 10 age points that were recoded as the time *k* outcome one time. These age points were 24, 38, 50, 76, 82.8, 83, 84, 96, 168, and 189 months. Each of these age points represent 3.3 percent of the mean ages at the T_k wave. All other age points in the T_k wave were not found in this section (60, 77, 78, 79, 89, 108, 144, 156, 192, and 204 months).

The next characteristic of the samples displayed is the difference from T_1 to T_k (in years). This represents the length of time from the initial wave to the wave of collection for the problematic behavior in the prenatal section. The most common difference was from 6 – 6.9 years, which occurred 9 times across the samples (30 percent). The next

most occurring difference from T_1 to T_k was 7 – 7.9 years. This represented 16.7 percent of the samples (5 times). The third most occurring difference in time was for the 2 – 2.9 span, the 3 – 3.9 span and the 4 – 4.9 span, which each happened three times and represented 10.0 percent of the samples each. The span of 5 – 5.9 and 8 – 8.9 happened two times each, accounting for 6.7 percent of the samples each. Three year spans (8 – 8.9, 14 – 14.9, and 15 – 15.9) was each found one time and were responsible for 3.3 percent of the samples each. No other spans were coded in the prenatal section.

The sex of the samples was also coded. If a sample had more than 75 percent male, it was considered a male sample. This occurred in six of the samples, and accounted for 20.0 percent of the samples. The majority of samples (24) were considered mixed sex, and represented 80.0 percent of the samples.

Race of the samples was coded as Asian, Black, Caucasian, or mixed. It was determined a singular race sample if the sample was more than 85 percent of one category. Mixed race and Black were the most common type of sample, and each was recorded nine times. This accounted for 30.0 percent each (60.0 percent for both). The Caucasian race category was coded four times, which represents 13.3 percent of the samples. Lastly, the race could not be recorded in eight of the samples. This represents 26.7 percent of the samples for the prenatal section.

The final sample characteristic reported is sample type. The samples were of three types: twin studies, matched samples, or cohort studies. The most common of these was the matched sample study, which occurred 14 times (46.47 percent). Cohort Studies were the second most common type of sample, and there were 14 of these in the prenatal

section (40.0 percent). Twin studies were found four times and represented 13.7 percent of the types of samples used.

Table 4.2. Descriptive Statistics: Characteristics of the Samples used for Prenatal Influences on Problematic Behavior

Characteristic	*k*	%
Mean age at T_1 (in months)		
0-1	29	96.7
1.5		
2		
3	1	3.3
4		
5		
24		
36		
Mean age at T_k (in months)		
24	1	3.3
30	2	6.7
36	2	6.7
38	1	3.3
48	2	6.7
50	1	3.3
60		
70	2	6.7
72	7	23.3
76	1	3.3
77		
78		
79		
82.8	1	3.3
83	1	3.3
84	1	3.3
89		
96	1	3.3
108		
120	2	6.7
144		
156		
168	1	3.3
189	1	3.3
192		
204		

Table 4.2. Continued

Characteristic	*k*	%
Difference from T_1 to T_k (in years)		
0 - 1.9		
2 - 2.9	3	10.0
3 - 3.9	3	10.0
4 - 4.9	3	10.0
5 - 5.9	2	6.7
6 - 6.9	9	30.0
7 - 7.9	5	16.7
8 - 8.9	1	3.3
9 - 9.9		
10 - 10.9	2	6.7
13 - 13.9		
14 - 14.9	1	3.3
15 - 15.9	1	3.3
16 - 16.9		
17 - 17.9		
Sex		
More than 75% Male	6	20.0
Mixed	24	80.0
Race		
Asian		
Black	9	30.0
Caucasian	4	13.3
Mixed	9	30.0
Missing	8	26.7
Sample Type		
Twin Study	4	13.3
Matched Sample	14	46.7
Cohort Study	12	40.0

Characteristics of the Studies

Items that describe the studies themselves were also coded. Table 4.3 displays the characteristics of the studies used in this dissertation. These items include the subsection section components, age of the mother at birth, a parent measure, a parenting style measure, a socioeconomic status measure, the problem behavior assessed, the way it was assessed, if the measure was through official delinquency, and the behavior scale used for the effect size calculation.

In the prenatal section, the most common issue an effect size was recorded for was smoking, which was 11 (36.7 percent). Alcohol was recorded 5 times, as was drugs (16.7 percent each). Polysubstance use was recorded six times, representing 20 percent of the 15 effect sizes in the prenatal section. Lastly, teratogens, major depression, and a mixed prenatal panel were each used one time, representing 3.3 percent of the prenatal section (each).

As described in the methods chapter, items were coded to capture how samples were matched to each other within individual studies. Age of the mothers, number of parents, parenting style, and socioeconomic status measures were coded. The age of the mothers was parceled into four categories. Of the studies that reported a mean age for the mother, most often these studies had mothers whose mean age fell between 26 and 30 years (7 times, 23.3 percent). Four times the mean age of mothers was 25 and under (13.3 percent). Finally, For two of the studies had a mean age of the mother in the over 35 category (6.7 percent). However, there were multiple (17) studies where the mother's mean age was not disclosed (56.7 percent).

Number of parents was the next study characteristic to be coded. Twelve studies had one and two-parent families (40.0 percent). This was considered as mixed. Only one study (3.3 percent) recorded that all participants had two parents. The remainder of the studies in the prenatal section did not display the number of parents involved (17, 56.7 percent).

Parenting style was also sparsely coded. Only two studies recorded parenting styles, and it was displayed as mixed parenting. This accounted for 6.7 percent of the studies. The remaining studies in this section did not report the parenting style measure (28, 93.3 percent).

The last control measure coded was for socioeconomic status. It was coded 24 times (80.0 percent). Only 6 studies did not use or display a measure of socioeconomic status (20.0 percent).

As for the outcome measure (problematic behavior), it was coded in four distinct ways. First, there was the type of behavior recorded, which included aggression, delinquency, and externalizing behavior. Aggression was coded nine times, accounting for 30.0 percent of the prenatal section. Effect sizes using conduct problems as the outcome were coded seven times (23.3 percent). Delinquency was used three times, which was responsible for 10.0 percent of the effect sizes. Externalizing behavior problems was used six times, which represents 20.0 percent. Impulsivity/antisocial behavior was recorded twice (6.7 percent). Finally, a total composite score of externalizing and internalizing behavior problems was used three times, representing 10.0 percent.

The coding of the problem behavior was also coded for who was recording the scale or account of the behavior. Police arrests, court recording, or probation reporting was used four times, which accounts for 13.3 percent of the effect sizes. A self-report or parent-report approach was coded five times, representing 16.7 percent. The largest category was found with teacher, therapist, or counselor reporting, which was found 16 times (53.3 percent). A mixture reporting approach (or other approach) was found five times, representing 16.7 percent.

The level of the measure used was also recorded. Across the effect sizes a dichotomy or summed dichotomy measure was used 20 times, representing 66.7 percent of the effect sizes recorded. The other method was collapsed into a scale, frequency, or rate code for how the measure was assessed. It was recorded 10 times across the studies. This represents 33.3 percent of the 30 effect sizes calculated in the prenatal section.

Finally, the scales used for the creation of the effect sizes were also recorded. The Child Behavior Check List was used the most often (20 times, 66.7 percent). A variant of the CBCL (the Achenbach Teacher Form) was coded one time, and accounts for 3.3 percent of the effect sizes. A composite behavior scale was used two times (6.7 percent). The Conners Questionnaire was coded twice, accounting for 6.7 percent of the effect sizes. An independent form assessing behavioral problems was used three times, which represents 10.0 percent. The Richman Behavior Scale was used once, representing 3.3 percent of the effect sizes coded. No other scales were used in the recorded of problematic behavior in the prenatal section.

Table 4.3. Descriptive Statistics: Characteristics of the Studies used for Prenatal Influences on Problematic Behavior

Characteristic	*k*	%
Prenatal Issue		
Smoking	11	36.7
Alcohol	5	16.7
Drug	5	16.7
Teratogen	1	3.3
Polysubstance	6	20
Major Depression	1	3.3
Mixed	1	3.3
Mean Age of Mothers at Birth		
Up to 25	4	13.3
26 to 30	7	23.3
31-35		
Over 35	2	6.7
Missing	17	56.7
Number of Parents Included		
2	1	3.3
Mixed	12	40.0
Missing	17	56.7
Parenting Style Measure		
Noninvolved		
Mixed	2	6.7
Missing	28	93.3
SES Control Measure		
No	6	20.0
Yes	24	80.0

Table 4.3. Continued

Characteristic	*k*	%
Type of Problem Behavior Measured		
Aggression	9	30.0
Conduct Problems	7	23.3
Delinquency	3	10.0
Externalizing Behavior Problems	6	20.0
Impulsivity/Antisocial Behavior	2	6.7
Total External/Internal Behavior Problems	3	10.0
Problem Behavior Measure Source		
Police/Court/Probation Reported	4	13.3
Parent/Self-Reported	5	16.7
Teacher/Therapist Reported	16	53.3
Mixed/Other Reported	5	16.7
Level of Measure for Source		
Dichotomy/Summed Dichotomy	20	66.7
Scale/Frequency/Rate	10	33.3
Scale Used		
Child Behavior Check List	20	66.7
Achenbach Teacher Report	1	3.3
Composite Behavior Scale	2	6.7
Conners Questionnaire	2	6.7
Independent Form	3	10.0
K-Sads	1	3.3
Manheim Parent Form		
Richman Behaviors Scale	1	3.3
Rutter Behavior Scale		
Self Report Delinquency		

Methodological Quality Index Characteristics

The final table of characteristics reported was for the methodological quality index measures of the studies used. As previously discussed, these items can be used to weight the scientific rigor, or the worth of the studies used when calculating the effect sizes. This included a measure for the representativeness of a sample compared to the population it was in, and an adequate description of the subjects involved in the study. It also included a measure of a normal meta-analysis statistic, a description of the response rate at T_1, and a description of the overall amount of attrition that occurred within the sample in the final wave (T_k).

Two of the studies were counted in the not at all category for the representativeness of the samples, which accounted for 6.7 percent. The low category was found nine times (30.0 percent). The moderate category contained 11 studies, which represents 36.7 percent. Finally, the high category had three, which represents 10.0 percent of the studies.

A methodological quality index measure was also recorded if the study provided an adequate description of the subjects used within the sample. This included concepts such as age, race, gender, and a description about parents. All studies in the prenatal section had collected a majority of these items.

The normal meta-analytic statistics include T-test values, *F* scores, proportions, correlations, odds ratios, chi-squared values, Somer's *d,* and *p* values. All studies in this section used a normal statistic (30, 100.0 percent). Only two effect sizes were calculated from non-normal statistics for the overall model (which will be discussed in Table 4.28).

Finally, the amount of attrition from T_1 to T_k was recorded. Sixteen of the studies in this section had little attrition (0 – 10 percent). This represents 53.3 percent of the studies. Ten of the studies had between 10.1 and 20.0 percent attrition, which represents 33.3 percent of the studies. Three studies had 20.1 to 30.0 percent attrition (10.0 percent). Only one study had more than 50 percent attrition (3.3 percent).

Table 4.4. Descriptive Statistics: Methodological Quality Characteristics used for Prenatal Influences on Problematic Behavior

Characteristic	*k*	%
Representativeness of the Sample		
Not at all	2	6.7
Low	9	30.0
Moderate	11	36.7
High	3	10.0
Adequate Description of the Subjects		
No	0	0.0
Yes	30	100.0
Standard Meta-Analysis Statistic		
No	0	0.0
Yes	30	100.0
Response Rate at T_1		
No	1	3.3
Yes	29	96.7
Attrition at T_k		
More than 50% Attrition	1	3.3
40.1 - 50% Attrition		
30.1 - 40% Attrition		
20.1 - 30% Attrition	3	10.0
10.1 - 20% Attrition	10	33.3
0 - 10% Attrition	16	53.3

PERI-NATAL INFLUENCES ON BEHAVIOR

Characteristics of the Publications Used

Table 4.5 presents the information for the characteristics for the publications in the peri-natal section. Collectively, there were 15 effect sizes presented in this section. Approximately 46.7 percent of the publications (7) were published in the 1990 decade. Six publications were from the 2000s (40.0 percent). One study came from the 1980s, and one study came from the 1970s (each representing 6.7 percent). All 15 studies were from journals (100.0 percent).

The affiliation of the lead author was from academia six times (40.0 percent). While the majority of lead authors came from the medical field (9, 60.0 percent). The discipline of the authors varied across four categories. Roughly 20.0 percent of the time, the lead author discipline was psychology (3). The majority of the time, the lead author was from the medical field (6 times, 40.0 percent). Psychiatry had five, representing 33.3 percent. Only one time was there a lead author whose discipline was outside of these three areas (6.7 percent).

As for the number of authors, three authors, four authors, and seven or more authors were recorded three times each (20.0 percent per). Two authors and five authors were all found twice each (13.3 percent each). Six authors was coded one time (6.7 percent). One author was also coded one time (6.7 percent). Finally, the location of the publications was also documented. The majority of articles (8) came from Europe (53.3 percent). North America had six publications, which represents 40.0 percent of the

studies. Lastly, there was one study from Asia, which was 6.7 percent of the studies published that were used in the peri-natal section.

Table 4.5. Descriptive Statistics: Characteristics of the Publications used for Peri-natal Influences on Problematic Behavior		
Characteristic	***k***	**%**
Decade of Study		
1970	1	6.7
1980	1	6.7
1990	7	46.7
2000	6	40.0
Study Type		
Journal	15	100.0
Theses/Dissertation		
Lead Author Affiliation		
Academic	6	40.0
Medical/Hospital	9	60.0
Government		
Other		
Number of Authors		
1	1	6.7
2	2	13.3
3	3	20.0
4	3	20.0
5	2	13.3
6	1	6.7
7 or more	3	20.0
Lead Author Discipline		
Psychology	3	20
Medical	6	40
Psychiatry	5	33.3
Other	1	6.7
Location of Study		
North America	6	40
Europe	8	53.3
Asia	1	6.7

Characteristics of the Samples

The sample characteristics for the peri-natal influences on behavior, Table 4.6, offers descriptive statistics on the age of the youth involved, the sex, race, and the type of sample that was used. As with the previous section, the mean age of the sample was recorded in months. This was considered the T_1 wave. The vast majority of samples (14) were found in the zero to one-month category, representing 93.3 percent of the samples. The only other study in this section was coded at one and a half months (6.7 percent).

The T_k wave was also recorded in months. The most common outcome in this measure was found at 36 months (3 times, 20.0 percent). Seventy-two months and 84 months, each had two counts, representing 13.3 percent of the samples each. There were no other T_k wave outcomes that had more than one count. The following months, 60, 78, 79, 84, 89, 96, 108 156, and 204 months, all had one count. Each of these represents 6.7 percent of the sample of T_k wave outcomes in the peri-natal section.

The last measure of sample age was the difference from the T_1 wave to the T_k wave. This difference measure was coded in year spans, like 2 – 2.9 years. In the 3 – 3.9 span, there were three samples, which accounted for 20.0 percent. The span of 6 – 6.9 years also had three counts (20.0 percent). The age span of 7 – 7.9 was also recorded three times (20.0 percent). One span, (8 – 8.9) that had two counts (13.3 percent a piece). Finally, there were three spans that each had one count. Spans 5 -5.9, 9 – 9.9, and 17 – 17.9 each represent 6.7 percent of the samples in the peri-natal section.

The sex of the samples for this section was predominantly mixed. Ninety-three point three percent of the samples (14) were in the mixed category. Only one study (6.7 percent was a male sample. Race was also a mixed majority. Nine of the samples (60.0

percent) were mixed. The Asian Race was coded for one study (6.7 percent). Caucasians were predominant in two studies (13.3 percent). Finally, there were three studies where the race of the sample was not recorded (20.0 percent).

The final sample characteristic was the type of sample. The majority of samples in the peri-natal section fell into the cohort category. It was coded 10 times (66.7 percent). Matched samples were found four times in the studies within the peri-natal section (26.7 percent). Only one twin study (6.7 percent) was used in the peri-natal section.

Table 4.6. Descriptive Statistics: Characteristics of the Samples used for Peri-natal Influences on Problematic Behavior

Characteristic	*k*	%
Mean age at T_1 (in months)		
0-1	14	93.3
1.5	1	6.7
2		
3		
4		
5		
24		
36		
Mean age at T_k (in months)		
24		
30		
36	3	20.0
38		
48		
50		
60	1	6.7
70		
72	2	13.3
76		
77		
78	1	6.7
79	1	6.7
82.8		
83		
84	2	13.3
89	1	6.7
96	1	6.7
108	1	6.7
120		
144		
156	1	6.7
168		
189		
192		
204	1	6.7

Table 4.6. Continued

Characteristic	*k*	%
Difference from T_1 to T_k (in years)		
0 - 1.9		
2 - 2.9		
3 - 3.9	3	20.0
4 - 4.9		
5 - 5.9	1	6.7
6 - 6.9	3	20.0
7 - 7.9	3	20.0
8 - 8.9	2	13.3
9 - 9.9	1	6.7
10 - 10.9		
13 - 13.9	1	6.7
14 - 14.9		
15 - 15.9		
16 - 16.9		
17 - 17.9	1	6.7
Sex		
More than 75% Male	1	6.7
Mixed	14	93.3
Race		
Asian	1	6.7
Black		
Caucasian	2	13.3
Mixed	9	60.0
Missing	3	20.0
Sample Type		
Twin Study	1	6.7
Matched Sample	4	26.7
Cohort Study	10	66.7

Characteristics of the Studies

In the peri-natal section, there were three distinct areas where insults could influence the behavioral outcomes of the youth. Table 4.7 describes the characteristics of the studies used, which include the subsections of the peri-natal section, the mother's age at birth, number of parents, parenting style, and a socioeconomic status measure. The second half of this table (Table 4.7) details the way that the outcome measure was recorded.

The peri-natal section can be parceled into three categories, birth weight category (LBW, VLBW, and ELBW), the ear problem/minor physical anomalies category, and the obstetric complications category. The birth weight category was used nine times, attributing for 60.0 percent of the section total. The OME/MPA category was recorded twice (13.3 percent). Finally, the obstetric complications were recorded four times (26.7 percent).

The mean age of the mother at time of birth was separated into four categories (and a missing category). Twenty-five and younger was coded three times (20.0 percent). Only two studies were recorded in the 31 to 35 category. The mean age of the mother at time of birth was missing for 10 of the studies (66.7 percent).

The number of parents was mostly mixed. The mixed number of parents was coded six times (40.0 percent). Samples that reported two parents only occurred one time (6.7 percent). The remainder of the samples did not display their number of parents (8, 53.3 percent). The parenting style measure was similar. Only to studies reported a parenting style (mixed), which accounted for 13.3 percent. The remaining 13 studies did not report the style of parenting (86.7 percent).

The measure of socioeconomic status, as a control, was captured regularly. It was recorded 11 times, representing 73.3 percent of the samples in the peri-natal section. Only four studies did not use a socioeconomic status control variable (26.7 percent).

As for the outcome measure, problematic behavior, it was coded in four different manners. First, the type of problematic behavior was recorded. Aggression was coded four times, representing 26.7 percent of the type of behavioral problems measured. Conduct problems, as a type, was also recorded four times (26.7 percent). Delinquency was another measure that was coded four times (also 26.7 percent). Externalizing behavior problems was counted one time (6.7 percent). Finally, impulsivity/antisocial behavior was coded two times (13.3 percent).

The behavior problem was reported by different individuals across the studies. The most common way the problem behavior was reported was by a teacher, a therapist, or a counselor. This occurred seven times (46.7 percent). Parents or self-reporting occurred twice, representing 13.3 percent. Only one police report was used in the peri-natal section (6.7 percent). The remaining five times, it was reported by a mix of individuals (33.3 percent).

The source of the measure came in two fashions, a dichotomy (or summed dichotomy) and a continuous measure (scale, frequency, or a rate). As a dichotomy, the behavior problem was recorded nine times (66.7 percent). The continuous approach was found five times, representing 33.3 percent.

The last scale used to collect the measure of problem behaviors fell into six categories. The most common form was the Child Behavior Check List, which was recorded four times (26.7 percent). The Achenbach Teacher Report was used three times

to record the problematic behavior. This represented 20.0 percent of the ways the behavior was recorded. The Composite Behavior Scale was also recorded three times (20.0 percent). Two scales were used two times each; an independent behavior form, and the Rutter Behavior Scale, which each represented 13.3 percent of the ways that the behaviors were recorded. Lastly, the Richman Behaviors Scale was used one time, which was 6.7 percent of the way in which the problematic behavior was recorded in the peri-natal section.

Table 4.7. Descriptive Statistics: Characteristics of the Studies used for Peri-natal Influences on Problematic Behavior

Characteristic	*k*	%
Peri-natal Issue		
LBW/VLBW/ELBW	9	60.0
OME/MPA	2	13.3
Obstetric Complication	4	26.7
Mean Age of Mothers at Birth		
Up to 25	3	20.0
26 to 30		
31-35	2	13.3
Over 35		
Missing	10	66.7
Number of Parents Included		
2	1	6.7
Mixed	6	40.0
Missing	8	53.3
Parenting Style Measure		
Noninvolved		
Mixed	2	13.3
Missing	13	86.7
SES Control Measure		
No	4	26.7
Yes	11	73.3

Table 4.7. Continued

Characteristic	*k*	%
Type of Behavior Measured		
Aggression	4	26.7
Conduct Problems	4	26.7
Delinquency	4	26.7
Externalizing Behavior Problems	1	6.7
Impulsivity/Antisocial Behavior	2	13.3
Total External/Internal Behavior Problems		
Problem Behavior Measure Source		
Police/Court/Probation Reported	1	6.7
Parent/Self-Reported	2	13.3
Teacher/Therapist Reported	7	46.7
Mixed/Other Reported	5	33.3
Level of Measure for Source		
Dichotomy/Summed Dichotomy	10	66.7
Scale/Frequency/Rate	5	33.3
Scale Used		
Child Behavior Check List	4	26.7
Achenbach Teacher Report	3	20.0
Composite Behavior Scale	3	20.0
Conners Questionnaire		
Independent Form	2	13.3
K-Sads		
Manheim Parent Form		
Richman Behaviors Scale	1	6.7
Rutter Behavior Scale	2	13.3
Self-Report Delinquency		

Methodological Quality Index Characteristics

Table 4.8 provides the quality index measures for the peri-natal section. The representativeness of the sample was categorized into four areas, not at all, low, moderate, and a highly representative sample. The not at all was coded four times (26.7 percent). The representativeness of the sample was counted as low one time (6.7 percent). Moderate was counted three times, representing 200.0 percent. Most of the samples were considered representative, seven, and accounted for 46.7 percent of the samples.

An adequate description of the samples was the next quality index measure. A sample was considered as described thoroughly in 73.3 percent of the samples (11). Four of the studies were not well described within their respective articles (26.7 percent).

The next measure of quality was for the use of a normal meta-analytic statistic. About 80.0 percent of the effect sizes were calculated from normal statistics (12). Only three studies (20.0 percent) used a non-normal meta-analytic statistic in the calculation of the effect size. The response rate description at T_1 was also coded. The majority of samples (14) discussed the response rate in the first wave (93.3 percent). Only one study did not report the response rate in the first wave (6.7 percent).

The final quality index measure was attrition in the final wave (T_k). Only one study had high attrition in the T_k wave (6.7 percent). Three studies had lost between 10.1 and 20 percent (21.4 percent). The majority of studies had lost less than 10 percent of their samples (73.3 percent).

Table 4.8. Descriptive Statistics: Methodological Quality Characteristics used for Peri-natal Influences on Problematic Behavior

Characteristic	*k*	%
Representativeness of the Sample		
Not at all	4	26.7
Low	1	6.7
Moderate	3	20.0
High	7	46.7
Adequate Description of the Subjects		
No	4	26.7
Yes	11	73.3
Standard Meta-Analysis Statistic		
No	3	20.0
Yes	12	80.0
Response Rate at T_1		
No	1	6.7
Yes	14	93.3
Attrition at T_k		
More than 50% Attrition	1	6.7
40.1 - 50% Attrition		
30.1 - 40% Attrition		
20.1 - 30% Attrition		
10.1 - 20% Attrition	3	20.0
0 - 10% Attrition	11	73.3

POSTNATAL INFLUENCES ON BEHAVIOR

The third question asked in this dissertation is about postnatal complications and their impact on behavior problems in adolescence. The following four tables detail the publication characteristics, the sample characteristics, the study characteristics, and the quality measures used to answer this question.

Characteristics of the Publications Used

Table 4.9 begins with the description of the publication decade. The majority of publications came from the 2000s (7, 63.6 percent). Two publications came from the 1990s (18.2 percent). There was one publication that came from the 1980s and one publication that came from the 1970s (each at 9.1 percent). Additionally, almost 91 percent of the publications (90.9 percent) of the publications came from peer-reviewed journals. Only one publication was from a doctoral dissertation (9.1 percent).

The primary affiliation of the lead author was academic. This occurred nine times (81.8 percent). The remaining two publications (18.2 percent) listed a medical facility or hospital as the affiliation of the lead author. The discipline of the lead author for most of the publication in the postnatal section came from psychiatry. There were five of these, representing 45.5 percent of the publications. Psychology and medicine were each coded twice (18.2 percent per), for the lead author discipline. Two other publications had other disciplines listed as the lead author affiliation (also 18.2 percent).

As for the number of authors of the publications, three authors was the most common occurrence. This was recorded four times (36.4 percent). Four authors as the

number of authors was coded three times (27.3 percent). There was one publication with seven or more authors (9.1 percent). Two authors for a publication was also registered one time (9.1 percent). Finally, there was one count of a solo author publication (also 9.1 percent).

The publications mostly came from North America. This occurred nine times, representing 81.8 percent of the publications. Lastly, two publications came from Europe (18.2 percent) in the postnatal section.

Table 4.9. Descriptive Statistics: Characteristics of the Publications used for Postnatal Influences on Problematic Behavior

Characteristic	*k*	%
Decade of Study		
1970	1	9.1
1980	1	9.1
1990	2	18.2
2000	7	63.6
Study Type		
Journal	10	90.9
Theses/Dissertation	1	9.1
Lead Author Affiliation		
Academic	9	81.8
Medical/Hospital	2	18.2
Government		
Other		
Number of Authors		
1	1	9.1
2	1	9.1
3	4	36.4
4	3	27.3
5	1	9.1
6		
7 or more	1	9..1
Lead Author Discipline		
Psychology	2	18.2
Medical	2	18.2
Psychiatry	5	45.5
Other	2	18.2
Location of Study		
North America	9	81.8
Europe	2	18.2
Asia		

Characteristics of the Samples

Table 4.10 provides the descriptive statistics for the samples that were used in calculating effect sizes in the postnatal section. As with the other two sections, there were multiple measures of age. First, the mean age at T_1 was coded. The majority of samples had a mean age at time one of zero to one month. This occurred five times (45.5 percent). A mean age of two months was found one time, representing 9.1 percent of the samples. A mean age of four months was also coded one time (9.1 percent). A mean age of five was also found one time (9.1 percent). Twenty-four months was coded one time as well (also 9.1 percent). The last mean age recorded was 36 months. It was recorded two times, representing 18.2 percent of the samples in the postnatal section.

The mean age in the final wave (T_k) of a sample was also counted. The most common age (in months) counted in the final wave was 96 months. This age was recorded three times, accounting for 27.3 percent of the T_k wave ages. The age of 78 months was coded twice, representing 18.2 percent. Thirty months was found once (9.1 percent). Sixty months was also recorded one time, also representing 9.1 percent. Additionally, 72 months, 77 months, and 144 months were recorded one time each (9.1 percent a piece). The last T_k wave mean age was 192 months. It also was recorded one time, representing 9.1 percent of the samples collected in the postnatal section.

The next characteristic displayed in Table 4.10 is the difference from T_1 to T_k, shown in years. The most common span in this measure was for 6 – 6.9 years, which occurred four times (36.4 percent). The next most often occurring span was for the 8 – 8.9 span. It was recorded two times, representing 18.2 percent. There were five spans that were recorded one time each. These five were the 0 – 1.9 span, the 2 – 2.9 span, the 5 –

5.9 span, the 14 – 14.9 span, and the 16 – 16.9 span. Each of these five spans accounted for 9.1 percent of the coded differences of T_1 to T_k, shown in years.

The sex and race of the samples was also recorded. However, all 11 samples contained mixed gender in the postnatal section (100.0 percent). Samples that were considered Black were recorded two times (18.2 percent). Additionally, Caucasian samples were also coded twice (18.2 percent). The remaining seven samples were considered as mixed race, representing 63.6 percent of the samples.

The final sample characteristic recorded was for the type of sample itself. This included matched samples and cohort studies. Matched samples were found two times, accounting for 18.2 percent of the samples. The other nine samples, 81.8 percent, were cohort studies.

Table 4.10. Descriptive Statistics: Characteristics of the Samples used for Postnatal Influences on Problematic Behavior

Characteristic	*k*	%
Mean age at T_1 (in months)		
0-1	5	45.5
1.5		
2	1	9.1
3		
4	1	9.1
5	1	9.1
24	1	9.1
36	2	18.2
Mean age at T_k (in months)		
24		
30	1	9.1
36		
38		
48		
50		
60	1	9.1
70		
72	1	9.1
76		
77	1	9.1
78	2	18.2
79		
82.8		
83		
84		
89		
96	3	27.3
108		
120		
144	1	9.1
156		
168		
189		
192	1	9.1
204		

Table 4.10. Continued

Characteristic	*k*	%
Difference from T_1 to T_k (in years)		
0 - 1.9	1	9.1
2 - 2.9	1	9.1
3 - 3.9		
4 - 4.9		
5 - 5.9	1	9.1
6 - 6.9	4	36.4
7 - 7.9		
8 - 8.9	2	27.3
9 - 9.9		
10 - 10.9		
13 - 13.9		
14 - 14.9	1	9.1
15 - 15.9		
16 - 16.9	1	9.1
17 - 17.9		
Sex		
More than 75% Male		
Mixed	11	100
Race		
Asian		
Black	2	18.2
Caucasian	2	18.2
Mixed	7	63.6
Sample Type		
Twin Study		
Matched Sample	2	18.2
Cohort Study	9	81.8

Characteristics of the Studies

As with the other two prior sections, a table of the characteristics of the studies is presented. Table 4.11 provides information on the studies used in the postnatal section. The third section, postnatal, may be parceled into three subsections, all concerned with early life trauma. This includes brain damage and neurophysiological problems, teratogens and environmental toxins, and finally malnutrition and neglect/abuse. There were four studies that fit in the brain damage category, representing 36.4 percent. The malnutrition/neglect section also had four effect sizes calculated (36.4 percent). Finally, the toxins section had three effect sizes coded, representing 27.3 percent of this section.

The mean age of the mothers at birth was also recorded. The mean age of the mothers was recorded once in the 26 to 30 category. This represents 9.1 percent of the counts of mean age of the mother at birth. When the mean age of the mother at birth was between 32 and 35, it was found one time (also 9.1 percent). However, this was not reported in nine of the eleven studies (81.8 percent).

The number of parents in the study and the parenting style were two more measures collected. There were two studies that included two parents in their study designs. This accounts for 18.2 percent of the studies in the postnatal section. The remaining nine studies did not report the number of parents in the study. Within reporting the parents, there were two styles of parenting reported. Noninvolved was recorded one time, as was a count of a mixed measure of parenting. Each of these represents 9.1 percent of the studies. The other nine studies did not report the parenting style within the studies (81.8 percent).

Finally, if a measure of socioeconomic status was used as a control within the study, it was coded. Seven of the studies in this section had a socioeconomic status control measure (63.6 percent). The remaining four studies did not have a socioeconomic status control measure reported (36.4 percent).

The second half of Table 4.11 examines the four ways the outcome measure was assessed. The type of problem behavior was recorded across five categories. It was recorded as a measure of aggression twice (18.2 percent). Conduct problems was the most often way the problem behavior was recorded. This occurred four times, representing 36.4 percent. Delinquency was coded once, accounting for 9.1 percent of the studies. Externalizing behavior problems, on the CBCL, was recorded three times (27.3 percent). Finally, a measure of impulsivity/antisocial behavior was used one, accounting for 9.1 percent of the studies used in the postnatal section.

The source of the measure was coded in five categories. It was recorded through police, courts, or probation one time (9.1 percent). A parent-report or self-report method was used one time (also 9.1 percent). A teacher, therapist, or counselor approach was coded four times, representing 36.4 percent of the studies. Lastly, a mixed method was recorded five times (45.4 percent).

The level of the measure was also recorded. This was put into one of two categories, a dichotomy or summed dichotomy, and a scale, frequency, or rate category. The dichotomy category was found five times, accounting for 45.4 percent. The majority of times, the studies used a scale, frequency, or rate. This was coded six times across the studies (64.6 percent).

The last way in which the outcome measure was assessed was on the scale that was used to assess the problematic behavior. The most frequently used method in the postnatal section was the Rutter Behavior Scale. It was used four times, representing 36.4 percent of the studies. The second most often used method of collection was the Child Behavior Check List. This was used three times, for 27.3 percent. There were four other scales, each used one time. This included the Composite Behavior Scale, and independent form, the Manheim Parent Form, and a self-report measure of delinquency. Each of these represents 9.1 percent of the studies used in the postnatal section.

Table 4.11. Descriptive Statistics: Characteristics of the Studies used for Postnatal Influences on Problematic Behavior

Characteristic	*k*	%
Postnatal Issue		
Brain Damage/Neurophysiological	4	36.4
Environmental Toxins	3	27.2
Malnutrition/Neglect/Abuse	4	36.4
Mean Age of Mothers at Birth		
Up to 25		
26 to 30	1	9.1
31 to 35	1	9.1
Over 35		
Missing	9	81.8
Number of Parents Included		
2	2	18.2
Mixed		
Missing	9	81.8
Parenting Style Measure		
Noninvolved	1	9.1
Mixed	1	9.1
Missing	9	81.8
SES Control Measure		
No	4	36.4
Yes	7	63.6

Table 4.11. Continued

Characteristic	*k*	%
Type of Problem Behavior Measured		
Aggression	2	18.2
Conduct Problems	4	36.4
Delinquency	1	9.1
Externalizing Behavior Problems	3	27.3
Impulsivity/Antisocial Behavior	1	9.1
Total External/Internal Behavior Problems		
Problem Behavior Measure Source		
Police/Court/Probation Reported	1	9.1
Parent/Self-Reported	1	9.1
Teacher/Therapist/Counselor Reported	4	36.4
Mixed/Other Reported	5	45.4
Level of Measure for Source		
Dichotomy/Summed Dichotomy	5	45.4
Scale/Frequency/Rate	6	64.6
Scale Used		
Child Behavior Check List	3	27.3
Achenbach Teacher Report		
Composite Behavior Scale	1	9.1
Conners Questionnaire		
Independent Form	1	9.1
K-Sads		
Manheim Parent Form	1	9.1
Richman Behaviors Scale		
Rutter Behavior Scale	4	36.4
Self Report Delinquency	1	9.1

Methodological Quality Index Characteristics

The last table used to describe the postnatal section (Table 4.12) incorporates the methodological quality index measures. These include measures of the sample attrition, representativeness of the samples, and statistics used. There were three categories coded for the representativeness of the samples in the postnatal section. Four of the studies were coded as having low representativeness (36.4 percent). Three studies were recorded in the moderate representativeness category (27.3 percent). Lastly, four studies met the high category for representativeness (36.4 percent).

Almost all of the studies in this section had an adequate description of the subjects in the studies (10, 90.9 percent). Only one study did not adequately describe their sample. However, all eleven studies (100.0 percent) in the postnatal section used a normal meta-analytic statistic. These include items like T-test values, *F* scores, proportions, correlations, ratios, chi-squared values, Somer's *d,* and *p* values.

Additionally, almost all of the studies in this section (10) reported their response rate in the first wave of the study (T_1). This represents 90.9 percent of the studies. Only one study (9.1 percent) failed to report the response rate in the initial wave. As for the attrition of the studies in the outcome wave (T_k), most studies had less than 20 percent attrition. Seven studies reported having between 10.1 – 20 percent attrition (63.6 percent). Three studies reported zero – 10 percent attrition. There was only one study that was coded in between the 20.1 – 30.0 percent attrition range. This represents 9.1 percent of the studies used in the postnatal section.

Table 4.12. Descriptive Statistics: Methodological Quality Characteristics for Postnatal Influences on Problematic Behavior

Characteristic	*k*	%
Representativeness of the Sample		
Not at all		
Low	4	36.4
Moderate	3	27.3
High	4	36.4
Adequate Description of the Subjects		
No	1	9.1
Yes	10	90.9
Standard Meta-Analysis Statistic		
No	0	0.0
Yes	11	100.0
Response Rate at T_1		
No	1	9.1
Yes	10	90.9
Attrition at T_k		
More than 50% Attrition		
40.1 - 50% Attrition		
30.1 - 40% Attrition		
20.1 - 30% Attrition	1	9.1
10.1 - 20% Attrition	7	63.6
0 - 10% Attrition	3	27.3

MEAN EFFECT SIZES

As described in chapter III, the studies were quantified into effect sizes, which include individual effects sizes and overall effect sizes, represented in the tables as *r*, by section, along with an overall effect size. The effect sizes presented in this chapter all represent the level of effect a prenatal, peri-natal, or postnatal condition has on problematic behavior. Larger effect sizes reflect greater influence that the prenatal, peri-natal, or postnatal condition has on behavior. Table 4.13 displays the effect sizes for the first three questions posed in this dissertation. They were: 1) What is the effect of prenatal conditions on early behavioral problems?, 2) What is the effect of peri-natal complications on early behavioral problems?, and 3) What is the effect of postnatal complications on early behavioral problems? It also displays the 95 percent confidence interval around each of the mean effect sizes.

Additionally, chapter III also discussed the use of fixed-effects models and random-effects models. The fixed-effects models assume that there is no heterogeneity across the samples. In other words, it assumes that the studies all have similarly sized and similarly distributed samples. The random-effects models do not have this assumption. The *Q* Statistic is used to assess the spread of the distributions of the samples. The *Q* statistic fits on a chi-square distribution with degrees of freedom of *k*-1. If the value reaches significance, the distribution of effect sizes is assumed heterogeneous, and outliers are then identified by assessing their standard deviations on this distribution. This is usually three standard deviations and above. Once removed, all values within the distribution are reported as equal, or homogeneous. Typically, results are reported both

with outliers included, and subsequently omitted. Therefore, Table 4.13 presents both fixed-effects and random-effects models. Additionally, Table 4.13 displays the weighted mean effect size (Z^+) and the 95 percent confidence intervals around each weighted mean effect size.

Prenatal Effects on Behavior

Thirty effect sizes were included to produce a mean effect size of $r = .231$ (sd = .109), and a weighted mean effect size of .236 for the random-effects model. Neither of the confidence intervals include zero. This suggests that the effect sizes are significant, and do support that prenatal effects do influence problematic behavior. Additionally, the confidence intervals for the random-effects models and the fixed effects models overlap, suggesting they are not significantly different from each other. The *Q* statistic for the fixed-effects model was significant, thus outliers were removed. After removing the effect sizes that were $\pm$ 3 standard deviations from the weighted mean effect size, the mean effect size was still non-significantly different from the random-effects model. Thus, the random effects model is used in future calculations, as it is not bound by the sample homogeneity assumption.

Peri-Natal Effects on Behavior

The second question in this dissertation was also supported. Table 4.13 also displays the mean effect size and weighted mean effect sizes for the random-effects model, and the fixed-effects model for peri-natal effects on behavior. Similar to the prenatal section, there were no confidence intervals in the peri-natal section that included

a value of zero. Therefore, the statement of peri-natal insults effecting behavior is supported. The random-effects model had a mean effect size of r = .200, and a weighted mean effect size of .202. The fixed-effects model had a weighted mean effect size .165. The confidence intervals for the weighted mean effects sizes of the two models did overlap. This does suggest that they are not different from each other. In fact, the confidence of the fixed-effects model (CI = .151 to .178) was completely within the confidence interval of the random-effects model (CI = .107 to .298). The Q statistic for this model was significant, so outliers were removed. The weighted mean effect size of the reduced model (.093) was smaller than the random effects-model. However, the two confidence intervals did overlap, suggesting that they are not different, significantly. Therefore, the random-effects model was chosen as the best representative of the peri-natal section.

Postnatal Effects on Behavior

The last model in Table 4.13 represents the postnatal effect on behavior. Since none of the confidence intervals in the three iterations included zero, the third question in the dissertation was also supported. The mean effect size for the random-effects model was r =.265, and the weighted mean effect size was .272. Also in a positive direction, it does suggest that postnatal problems do affect behavioral problems at an early age. Additionally, after adjusting for the significant outliers in the fixed-effects model, the reduced iteration had a weighted confidence interval that was contained within the confidence interval of the weighted mean effect size for the random-effects model. Thus, it was also chosen as the most appropriate approach for the postnatal section.

Table 4.13. Mean Effect Sizes

Section	*k*	N	*r*	sd	95%CI	Z^+	95%CI	*Q*
Prenatal Effects on Problematic Behavior								
Random Effects	30	18,358	.231	.109	.194 - .268	.236	.197 - .275	--
Fixed Effects	30	18,358	.188	.038	.174 - .202	.231	.176 - .205	.000
Outliers removed	22	2,947	.282	.089	.248 - .345	.290	.254 - .327	.275
Peri-Natal Effects on Problematic Behavior								
Random Effects	15	21,542	.200	.189	.106 - .289	.202	.107 - .298	--
Fixed Effects	15	21,542	.163	.027	.150 - .176	.165	.151 - .178	.000
Outliers removed	10	4,266	.092	.047	.063 - .125	.093	.063 - .123	.385
Postnatal Effects on Problematic Behavior								
Random Effects	11	15,944	.265	.095	.097 - .419	.272	.097 - .446	--
Fixed Effects	11	15,944	.429	.026	.417 - .442	.459	.443 - .475	.000
Outliers removed	6	1,693	.171	.058	.120 - .242	.173	.125 - 247	.176

Note: The *Q* statistic was significant in all three fixed-effects models. The fixed-effects models are also presented with outliers (sd = $\pm$ 3) removed.

MODERATORS

To examine if there was significant influence by the moderators described in Tables 4.1 through 4.12, the mean effect size and 95 percent confidence intervals will be presented for each. If confidence intervals for categories within a moderator do not overlap, they are considered to be significantly influencing the overall relationship between the independent variable (prenatal, peri-natal, and postnatal insults) and the dependent variable. Moderator influence was examined across all four categories, the publication characteristics, the sample characteristics, the study characteristics, and within the quality index measures. This was performed for each of the three research questions.

However, if there were moderators with low *k* values, the moderator groups were collapsed in order to provide more stability for the represented effect sizes (to increase *k* for categories within the moderators), as well as providing meaningful differences within each moderator. Some moderators were not reported, due to the overall lack of numbers within *k* categories.

Publication Moderators for Prenatal Influence

Table 4.14 details the impact of the publication characteristics on the influence of prenatal characteristics on behavioral problems. The first publication characteristics, the decade of study was collapsed into two categories, prior to 2000, and 2000 to 2006. There were no significant differences found. Newer publications were no more influential (r = .236, CI = .198 to .274) than older publications (r = .232, CI = .181 to .281) as a

moderator. The lead author affiliation was also found to have no overall significant differences, as the confidence intervals for each of these two categories (Academic, versus Non-Academic) also overlapped.

As for the number of authors, this moderator was collapsed into two groups. These groups were not significantly different from each other, as both confidence intervals overlapped (CI = .152 to .248, and CI = .214 to .301). This was also the case for lead author discipline. All four confidence intervals overlapped, suggesting no significant differences based on discipline.

Finally, the location characteristic also had no significant differences. The confidence interval for the North America category (CI = .214 to .312) overlapped with the confidence interval for the Europe category (CI = .111 to .242). This suggests that there are no significant differences across locations when using location as a moderator for the effects of prenatal insults on the impact of problematic behavior.

Table 4.14. Effect Sizes: Characteristics of the Publications used for Prenatal Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Decade of Study				
Prior to 2000	19	14,065	.232	.181 - .281
2000 and up	11	4,293	.236	.198 - .274
Lead Author Affiliation				
Academic	22	13,506	.218	.172 - .262
Non-Academic	8	4,582	.265	.200 - .329
Number of Authors				
Up to 3	12	8,398	.201	.152 - .248
4 or more	18	9,960	.258	.214 - .301
Lead Author Discipline				
Psychology	14	7,941	.225	.162 - .287
Medical	11	9,645	.231	.180 - .281
Psychiatry	4	727	.189	.189 - .326
Other	1	45	.349	.062 - .583
Location of Study				
North America	23	7,038	.178	.214 - .312
Europe	7	11,320	.264	.111 - .242

Sample Moderators on Prenatal Influence

The next table (Table 4.15) presents the moderating effects of the sample. Specifically, did the collection time, or the final wave time have an influence on the impact of prenatal influence on behavioral problems? Additionally, Table 4.15 examines sample characteristics such as sex, race, and sample type.

The first moderator in this section was the mean age of the youth (T_1). Only two categories of effect sizes recorded within this moderator. The confidence intervals for the mean effect sizes were .195 to .271 for the newborn category (within one month of birth), and .064 to .310 for the after one month. Since these two confidence intervals overlap, they are not considered significantly different.

The second moderator in Table 4.15 is mean age at the final wave of data collection (T_k). As with the first measure (T_1), there were no confidence intervals that stood alone (all confidence intervals overlapped). Additionally, to assess whether or not the difference of T_1 to T_k had an impact on the influence of prenatal conditions and problematic behavior, the mean effects sizes for this difference were also reported. These were collapsed into three categories in order to provide more stable effect size estimates. As with the other age moderators, there were no significant differences in the overall spread of the confidence intervals, as all three confidence intervals overlapped each other.

The sex of the samples was recorded in two categories, more than 75% percent male, or mixed. The mean effect size was larger for the majority male samples (r = .296, versus r = .214). However, the confidence intervals of the two categories of sex overlapped (CI = .219 - .370, and CI =.174 - .254, respectively). Therefore, the influence of the samples was significantly more influence by either category.

The race of the samples also showed no significant differences across groups. The Black category produced the largest effect size (r = .276), but it was not significantly different from any other group (overlapping confidence intervals). Therefore, no one race had a significant impact on the relationship of prenatal insults on problematic behavior.

There were significant differences in the type of sample collected. The matched sample category confidence interval was not overlapping the other two category confidence intervals (CI = .275 - .383), suggesting that a matched sample approach could provide a more substantive relationship of prenatal insults to behavior problems. Additionally, this was also the strongest mean effect size within this moderator (r = .330), suggesting that a matched sample approach could provide a better estimate of the influence of early life insults, and their influence on behavioral outcomes. However, caution must be used here, as the overall number of effect sizes in another category of this moderator are smaller, which may bias the results.

Table 4.15. Effect Sizes: Characteristics of the Samples used for Prenatal Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Mean age at T_1 (in months)				
Birth Month	29	18,122	.234	.195 - .271
Over 1 month	1	236	.190	.064 - .310
Mean age at T_k (in months)				
24 - 60 months	9	4,044	.187	.118 - .255
61 - 96 months	17	8,059	.252	.198 - .304
97 months and up	4	6,255	.270	.168 - .367
Difference from T_1 to T_k (in years)				
0 - 5 years	9	7,735	.254	.175 - .330
6 - 11 years	17	9,104	.223	.171 - .274
12 - 17 years	4	1,519	.267	.113 - .409
Sex				
More than 75% Male	6	1,275	.296	.219 - .370
Mixed	24	17,083	.214	.174 - .254
Race				
Black	9	1,768	.276	.195 - .352
Caucasian	4	7,381	.192	.099 - .282
Mixed	9	4,870	.222	.152 - .289
Missing	8	4,339	.250	.153 - .343
Sample Type				
Twin Study	4	5,171	.142	.042 - .240
Matched Sample	14	1,132	.330	.275 - .383
Cohort Study	12	12,055	.203	.158 - .246

Study Moderators for Prenatal Influence

Table 4.16 displays the results of the study moderators on the influence of prenatal insults, and how they affect behavioral problems. The first moderator is the subsection of prenatal insults. Smoking was the most often type of study found (k = 11), and had a mean effect size of .176. The confidence interval of the smoking category was relatively narrow, suggesting it is a highly accurate estimate of the effects of smoking on problem behavior (CI = .161 - .191). There was a significant difference found between smoking and drugs. The confidence interval for drug effects was .226 to .352. Since these two confidence intervals do not overlap, the effects of drug use may be significantly stronger than smoking. However, drug use was not significantly stronger than any of the other categories (alcohol, major depression, or mixed prenatal insults).

The mean age of the mother at time of birth was also recorded. It was classified into two groups, up to 30 years old, and over 30 (the missing category was not reported). The confidence intervals for the categories overlapped, suggesting that one age category is not more problematic than another category.

There was a significant difference found in the socioeconomic moderator. When studies incorporated an SES control, the mean effect size was r = .204. When there was no control for socioeconomic conditions, the mean effect was r = .401. Additionally, these two confidence intervals did not overlap, supporting the significant difference. Moreover, this does support the position that environmental factors, like socioeconomic status can have an influence on behavioral outcomes.

The way in which the problematic behavior was assessed did have one significant finding. When assessed as impulsivity or antisocial behaviors, the mean effect size was r

=.431, with a confidence interval of .311 to .537. This method of assessing problematic behavior was significantly different from all other methods (a measure of aggression, externalizing behaviors, etc…). However, caution is warranted here, as this measure was based on only two studies, and is susceptible to instability of an estimate, when comparing it to the other categories of this moderator ($k = 2$, N = 203).

The person or agency reporting the measure of problematic behavior had no significant difference across the groups. Although the teacher, therapist, or counselor category did have the largest effect size ($r = .273$), all confidence intervals in the category overlapped. This does speak to the universality of problematic behavior. That is, regardless of who is recording the behaviors, there is great consistency in the understanding of problematic behavior. The level of measurement of the outcome variable also produced no significant differences. Using a dichotomy or a scalar version of problematic behaviors made little difference.

Finally, there were also no significant differences across the scales used to assess the problematic behavior. The Child behavior Check List did have the most precise estimate across the groups, with a confidence interval of .171 to .261. This suggests the instrument does good job at assessing problematic behaviors.

Table 4.16. Effect Sizes: Characteristics of the Studies Used for Prenatal Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Prenatal Issue				
Smoking	11	15,657	.176	.161 - .191
Alcohol	5	900	.222	.159 - .284
Drug	5	832	.290	.226 - .352
Polysubstance	6	803	.256	.190 - .320
Major Depression	1	43	.380	.090 - .611
Mixed	1	123	.251	.075 - .411
Mean Age of Mothers at Birth				
Up to 30	11	11,131	.216	.163 - .266
Over 30	2	134	.306	.142 - .454
SES Control Measure				
No	6	453	.401	.320 - .477
Yes	24	17,905	.204	.167 - .240
Type of Problem Behavior Measured				
Aggression	9	3,186	.162	.131 - .193
Conduct Problems	7	8,159	.228	.207 - .248
Delinquency	3	2,665	.114	.076 - .151
Externalizing Behavior Problems	6	1,753	.150	.103 - .195
Impulsivity/Antisocial Behavior	2	203	.431	.311 - .537
Total Externalizing/Internalizing Problems	3	1,762	.180	.134 - .225
Problem Behavior Measure Source				
Police/Court/Probation Reported	4	8,272	.0207	.113 - .297
Parent/Self-Reported	5	5,123	.197	.109 - .282
Teacher/Therapist Reported	16	3,383	.273	.193 - 349
Mixed/Other Reported	5	518	.247	.164 - .327
Level of Measure for Source				
Dichotomy/Summed Dichotomy	20	10,581	.243	.195 - .290
Scale/Frequency/Rate	10	7,777	.219	.152 - .284

Table 4.16. Continued

Characteristic	*k*	N	r	95%CI
Scale Used				
Child Behavior Check List	20	15,322	.217	.171 - .261
Achenbach Teacher Report	1	236	.190	.064 - .310
Composite Behavior Scale	2	237	.238	.063 - .399
Conners Questionnaire	2	147	.313	.158 - .453
Independent Form	3	2,161	.329	.079 - .541
K-Sads	1	129	.279	.112 - .431
Manheim Parent Form	0	--	--	--
Richman Behaviors Scale	1	126	.387	.228 - .527
Rutter Behavior Scale	0	--	--	--
Self-Report Delinquency	0	--	--	--

Quality Indicators on Prenatal Influence

The last table of moderators (Table 4.17) for the prenatal section is the quality index measures. These include representativeness of the sample, and attrition of the sample at T_k of the sample. Representativeness of the sample had no influence on the relationship of prenatal conditions and behavior. Both of the category confidence intervals overlapped.

Attrition was collapsed into two groups, 10% attrition and less, and more than 10% attrition. The confidence intervals for these two moderator categories overlapped (CI = .175 to .297, and CI = .185 to .276), suggesting that there was no significant influence of attrition of the sample on the relationship of prenatal influences on behavior.

Table 4.17. Descriptive Statistics: Methodological Quality Characteristics for Prenatal Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Representativeness of the Sample				
Not at all to Low	16	11,789	.216	.193 - .298
Moderate to High	14	6,569	.246	.163 - .268
Attrition at T*k*				
More than 10% Attrition	14	6,776	.237	.175 - .297
0 - 10% Attrition	16	11,582	.231	.185 - .276

Publication Moderators on Peri-Natal Influences

Table 4.18 details the effect of publication moderators, and how they impact the relationship of peri-natal complications on problematic behavior. The decade of study was again collapsed into two categories, prior to 2000 and 2000 to 2006. As both confidence intervals overlapped, these two moderator categories are not considered different.

Similar to the prenatal section, the affiliation of the lead author confidence intervals contained two categories, academic and non-academic. Since there was overlap with their respective confidence intervals (CI = .081 to .253, versus CI = .090 to .350), no significant differences were found. This suggests that there is no significant impact of where the lead author is affiliated. As for the discipline of the author, there were no significant differences, as all of the confidence intervals across the four categories overlapped. There was also one category (psychology) that included a value of zero, suggesting no significant influence of this characteristic.

The number of authors also did not produce significant differences. As with the prior author numbers (in the prenatal section), this was collapsed into two groups (up to 3 authors, and 4 or more authors). The confidence intervals of these two categories were very similar, suggesting no impact from this moderator.

Lastly, there were significant differences across the location of studies. The publication from Asia was significantly higher than (r = .385) than the other two locations, as there was no overlap in confidence intervals. However, this was based on a k of one study, thus, this should be assessed with caution, as it may be an unstable estimate due to the lack of studies in this category.

Table 4.18. Effect Sizes: Characteristics of the Publications used for Peri-natal Influences on Problematic Behavior				
Moderator	***k***	**N**	**r**	**95%CI**
Decade of Study				
Prior to 2000	9	4,269	.198	.093 - .335
2000 to 2006	6	16,424	.217	.030 - .354
Lead Author Affiliation				
Academic	9	13,525	.168	.081 - .253
Non-Academic	6	7,168	.224	.090 - .350
Number of Authors				
Up to 3	6	15,198	.259	.082 - .420
4 or more	9	5,495	.177	.041 - .306
Lead Author Discipline				
Psychology	3	1,477	.116	.019 - .246
Medical	6	14,869	.203	.022 - .372
Psychiatry	5	5,137	.234	.048 - .405
Other	1	59	.320	.070 - .532
Location of Study				
North America	6	3,052	.132	.065 - .197
Europe	8	15,524	.210	.063 - .348
Asia	1	2,966	.385	.354 - .416

Sample Moderators on Peri-Natal Influence

Age at T_1 had no significant differences within the two categories. Both confidence intervals were overlapping. This was also the case for the mean age at T_k measure. All three confidence intervals for this measure were also overlapping, supporting no moderator influence.

The difference of T_1 to T_k as a measure also had similar findings. As this was collapsed the same as for the prenatal measure (0 to 5 years, 6 to 11 years, and 122-17 years), all three confidence intervals overlapped.

The sex of the samples did not significantly differ. Moreover, as the male samples had a confidence interval that overlapped zero (CI = -.001 - .132), it was not considered significant. The two categories also had overlapping confidence intervals, suggesting that sex was not a moderating characteristic. The race of the samples was similar. The Caucasian category confidence interval crossed zero (CI = -.015 - .1477). However, the Asian category for race did have a significantly larger effect size than the other categories (r = .385), again suggesting that this study had a more significant impact on overall.

The type of sample also had a confidence interval that crossed zero (twin studies), and all three confidence intervals were overlapping. This suggests that the sample types did not significantly differ from one another.

Table 4.19. Effect Sizes: Characteristics of the Samples used for Peri-natal Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Mean age at T_1 (in months)				
Birth Month	14	21,392	.198	.101 - .292
Over 1 month	1	150	.222	.064 - .369
Mean age at T_k (in months)				
24 - 60 months	4	13,162	.198	.078 - .312
61 - 96 months	8	4,202	.203	.045 - .351
97 months and up	3	4,178	.189	.065 - .419
Difference from T_1 to T_k (in years)				
0 - 5 years	4	4,030	.27	.043 - .470
6 - 11 years	10	167,711	.189	.077 - .297
12 - 17 years	1	801	.072	.003 - .141
Sex				
More than 75% Male	1	849	.066	-.001 - .132
Mixed	14	20,693	.210	.111 - .306
Race				
Asian	1	2,966	.385	.354 - .416
Black				
Caucasian	2	582	.066	-.015 - .147
Mixed	9	17,741	.163	.057 - .265
Missing	3	253	.374	.132 - .573
Sample Type				
Twin Study	1	525	.076	-.010 - .160
Matched Sample	4	949	.248	.090 - .394
Cohort Study	10	20,068	.191	.071 - .306

Study Moderators on Peri-Natal influence

When parceling the studies out across the sub-types of peri-natal influence, there were no significant differences found. All three of the confidence intervals overlapped, and none of three confidence interval ranges included a zero. This suggests that the three categories of assessing peri-natal influence are similar.

Additionally, there were no significant differences in mean effect size when socioeconomic conditions were controlled for (CI = .050 to .265), versus when they were not (CI = .176 to .447). The mean effect size for the influence of peri-natal impacts was smaller when there was a measure of SES included, suggesting that environmental conditions may influence the overall outcome of peri-natal influences on behavior.

The way in which the outcome was measured also had no significant differences across the categories. When the outcome measure assessed conduct problems, it did have the largest mean effect size (r = .345), but this was not significantly different from any of the other measures.

When the problem behavior was recorded by the police, courts or probation, there was a significantly higher influence from peri-natal complications (r = .385, CI = .354 - .416). This was significantly different from all other categories, including parent-reported or self-reported, teacher reported, or other methods. This could be due to the finite nature of police reports (a dichotomy of an official report, versus a behavioral scale). Although when assessing the difference between dichotomy scores and scales used to measure the outcome, there were no significant differences found. Both styles of measuring the outcome had overlapping confidence intervals, suggesting no substantive differences between the groups.

The last way in which the outcome measure was reported was the assessment form. As with many other moderating measures, no significant differences were found across the different categories. For instance, the Child Behavior Check List (CI = .044 - .378) was not significantly difference from the Richman Behavior Scales (CI = .064 - .369).

Table 4.20. Effect Sizes: Characteristics of the Studies Used for Peri-natal Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Peri-natal Issue				
LBW/VLBW/ELBW	9	7,444	.232	.104 - .354
OME/MPA	2	12,694	.131	.011 - .250
Obstetric Complication	4	1,404	.138	.050 - .183
SES Control Measure				
No	4	662	.318	.176 - .447
Yes	11	20,880	.159	.050 - .265
Type of Problem Behavior Measured				
Aggression	4	1,445	.102	.022 - .180
Conduct Problems	4	2 032	.345	.081 - .563
Delinquency	4	4,979	.166	-.037 - .356
Externalizing Behavior Problems	1	133	.167	-.003 - .328
Impulsivity/Antisocial Behavior	2	12,953	.164	.006 - .313
Total External/Internal Problems				
Problem Behavior Measure Source				
Police/Court/Probation Reported	1	2,966	.385	.354 - .416
Parent/Self-Reported	2	1,068	.057	-.003 - .116
Teacher/Therapist Reported	7	3,927	.185	.024 - .338
Mixed/Other Reported	5	13,581	.212	.096 - .321
Level of Measure for Source				
Dichotomy/Summed Dichotomy	10	18,042	.201	.105 - .299
Scale/Frequency/Rate	5	3,500	.169	-.041 - .364
Scale Used				
Child Behavior Check List	4	3,727	.217	.044 - .378
Achenbach Teacher Report	3	1,968	.094	.050 - .138
Composite Behavior Scale	3	932	.215	.012 - .402
Conners Questionnaire				
Independent Form	2	908	.166	-.085 - .397
K-Sads				
Manheim Parent Form				
Richman Behaviors Scale	1	150	.222	.064 - .369
Rutter Behavior Scale	2	13,857	.291	-.110 - .610
Self-Report Delinquency				

Quality Index Moderators on Peri-Natal Influence

The last group of moderators assessed on peri-natal influences was the quality index measures. The representativeness of the samples revealed no significant differences across the two groups. The not at all to low category had the least influence on the outcome of peri-natal influence (r = .172, CI = .037 to .301). However, this confidence interval overlapped with the category (CI = .085 to .314), suggesting that there were no substantive differences across the sample, in terms of representativeness.

The measure, adequate description of the subjects, yielded no significant differences. Both of the category confidence intervals for this measure overlapped, determining that there was no difference if the sample was adequately discussed

There was also no significant difference found when assessing the attrition rate at T_k. Neither the zero to 10 percent category, nor the more than 10 percent category had differing confidence intervals. This suggests that there was no moderating difference based on the attrition rate of the sample, when assessing peri-natal influence on problematic behavior.

Table 4.21. Effect Sizes: Methodological Quality Characteristics for Peri-natal Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Representativeness of the Sample				
Not at all or Low	5	1,534	.172	.037 - .301
Moderate to High	10	20,008	.202	.085 - .314
Adequate Description of the Subjects				
No	4	1,171	.224	.023 - .408
Yes	11	20,371	.193	.104 - .298
Attrition at T*k*				
0 – 10% Attrition	11	19,958	.233	.117 - .343
More than 10% Attrition	4	1,584	.100	.030 - .170

Publication Moderators on Postnatal Influence

The last of the three sections to assess the impact of moderators is the postnatal section. Table 4.22 reports the moderator description for the publications used in the postnatal section. There were no significant effect size differences across the two decades of study categories. Both confidence intervals of the categories overlapped, suggesting no significant differences. There were also no significant differences when assessing the lead author affiliation. Both confidence intervals overlapped (CI = .095 to .459, and CI = .098 to .233).

This was also the case when reviewing the number of authors for a publication. The mean effect size (r = .185, CI = .072 to .293) for four authors and up not different from the first category, up to three authors (r = .325, CI = .139 to .488).

The confidence intervals of the mean effect sizes of categories within the discipline of the first author were found to cross zero (medical and other), but the other confidence intervals did overlap. This suggests that there were no overall differences across these author discipline types.

Lastly, there were no significant differences in the mean effect sizes when assessing the location of the publication. Both North America and Europe had similar confidence intervals.

Table 4.22. Effect Sizes: Characteristics of the Publications used for Postnatal Influences on Problematic Behavior				
Moderator	***k***	**N**	**r**	**95%CI**
Decade of Study				
Prior to 2000	4	12,255	.358	.144 - .540
2000 to 2006	7	3,689	.203	.107 - .294
Lead Author Affiliation				
Academic	9	15,146	.287	.095 - .459
Non-Academic	2	798	.166	.098 - .233
Number of Authors				
Up to 3	6	12,730	.325	.139 - .488
4 or more	5	3,214	.185	.072 - .293
Lead Author Discipline				
Psychology	2	192	.334	.201 - .236
Medical	2	12,427	.352	-.017 - .637
Psychiatry	5	2,977	.130	.063 - .196
Other	2	348	.354	-.010 - .635
Location of Study				
North America	9	15,553	.277	.088 - .446
Europe	2	391	.178	.080 - .273
Asia				

Sample Moderators on Postnatal Influence

Table 4.23 begins with the assessment of mean age in months at T_1 on the impact of postnatal complications on behavioral problems. There were no significant differences when measuring mean age at T_1, as both confidence intervals overlapped. At T_k there was one category that was significantly different from all others. With a mean effect size of r = .509 (CI = .495 - .522), the 24 to 60 months was significantly different from all other outcome mean age categories. However, this should also be assessed with caution, as this was based on a k of two, which could potentially be unstable.

When assessing the the difference between T_1 and T_k, there were no significant differences between the three age categories, as all three confidence intervals overlapped (CI = .013 to.516, CI = .150 to .349, and CI = .035 to .201).

There was no variation in moderator categories for sex in the postnatal section. However, there were categories of race represented. Three of the four categories of race had zero within their confidence intervals, and all intervals overlapped, suggesting there was no significant impact of race on the relationship of postnatal insults on behavioral outcomes.

The last moderator assessed in the sample characteristics was sample type. However, both the matched sample type and the cohort type had overlapping confidence intervals, suggesting that there was no difference in the sampling type.

Table 4.23. Effect Sizes: Characteristics of the Samples used for Postnatal Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Mean age at T_1 (in months)				
Birth Month	5	12,740	.387	.202 - .546
Over 1 month	6	3,204	.138	.077 - .229
Mean age at T_k (in months)				
24 - 60 months	2	12,039	.509	.495 - .522
61 - 96 months	7	3,689	.203	.107 - .294
97 months and up	2	216	.195	.062 - .321
Difference from T_1 to T_k (in years)				
0 - 5 years	5	14,340	.261	.013 - .516
6 - 11 years	5	1,063	.297	.150 - .349
12 - 17 years	1	541	.179	.035 - .201
Race				
Asian				
Black	2	647	.347	-.025 - .634
Caucasian	2	475	.256	.056 - .436
Mixed	7	14,768	.239	-.013 - .461
Sample Type				
Twin Study				
Matched Sample	2	216	.195	.062 - .321
Cohort Study	9	15,728	.275	.089 - .443

Study Moderators for Postnatal Influence

The next table (Table 4.24) presents effect size differences of the moderators in the studies section. First, the studies were separated by type of postnatal complication. There were no confidence intervals across the three groups, suggesting that each type of postnatal influence had a significant impact on behavioral outcome problems. Environmental toxins (i.e., lead) had a significantly higher mean effect size over the other two categories (brain damage and malnutrition). With a mean effect size of $r = .509$ (CI = .495 - .522), it had a higher influence.

Socioeconomic status had no significant differences across the two groups (yes, and no). Even though one mean effect sizes was higher, they were not significantly different, as the two confidence intervals overlapped (CI = .052 to .326, and CI = .118 to .464).

As for the outcome measure, it was also assessed in four ways for the postnatal section. First, there five different ways in which problematic behaviors were assessed in this section (aggression, conduct problems, delinquency, externalizing behaviors, and impulsivity/antisocial behaviors). The mean effect size of impulsivity/antisocial behavior $r = .305$ was significantly higher than that of aggression $r = .080$, but both confidence intervals were covered by other categories, thus, they were not considered significantly different.

A similar result was found in the source of the problem behavior. The teacher/therapist/counselor mean effect size $r = .092$ was significantly lower than that the mixed method $r = .401$, but both confidence intervals were covered by the other

categories. This may suggest that the teach report approach is less effective than the mixed model, but it is not different that the parent or self-report method.

There was a significant difference found between a dichotomy measure and a scalar measure. The mean effect size of the dichotomy was r = .496 (CI = .482 - .509), while the scalar approach was r = .129 (CI = .095 - .162). However, both were still significant.

The last way the outcome was measured was by the assessment type. There were two mean effect sizes, whose values were significantly larger than the rest. The Rutter Behavior Scale mean effect size was r = .510 (CI = .432 - .458), and the self-report method mean effect size was r = .429 (CI = .417 - .442). Additionally, there was one mean effect size confidence interval that did cross zero (the independent form), suggesting that it was not substantive at measuring the impact of postnatal complications on the impact of behavioral problems. As with other low k measures, this should be viewed with caution, as the results of each category are based on small numbers of studies, suggesting that there is a likelihood of instability in the estimate (based on the small k).

Table 4.24. Effect Sizes: Characteristics of the Studies Used for Postnatal Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Postnatal Issue				
Brain Damage/Neurophysiological	4	691	.226	.128 - .320
Environmental Toxins	3	12,225	.509	.495 - .522
Malnutrition/Neglect/Abuse	4	3,028	.102	.064 - .139
SES Control Measure				
No	4	2,753	.193	.052 - 326
Yes	7	13,191	.301	.118 - .464
Type of Behavior Measured				
Aggression	2	2,026	.080	.037 - .124
Conduct Problems	4	13,154	.338	.085 - .551
Delinquency	1	162	.173	.019 - .319
Externalizing Behavior Problems	3	548	.305	.130 - .462
Impulsivity/Antisocial Behavior	1	54	.261	-.007 - .494
Total Ext/Int Behavior Problems				
Problem Behavior Measure Source				
Police/Court/Probation Reported	1	162	.173	.019 - .319
Parent/Self-Reported	1	337	.165	.060 - .268
Teacher/Therapist Reported	4	2,261	.092	.054 - .130
Mixed/Other Reported	5	12,824	.401	.229 - .549
Level of Measure for Source				
Dichotomy/Summed Dichotomy	5	12,676	.496	.482 - .509
Scale/Frequency/Rate	6	3,268	.129	.095 - .162
Scale Used				
Child Behavior Check List	3	672	.237	.164 - .308
Achenbach Teacher Report				
Composite Behavior Scale	1	162	.173	.019 - .319
Conners Questionnaire				
Independent Form	1	54	.261	-.007 - .494
K-Sads				
Manheim Parent Form	1	337	.165	.060 - .268
Richman Behaviors Scale				
Rutter Behavior Scale	4	14,533	.510	.432 - .458
Self-Report Delinquency	1	186	.429	.417 - .442

Quality Index Moderators on Postnatal Influence

The last table (Table 4.25) on the moderating effects of the postnatal relationship to behavior problems is on the quality index measures. First, the representativeness of the sample was assessed across two categories. There was no significant difference across these two categories. The confidence interval of the categories in this measure did overlap.

A measure of overall attrition (T_k) of the samples was also assessed. It was parceled into two categories as well, up to 10 percent attrition, and more than 10 percent attrition. Similar to the majority of moderators within the three subsections, there was no significant difference across the categories of this moderator, as the confidence intervals overlapped.

This concludes the individual section-level moderating effects on prenatal influences, peri-natal influences, and postnatal influences on behavioral outcomes. The results of the final question in the dissertation, overall early life problems, are presented next.

Table 4.25. Effect Sizes: Methodological Quality Characteristics for Postnatal Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Representativeness of the Sample				
Not at all to Low	4	839	.332	.138 - .501
Moderate to High	7	15,105	.228	.001 - .433
Attrition at T*k*				
Up to 10% Attrition	3	553	.177	.094 - .257
More than 10% Attrition	8	15,391	.289	.089 - .467

EARLY LIFE INFLUENCES ON PROBLEMATIC BEHAVIOR

The final question posed within this dissertation dealt with the combined effect of all three sections of insults, and their impact of behavior. To evaluate this, all effect sizes were used. Since this is only a combination of the three individual sections, the descriptive statistics tables for the combined models are not reported. However, as there could be moderator differences for the combined models, the effect sizes of the moderators for the publication characteristics, the sample characteristics, the study characteristics, and the quality index characteristics are presented. In addition to this material, regressions were performed to assess any potential relationships with age of the youth and impact of behavioral problems.

Publication Moderators on Early Life Influences

The first table for the combined model (Table 4.26) provides results from moderating effects of the publications. First, there were no significant differences across the two categories for decades of publication times, as the confidence interval of the prior to 2000 category (CI = -.194 to .352) overlapped the confidence interval of the 2000 to 2006 publications (CI = .165 to .267). Additionally, there were no differences by the discipline of the lead author, as all confidence intervals overlapped.

The lead author affiliation also did not differ significantly across the two types (academic, versus non-academic).

There was a significant difference found concerning the location of publication. The Asia category r = .385 (CI = .354 - .416) was significantly higher than the other two

categories (North America and Europe). This does suggest that the publication moderator of location may influence the value of the effect size. However, caution must be used here, as the *k* for the Asia category was one study.

Table 4.26. Effect Sizes: Characteristics of the Publications used for Early Life Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Decade of Study				
Prior to 2000	32	42,744	.275	.194 - .352
2000 to 2006	24	13,100	.212	.165 - .267
Lead Author Affiliation				
Academic	37	43,026	.249	.175 - .319
Non-Academic	19	12,818	.241	.169 - .309
Number of Authors				
Up to 3	30	36,326	.266	.176 - .351
4 or more	26	19,518	.218	.167 - .267
Lead Author Discipline				
Psychology	19	9610	0.212	.158 - .265
Medical	19	36941	0.271	.164 - .372
Psychiatry	14	8841	0.206	.116 - .293
Other	4	452	0.346	.150 - .516
Location of Study				
North America	38	25643	0.265	.187 - .339
Europe	17	27235	0.193	.130 - .255
Asia	1	2966	0.385	.354 - .416

Sample Moderators on Early Life Influences

Table 4.27 displays the results from the sample moderators on the overall early life impacts on behavior. The first moderator (mean age at T_1) had no within category significant differences. Both groups (birth month, and over one month) had overlapping confidence intervals. A similar result was found for the mean age at T_k moderator. There were no significant differences across the three categories of age for this moderator (all confidence intervals overlapped).

There were also similar findings when looking at the difference between the first waves (T_1) and ending waves (T_k) of the samples. An age span of zero to 5 years (r = .281, CI = ..176 to .379) was not different than 12 to 17 years (r = .193, CI = .105 to .277).

Sex had no significant differences within their categories across the samples. The male category confidence interval (CI = .162 - .376) was similar to the mixed category (CI = .182 - .298), suggesting that there was no significant differences between these two characteristics on the overall impact of early life influences affecting behavioral problems. Race did have some inter-category differences, but no overall significant difference. The Asian category (r = .385, CI = .354 - .416) was significantly different from the Caucasian and mixed categories, but was not different from the Black and missing categories. Additionally, the k for the Asian category was one study, suggesting it was susceptible to the lack of cases.

Lastly, there was a significant difference across types of samples. Matched samples (r = .302, CI = .241) were significantly more influential on the early life to problem behavior relationship, over twin studies (r = .130, CI = .043 - .215), and over

cohort studies (r = .226, CI = .150 = .299). While all three were significant in the relationship (none of the confidence intervals crossed zero), this does suggests that matched samples may provide a more robust measure of the relationship between early life insults and problematic behavior. Potentially, this is because matched samples do a better job of controlling for confounding variables that could reduce the strength of the relationship.

Table 4.27. Effect Sizes: Characteristics of the Samples used for Early Life Influences on Problematic Behavior				
Moderator	***k***	**N**	**r**	**95%CI**
Mean age at T_1 (in months)				
Birth Month	48	52,254	.260	.200 - .317
Over 1 month	8	3,590	.150	.095 - .204
Mean age at T_k (in months)				
24 - 60 months	15	29,245	.262	.118 - .395
61 - 96 months	32	15,950	.232	.181 - .282
97 months and up	9	10,649	.234	.135 - .328
Difference from T_1 to T_k (in years)				
0 - 5 years	18	26,105	.281	.176 - .379
6 - 11 years	32	26,878	.223	.175 - .269
12 - 17 years	6	2,861	.193	.105 - .277
Sex				
More than 75% Male	7	2,124	.273	.162 - .376
Mixed	49	53,720	.241	.182 - .298
Race				
Asian	1	2,966	.385	.354 - .416
Black	11	2,415	.295	.211 - .375
Caucasian	8	8,348	.172	.104 - .238
Mixed	24	37,379	.211	.112 - .307
Missing	12	4,646	.275	.191 - .354
Sample Type				
Twin Study	5	5,696	.130	.043 - .215
Matched Sample	20	2,297	.302	.241 - .360
Cohort Study	31	47,851	.226	.150 - .299

Study Moderators on Early Life Influences

Table 4.28 includes moderating effects of the studies themselves. This includes items such as number of parents involved in the youth during the study, a control for socioeconomic status, the type of behavior assessed, and others. First, a moderator effect was run on the section of the studies. This was done to assess if one section of early life problems was significantly more impacting than any other section. However, there were no significant differences across the three groups. Moreover, as there were sufficient studies within each section (prenatal $k = 30$, peri-natal $k = 15$, and postnatal $k = 11$), these do appear to be stable estimates.

As with the individual section analyses of a moderating effect a socioeconomic control measure, when a measure was used within a study, the strength of the relationship of an early life insult onto behavioral problems decreased. This continues to support a concept of environmental shaping or influence on this relationship. However, there was no significant difference between when it was controlled for in the study ($r = .222$, CI = .158 - .284), and when it was not addressed ($r = .316$, CI = .225 - .402). This also suggests that the overall nature of socioeconomic status may be only influential, and may not overpower the relationship of early life problems on behavioral issues.

There were inter-category differences found when assessing the type of problem behavior measured. Impulsivity and antisocial behavior ($r = .397$, CI = .274 - .507) was significantly higher than when a measure of aggression was used ($r = .155$, CI = .108 - .202). However, both confidence intervals fell into the confidence intervals of the other 4 categories, suggesting that there was no overall difference in the way in which the behavior problem was measured. Additionally, when the source of the behavior was

measured, there were no significant differences. It did not matter if it was the police reporting official delinquency, or a teacher, or a parent. All confidence intervals of the source of measurement overlapped. Moreover, none of the reporting sources had confidence intervals that included zero, suggesting they were all valid sources when reporting behavioral problems. A similar result was found when assessing the level of measurement of the outcome variable. There were no significant differences found when comparing the level of measure either. Both confidence intervals overlapped, thus, it did not matter if the assessment was a dichotomy, or a scalar measure.

There were some inter-category differences in the scale used to assess the behavioral problem. Self-report delinquency had the highest effect size (r = .510, CI = .395 - .609), and it was significantly higher than the CBCL, the Achenbach Teacher Report, and the Manheim Parent Form. However, there was not one confidence interval, whose range was significantly different overall, suggesting stability issues of smaller k sizes. Notably, the Self-report measure had a k of one.

Table 4.28. Effect Sizes: Characteristics of the Studies used for Early Life Influences on Problematic Behavior

Moderator	*k*	N	r	95%CI
Subsection				
Prenatal	30	18,358	.231	.194 - .268
Peri-natal	15	21,542	.200	.106 - .289
Postnatal	11	15,944	.265	.097 - .419
SES Control Measure				
No	14	3,868	.316	.225 - .402
Yes	42	51,976	.222	.158 - .284
Type of Problem Behavior Measured				
Aggression	16	7,635	.155	.108 - .202
Conduct Problems	12	23,151	.303	.185 - .413
Delinquency	9	8,013	.195	.085 - .300
Externalizing Behavior Problems	13	15,474	.223	.159 - .285
Impulsivity/Antisocial Behavior	3	257	.397	.274 - .507
Total External/Internal Problems	3	1,314	.246	.055 - .420
Problem Behavior Measure Source				
Police/Court/Probation Reported	6	11,400	.243	.133 - .347
Parent/Self-Reported	10	6,805	.201	.124 - .276
Teacher/Therapist Reported	34	24,897	.222	.174 - .269
Mixed/Other Reported	6	12,742	.361	.183 - .517
Level of Measure for Source				
Dichotomy/Summed Dichotomy	35	41,299	.270	.195 - .343
Scale/Frequency/Rate	21	14,545	.206	.143 - .267
Scale Used				
Child Behavior Check List	27	19,721	.235	.187 - .283
Achenbach Teacher Report	4	2,204	.105	.062 - .148
Composite Behavior Scale	6	1331	.204	.088 - .315
Conners Questionnaire	2	147	.313	.158 - .453
Independent Form	6	3,123	.236	.126 - .341
K-Sads	1	129	.279	.112 - .431
Manheim Parent Form	1	337	.165	.060 - .268
Richman Behaviors Scale	2	276	.304	.134 - .456
Rutter Behavior Scale	6	28,390	.237	.005 - .445
Self Report Delinquency	1	186	.510	.395 - .609

Quality Index Moderators on Early Life Influences

The last table in this section (Table 4.28) details the influence of quality indicators of the studies. Overall, there were no significant differences on the representativeness of the samples. Both confidence intervals overlapped. Similarly, there was no significant difference when there was an adequate description of the subjects, and when there was not. When information on the subjects was omitted from the study (r = .227, CI = .052 - .388), it did not differ from when information was included about the subjects (r = .247, CI = .191 - .302).

There was a significant difference found when assessing the use of a standardized meta-analytic statistic. As discussed previously, certain statistics (T-test values, F scores, proportions, correlations, odds ratios, chi-squared values, Somer's d, and p values) were used predominantly within this meta-analysis. Betas were only used two times, and the made no impact on the overall model (r = .057, CI = -.003 - .116). Peterson and Brown (2005) discuss the usability of betas within meta-analysis, suggesting that they are a reliable representation of r for a study. However, they tend to be more conservative (due to the prior standardization by the sample of the measure). This was found the case in this meta-analysis, as the confidence interval of the beta category crossed zero, suggesting these effect sizes were not significantly influencing the overall model. Ultimately, they were left in the full model, as they did not appear to overpower the standard measures.

Finally, there was no significant difference in the influence of attrition on the relationship of early life influences and behavioral problems in adolescence. It did not matter if there was little to no attrition (zero to 10 percent), or more than 10 percent

attrition, as the confidence intervals of these two categories for the attrition moderator overlapped.

This concludes the early life influences on behavioral problems section. Next is a discussion of ancillary statistics, like the binomial effect size display, the I^2 statistic, and the Fail-Safe *N*. The results of these different statistics are discussed.

Table 4.29. Effect Sizes: Characteristics of the Quality Index used for Early Life Influences on Problematic Behavior				
Moderator		**N**	**r**	**95%CI**
Representativeness of the Sample				
Not at all or Low	25	14,162	.248	.199 - .296
Moderate to High	31	41,682	.226	.144 - .305
Adequate Description of the Subjects				
No	5	1,225	.227	.052 - .388
Yes	51	54,619	.247	.191 - .302
Standard Meta-Analysis Statistic				
No	2	1,068	.057	-.003 - .116
Yes	54	54,776	.254	.199 - .308
Attrition at T_k				
0 to 10% Attrition	30	32,093	.235	.182 - .287
More than 10% Attrition	26	23,751	.255	.156 - .349

ANCILLARY STATISTICS

The I^2 Statistic

As discussed in chapter III, the I^2 statistic is incorporated in this dissertation. While, the Q statistic provides information if variation across studies is present, it does not necessarily provide any information about the amount of variability (heterogeneity). Thus, the I^2 statistic was used to evaluate the amount of heterogeneity of the studies used in this dissertation. Essentially, it is a complement to the Q statistic, which was discussed in Table 4.13, mean effect sizes. When looking at the overall dispersion, the I^2 statistic displays what proportion of the dispersion represents true dispersion, versus sampling error. Taken together, the Q and I^2 statistic allow a researcher to get a more complete picture of the homogeneity and heterogeneity of effect sizes across the studies within a meta-analysis. Higher I^2 scores relate to more heterogeneity across samples.

The I^2 statistic for the overall model was $I^2 = 97.30$ for the overall model. This suggests that the variation of effect sizes is due to the heterogeneity of samples, and not because of sampling error. Additionally, since this is a high amount of variability, and the mean effect size $r = .246$ is still robust, it suggests that the mean effect size is something we would expect to find across a variety of studies. This offers a level of validity to the overall mean effect size. If the mean effect size had been relatively weak ($r = .10$ or so), and the I^2 statistic had been low, it would mean that the mean effect size is more susceptible to change, and not a stable estimate. Another statistic that can be used to validate the stability of the estimate is the Fail-Safe N, which is now discussed.

Fail-Safe N

Also described in the methods chapter, the Fail Safe N is a statistic used to assess the viability of the findings. A criticism that often arises within meta-analysis is that not all studies on a topic are included. Rosenthal (1979) discusses the problem of the inability to gather every single piece of research on a topic, particularly the pieces that are in "file drawers," never to be seen. As discussed earlier, this is known as the Fail-Safe *N*. This measure tests how many studies it would take (that are not included) in order to produce a nonsignificant finding from a meta-analysis. Thus, the overall effect size would be no different from zero. Using Wolf's calculation (1986), it would take over 3,500 articles to be found with no results, to take this effect to a nonsignificant finding. While this is the classical Fail-Safe *N* method, it does provide insight as to the strength of the finding. Table 4.30 displays the Fail-Safe *N* statistics.

Other (more conservative) estimates were also performed. Orwin's (1983) Fail-Safe *N* is also an estimate of this statistic, so that it can be used with multiple metrics. Using this approach, it would take over 287 studies with a mean effect size of $r = -.05$ in order to negate the findings. Again, even though there are relatively few effect sizes here ($N = 56$), this demonstrates the robustness of the overall mean effect size found.

The last concept addressed in this chapter is the relationship of age and problematic behavior. While there has been no shortage of debate as to what factors influence behaviors (biological, environmental), it has been suggested that these early life influences may have lasting effects long into adolescence. To this end, a simple regression of the effect sizes to age was computed. Results are presented.

Table 4.30. Fail Safe *N* for Prenatal, Peri-Natal, Postnatal, and Early Life Influences on Problematic Behavior

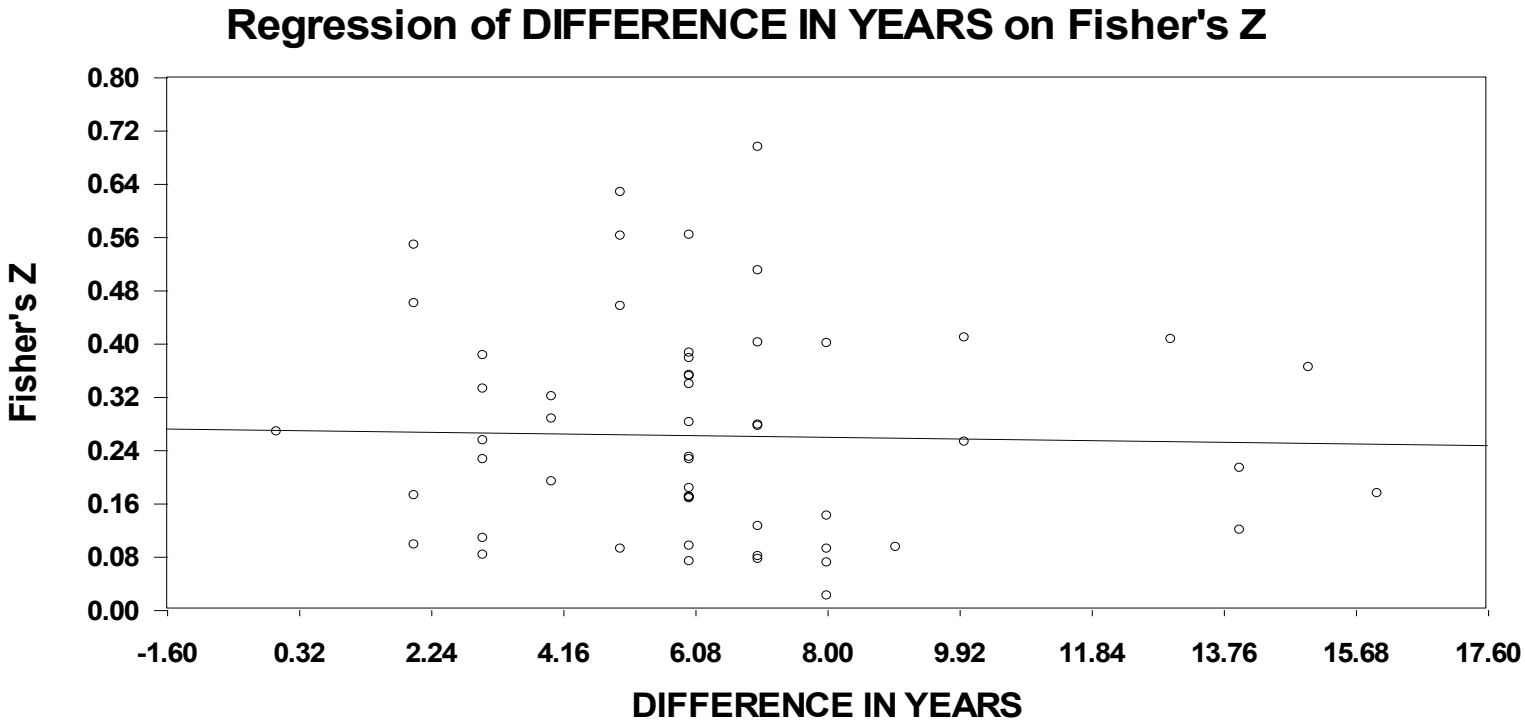
Section	z-value	Wolf Calculation	Orwin value	Orwin Calculation*
Prenatal	22.733	4,021	.188	115
Peri-Natal	20.826	1,679	.163	50
Postnatal	28.924	2,385	.429	101
Early life Outcomes (Cumulative)	40.266	3,581	.251	288

Note * = Effect sizes needed at $r > -.05$ in order to negate a finding per section.

RELATIONSHIP OF AGE ON EARLY LIFE PROBLEMS AND BEHAVIOR

Three moderators used in this dissertation were about the age of the youth in the studies. Specifically, the difference from T_1 to T_k was calculated for each study from the T_1 and T_k moderators (The first and last studies were considered as outliers, thus removed). This was regressed onto the mean effect sizes. Figure 4.1 displays the simple bivariate regression analysis. The intercept of the regression line is significant, suggesting that there is a relationship with the occurrence of early life problems and behavior (b = .26, p = .000). Interestingly, the slope of the relationship is not significant. This suggests that the relationship does not significantly decrease over time (b = -.001, p = .299). This finding is relevant for two reasons. First, it does suggest that the effects of early life problems are significant early in life. Second, it appears that the effects are not dissipating over time. That is, 12, 13, and 14 years after these initial insults occur, the effects of these insults still appear to influence problematic behavior. This is demonstrated across the studies, where some studies difference between the initial T_1 wave and the T_k wave are 12, 13, even 16 years apart.

Figure 4.1 Regression of Difference in Years on Effect Size



Intercept = .269, SE = .009, p = .000
Slope = -.00130, SE = .002, p = .299

CONCLUSION

The results presented in this chapter tested the four core questions within this dissertation. Specifically, It assessed the prenatal, peri-natal, postnatal, and overall, how insults to a child (and a combined model) impact behavior problems in adolescence. These results support the position that early life problems may create early differences in behavioral outcomes. First, prenatal insults appear to influence (negatively) problematic behavior. Second, Peri-natal complications appear to influence problematic behavior. Third, postnatal insults appear to influence problematic behavior. Collectively, early life problems appear to negatively influence behavior. Moreover, this relationship did not seem to alter across races, genders, differing socioeconomic statuses, or by different numbers of parents. These results also appear to be relatively consistent across decades, across disciplines, and across countries. Again, this speaks to the overall robustness of the findings. Even though the overall mean effects size was a modest value (r = .246), there were consistent patterns within the data, which promote a valid underlying factor, early life problems have an influential effect on behavior. Additionally, these behavioral problems may be long lasting. It did not appear to matter at what age the outcome wave was measured, there were still effects of the early life problems. Thus, the idea of *Tabula Rasa* does not hold.

The last chapter (Conclusions) discusses any theoretical, policy, or practical implications of the findings. Additionally, approaches for future research are also presented.

CHAPTER V

CONCLUSIONS

This dissertation set out to provide a systematic review of three areas in development that may affect behavior at a young age. Additionally, these three areas where insults may occur (prenatal, peri-natal, and postnatal stages of development) have the potential to change the executive cognitive functioning of a youth. This chapter summarizes the findings of this dissertation and describes how these findings may fit within the larger framework of criminology. It begins with a discussion of the limitations, such as the sample size. This is followed by important strengths of the findings. Next is a discussion of some of the key findings from the research. This is followed by a discussion on the possible theoretical impact these findings may have, followed by some real world applications that may be gleaned from these findings. Second to last, there is a discussion of potential future research. Lastly, closing remarks are presented.

SUMMARY OF THE FINDINGS

Limitations

While there are certainly larger concepts that may be drawn from the findings presented in this dissertation, a discussion of the limitations are also necessary. There are two different areas of limitations that need to be discussed prior to a discussion of control variables. First, a discussion about the sample size is warranted. This is followed by a discussion about the relatedness of these concepts to later life outcomes.

Sample Size. A general concern with meta-analyses is the number of articles that are needed in order to run a meta-analysis. According to Valentine, Pigott, and Rothstein (2010), only two articles are needed in order to come to a conclusion on a particular subject matter. However, this is more of an anecdotal answer, as Valentine et al. allude to within their discussion of different outcomes toward understanding the number of articles needed for a meta-analysis. They begin their discussion with fixed-effects models, relating to the homogeneity of the articles, in that, there is a statistic that may be calculated using the confidence interval of the mean effect size to produce a statistical power. Valentine et al. follow this with a discussion on random-effects models. Using the *Q* statistic from Hedges and Olkin (1985), they extrapolate the power of an analysis based on the number of articles, the mean effect size, and the samples of the articles. Essentially, they are describing how tau is used as a power of analysis for the meta-analysis. Valentine et al. offer that for studies that have a modest mean effect size (r = around .15), with 40 studies, and a high degree of heterogeneity, the power of the meta-analysis is substantive (2010, p. 226). Therefore, this would suggest that the information in this dissertation has substance.

Larger Picture Limitations. The second initial limitation centers around a larger concept, which is the process of the causal pathways from such an early event (early life insults) to later life outcomes (adolescent delinquency, and adult criminality). Wakschlag et al. (2001) discuss this very issue when assessing prenatal smoking effects on youth developmental pathways. Wakschlag and her colleagues discuss the complexities of trying to individually analyze everything (everything but the kitchen sink), in order to come to a model that explains delinquency. This is currently beyond the scope of many,

if not all, who study behavior. Rather, Wakschlag et al. adapt a higher-level conceptual model, similar to Moffitt's (1993) life-course persisters. That is, when individuals display a pattern of behavior that is markedly different from others, the beginnings of this pattern of development may be attributable to conditions that happen very early on in the life (like prenatal, peri-natal, and postnatal conditions). Specific causal mechanisms are recorded, and overall outcomes are assessed. Yes, there are many items that may influence the change along the way, but the point of their argument is that this "developmental process" begins from some difference early in life (Wakschlag et al., 2001, p. 462). That is one of the tenants of this dissertation. There is no assertion that prenatal, peri-natal, or postnatal problems are the sole explanation for problematic behavior. However, they do beset youth on a different developmental pathway, thus influencing (fairly well) the behavioral problems that the youth display within these prospective studies.

Few Controls

Another criticism that may arise when doing a meta-analysis is the lack of controls when doing a meta-analysis. Simply put, meta-analyses are criticized for not controlling well for the known predictors (individual or macro-level control variables) of delinquent or criminal behavior. Thus, many discount a meta-analysis as being too basic in its assessment of a phenomenon.

This limitation is always a consideration for any study, not just meta-analysis. Additionally, the parameters of a meta-analysis can be set up at the beginning of the coding process, in order to capture control variables, minimizing this limitation. This

dissertation used control measures like age, gender, race, and socioeconomic status, when coding the studies. Therefore, the studies that were included have description of these specific measures. As noted in the chapter four (Table 4.27, and 4.28), these types of controls had negligible difference in the overall value of the influence of early life problems and how they affect behavior in adolescence. This actually speaks to a potential strength of this research.

Strengths

As previously stated, there is a high level of consistency across the findings with this dissertation, regardless of the moderators used to assess the variation of the overall effect. There were some minor differences found within moderator category differences, but the overall pattern of effect sizes was consistent. Across age, race, gender, location, type of assessment, who reported it, or how it was reported, there was a consistent pattern. There is an overall effect that is measureable and stable from these early life influences. Additionally, this effect was notable across different lengths of time. The impact on behavioral problems was notably different for youth with early life influences, much more so than for youth that did not have insults at an early age.

Lastly, these effect sizes were also consistent across differing samples. As the I^2 statistic suggested, the studies used in this dissertation were heterogeneous. This also suggests that the findings of early life problems may have a consistent effect across diverse populations, not just in specific pockets or types of people. The results articulate this in Table 4.26, and Table 4.27. That is, regardless of location of the study, or race of

the samples, there were consistent effects found on problematic behaviors, due to early life problems.

Key Findings

First, the underlying concept within this dissertation is unique. Although there could be a similar piece of research that incorporates all three stages of early development and behavioral problems in adolescence, it was not found during the search for this meta-analysis. Incorporating other disciplines, like research in the field of medicine, is rare within the criminological discipline. However, it can provide insight into criminology, which ultimately strengthens the discipline.

Moreover, even though this is not the typical data to study within the discipline, all four research statements were supported. Prenatal insults had an impact on behavior problems (r = .231). Perinatal complications had an impact on behavior problems (r = .200). Postnatal problems had an impact on behavior problems (r = .265). All three of the individual confidence intervals overlapped, positing that there are no significant differences in these effect sizes across the three stages. Lastly, early life influences had an impact on behavior problems (r = .246).

In the final analysis, an additional concept that underlies the findings was assessed. The stability of these estimates appears to be robust. When measuring the impact of age on the relationship of early life problems to behavior problems, it does appear that the insults have a lasting impact through adolescence. Specifically, the intercept b = .229 of this relationship is significant, and did not significantly reduce over time. The stability of this estimate over time is of importance.

As noted in chapter II, numerous researchers have established the stability of aggressive behaviors (Huesmann et al., 1984; Olweus, 1979). Collectively, there is agreement that aggressive behaviors, like many other behaviors, are highly stable. This can be carried over to impacts on behaviors. The results of this dissertation support this concept. The impacts of early life influences appear to have stable effects. The effects of early life problems not only influence behavior problems in early adolescence, they also influence behavior problems well into late adolescence (age 15, 16, and 17). Thus, having a better understanding of important factors that influence behaviors early in life may assist with a better overall understanding of behavioral outcomes across the life-course. This brings up a discussion for the incorporation of problematic beginnings within a theoretical framework.

THEORETICAL IMPACT

Moffitt posited these insults early in life might provide a clearer picture to our understanding of delinquency. Specifically, she stated, "[n]eural development may be disrupted by maternal drug abuse, poor nutrition, or pre- or postnatal exposure to toxic agents" (Moffitt, 1993, p. 680). Neural development, also known as executive cognitive functioning, has been demonstrated to have significant impacts on behavioral outcomes (Giancola et al., 1998; Luria, 1980; Shallice, 1982). Thus, incorporating these initial differences that influence executive cognitive functioning may provide a more complete understanding of behavioral problems, to include delinquency and adult criminality.

This is all premised by an increase in longitudinal research, and an incorporation of ideas from other disciplines. As more longitudinal research is carried out in the criminological field, potential studies that incorporate prenatal, peri-natal, and postnatal insults could provide a more complete picture to our understanding of problematic behavior, as Moffitt suggests. In this vein, a greater incorporation of biosocial measures may also help criminologists better explain behaviors. Raine (2002) provides a healthy logistical model as to how criminology can more effectively assess biological factors and environmental factors, in order to have a more complete understanding of criminality. Specifically, Raine discusses issues that affect neural development, such as maternal smoking, minor physical anomalies, and others. All of which were shown to have an impact within this dissertation. More importantly, and addressed next, there are real-world implications that may be gleaned from these findings.

REAL WORLD APPLICATION

The meta-analysis presented in this dissertation centered on problems early in a youth's life that may have lasting effects. However, many of these problems can be reduced with improvements in neonatal healthcare and health education. For instance, it has long been known that cigarette smoking is detrimental to one's health. Additionally, there were numerous pieces of research in this dissertation discussing the harmful effects of smoking during pregnancy (Maugham et al., 2004; Oberleke et al., 1999; Slotkin, 1998). However, more information on the long-term effects of these substances on newborns could be introduced within health education classes within schools. Most

schools already discuss the dangers of drugs, smoking, and alcohol to the youth in high school. Educating youth on the harmful effects of these substances on potential offspring may have a better effect at reducing substance use within burgeoning adults, rather than the traditional scare tactics like D.A.R.E., which are not considered overly effective.

Beyond general education classes, some improvements in early life outcomes may be garnered from improvements in urban areas within cities. It has been demonstrated in this dissertation that lead is a harmful toxin to the healthy cognitive development of youth (Denno, 1990), and may foster severe brain dysfunctioning (Onalaja & Claudio, 2000). In fact, the Center for Disease Control and Prevention recognizes lead as a harmful teratogen that you may be exposed to in early stages of development. Over a quarter million youth, ages one to five, are reported to have dangerous levels of lead in their body (more than 10 micrograms per deciliter of blood). In her report to Congress, Gerberding (2002) discusses the need for increases in prevention, due to the harmful effects of lead on children. Influenced by the Contamination Control Act of 1988, there has been much done in the way of reducing lead exposure. However, as Gerberding urges, there is great need for continued awareness of the harmful effects, and ultimately the positive outcomes achievable, when children are less (or not) exposed to this harmful industrial product. More awareness of the benefits of lead reduction may assist these efforts.

IMPLICATIONS FOR FUTURE RESEARCH

A more thorough study of the three areas (prenatal, peri-natal, and postnatal), each individually, would help delineate the relationship between early life influences and how they affect behavior. For instance, the end-point for the search parameters in this dissertation was set at 2006. The number of studies listed in Table 4.26, under decade of study, illustrates the growing number of these types of studies as the decades progress. The 2000 category only contains six years, and yet, it has almost as many studies as the ten years prior. It would be interesting to see how many pieces of research could be found in the last six years (2007-2012). Additionally, these studies generally focused on one insult at a time. Raine (2002) discussed the potential for interactions across biological insults and environmental disadvantages. Moreover, he also discussed the potential of interactions across multiple biological insults. To this end, new research in this area could assess any interactions, either in biological and sociological interactions, or even between these early life insults.

Another issue for future consideration is the overall life outcomes of youth exposed prenatal, peri-natal, and postnatal deficits. This dissertation focused solely on problematic behavioral outcomes of these youth. However, much of the literature on healthy human development discusses the interconnectedness of a person's life. Thus, one would expect that these early life insults affect not only social maladjustment, but also several other later life outcomes. Research that taps into a more global approach, may provide a more complete picture of the human condition.

CLOSING REMARKS

This human condition, what we are born into this word with, is the culmination of environment and biology. Additionally, it is also how biology and environment vary in the shaping of our development. Granted, social, cultural, and legal norms, re-aligne most individuals to convention. In turn, this creates a funneling effect for most abnormal behaviors, and can often overpower (or normalize) many varied or non-social behaviors. However, when preinstalled deficits (or differences) are great enough to counterbalance the normalization path, antisocial behaviors are often a byproduct. Thus, how these differences occur and how they affect youth should be given more importance in our criminological understanding.

The reintegration of human physiology and biology into our understanding of delinquent and criminal behavior development has begun. Thanks to the continued works in the fields of medicine and neurophysiology, psychology, and others; we have a more enriched understanding of how things early in life affect choice, and the ability to choose, in the developmental years. This dissertation attempted to assess, in a meta-analytic fashion, how some of the early-life influences affect behavioral outcomes, specifically, problematic behavior. Prenatal, peri-natal, and postnatal complications do appear to affect the behavioral outcomes of youth. Moreover, this effect is substantive and stable across diverse groups of individuals. Finally, the effects of these early life problems appear to be long lasting, which suggests that they do influence individuals over their life course. In order to have a better understanding of delinquency, as Moffitt (1993) suggests, these areas should be incorporated into our ideas of what causes delinquency.

To this end, this research supports this idea. It does appear that prenatal insults, peri-natal complications, and postnatal damages matter.

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Appendix A. Listing of Keywords and Search Parameters (1976-2006)

Search Engines Found	Keywords Used	Pieces
Criminal Justice Abstracts	Aggression	626
	Behavior	2,010
	Birth Complications	2
Criminal Justice Periodical Index	Aggression	916
	Birth Complication	4
Dissertation and Thesis Abstracts	Aggression	11
	Behavior Development	88
	Birth Complications	10
Google Scholar	Aggression & Birth Complications	11,500
PubMed	Birth & Aggression	377
	Birth Complications & Behavior	2,502
	Biology & Crime	24
	Childhood Delinquent Behavior	112
PsycINFO	Aggression	8,947
	Birth Complications & Behavior	1,751

APPENDIX B. Coding Guide

I. STUDY IDENTIFICATION

A. Identification number **[STUDYNUM]** _____

B. Study is usable? (Yes=1, No=0) **[USABLE]** _____

This variable that was used to quick sort data on an article that met all inclusion criteria.

1. Work published (or made available) between 1976 and 2006
2. Includes some measure of prenatal, peri-natal, or postnatal complication (defined within the methods chapter)
3. Has a minimum of two measurement waves that are in adolescence.
4. Has an outcome measure of some form of aggression, delinquent, or other form of readily identifiable antisocial behavior (this is the main dependent variable, and the items that comprise this are also discussed within the methods section)

C. Country **[COUNTRY]** _____

Where was the study performed?

1 USA
2 EUROPE
3 ASIA
4 OTHER
99 MISSING

D. Author **[AUTHOR]** _____

This is the discipline of the lead author.

1 PSYCHOLOGY
2 CRIMINOLOGY
3 SOCIOLOGY
4 EDUCATION
5 MEDICAL
6 OTHER
7 PSYCHIATRY
99 MISSING

E. Number of Authors **[AUTHNUMB]** _____

Number of authors involved in the study/research.

1 1
2 2
3 3
4 4
5 5
6 6
7 7 OR MORE
99 MISSING

F. Lead Author Affiliation [**AUTH1AFF**] _____

Affiliation of the lead author.

1 ACADEMIC
2 MEDICAL / HOSPITAL OR MEDICAL RESEARCH FIRM
3 GOVERNMENT
4 OTHER
99 MISSING

G. First Author Name **[FA_NAME]** _____

A quick sort variable when collecting all of the information

H. Decade of publication **[DECADE]** _____

This was used to assess when the studies were being performed.

1 1976 – 1979
2 1980 – 1989
3 1990 – 1999
4 2000 – PRESENT
99 MISSING

I. Type of Publication **[PUB1]** _____

In what format was this material published

1 JOURNAL
2 ARTICLE IN AN EDITED VOLUME
3 BOOK
4 REPORT
5 CONFERENCE PAPER
6 THESIS/DISSERTATION
99 MISSING

J. Refereed Material **[PUB2]** _____

A dichotomous variable if the material went through some form of peer review process.

1 YES
2 NO
99 MISSING

K. Published Material **[PUB3]** _____

A dichotomous variable for whether or not the material was published officially.

1 YES
2 NO
99 MISSING

II. SAMPLE CHARACTERISTICS

A. Gender **[GENDER]** _____

Gender of sample- A moderator to be used when looking at the data as a whole.

1 > 75% MALE
2 > 75% FEMALE
3 MIXED
99 MISSING

B. Age at time 1 **[AGE1]** _____

Mean age of sample at first wave

Value
99 UNOBTAINABLE/MISSING

C. Age at Time K **[AGE2]** _____

Mean age of sample at measurement wave

Value
99 UNOBTAINABLE/MISSING

D. Education Level at Time 1 **[EDUC1]** _____

What was the grade level of child measured in wave 1.

1 0 – KINDERGARTEN
2 PRESCHOOL
3 ELEMENTARY SCHOOL
99 MISSING

E. Education at Time 2 **[EDUC2]** _____

What was the education level of the children in the last wave

1 0 – KINDERGARTEN
2 PRESCHOOL
3 ELEMENTARY SCHOOL
4 MIDDLE SCHOOL
5 HIGH SCHOOL
6 UNDERGRADUATE
7 GRADUATE/POSTGRADUATE
8 MIXED
99 MISSING

F. Race **[RACE]** _____

Race of sample (only if 85% 1 race, most will be mixed)

1 ASIAN
2 BLACK
3 CAUCASIAN
4 HISPANIC
5 MIXED
99 MISSING

G. Original Number in Sample **[ORIGNUM]** _____

This is the original sample size within a particular data set.

III. MODERATOR CHARACTERISTICS

A. Sub-section **[SECTION]** _____

This is the main grouping of articles when included

1 PRENATAL OR PARENTAL INFLUENCE
2 PERI-NATAL OR BIRTH COMPLICATIONS
3 POST NATAL OR EARLY LIFE TRAUMA

B. Type of Sample **[TYPECTRL]** _____

This moderator will be used to assess the type of sample that was used in the study.

1 TWIN STUDY
2 MATCHED SAMPLE STUDY
3 COHORT STUDY
99 MISSING

C. Waves within Study **[WAVES]** _____

This variable is designed review how many waves of data were collected.

1 2
2 3
3 4
4 5
5 6
6 7
7 8 OR MORE
99 MISSING

D. Birth Complications **[BIRTHCOMP]** _____

Type of birth complication measured (this is for the peri-natal group)

1 PREMATURE
2 ANOXIA
3 ECLAMPSIA
4 CESAREAN
5 RESPIRATION
6 MECONIUM ASPIRATION SYNDROME
7 DISTRESS
8 MIXED
99 MISSING

E. Difference from T_1 to Outcome T_K **[DIFT1TK]** _____

What is the difference in months from the two age measures **AGE1** & **AGE2** (in months). We would expect less influence (lower *r* values) when the distance between the two waves is greater.

1 = 0 MONTHS OLD to 204 = 17.9 YEARS OLD

F. Age of First Wave **[AGEWAVE1]** _____

This descriptor is used to parcel out the age group of wave one.

1 PRENATAL (PARENT)
2 NEWBORN PERI-NATAL (0 – 3 MONTH)
3 INFANCY (4 MONTH OLD TO 2 YEAR OLD)
4 EARLY ADOLESCENCE (3 YEAR-OLD TO 5 YEAR-OLD)
5 LATER ADOLESCENCE (6 YEAR-OLD TO 8 YEAR-OLD)
6 PRETEEN (9 YEAR-OLD TO 12 YEAR-OLD)
7 TEEN (13 TO 17)
8 MIXED
99 MISSING

G. Number of Parents **[NUMBPAR]** _____

A measure for parent # within an individual study

1 1
2 2
3 MIXED
99 MISSING

H. Prenatal Issue **[PRENATAL]** _____

This measure is used in conjunction with the primary grouping.

1 Smoking
2 Alcohol
3 Drug
4 Teratogenic
5 Poly Drug
6 Poly substance
7 Mixed
99 Missing

I. Parenting Measure **[PARMEASR]** _____

Was there a measure for parenting style within an individual study?

1 YES
0 NO

J. Parenting Style **[PARSTYLE]** _____

Was there a measure for parenting style within an individual study?

1 INDULGENT
2 AUTHORITARIAN
3 AUTHORITATIVE
4 NONINVOLVED
5 MIXED
99 MISSING

K. Environmental Measure Included **[POSTNATAL]** _____

What types of environmental measures were examined (controlled for) during the study

1 LEAD EXPOSURE
2 MERCURY EXPOSURE
3 NUCLEAR PROXIMITY
4 MIXED
5 ACCIDENTS OR INJURIES
6 BRAIN DAMAGE
7 MALNUTRITION
99.00 MISSING

L. Socio-Economic Status Measure **[SES]** _____

Was there a control for (family) SES within the study?

1 YES
0 NO

IV. DEPENDENT VARIABLE DESCRIPTION

A. Problem Behavior [PROBBEHM] _____

This variable is used to determine the type of measure for the effect size calculation.

1 Aggression
2 Impulsivity
3 Antisocial Behavior
4 Externalizing Problem Behavior
5 Low Self Control
6 Delinquency
7 Total internalizing and externalizing behaviors
8 Conduct Problems

B. Source of Problem Behavior [BEHPROB2] _____

This is the source, or way in which the dependent variable was measured. It is the clinical range of that particular instrument. These will each be discussed within the methods section

CBCL Child Behavior Checklist
CBQ Rutter Choldhood Behavior Questionnaire
COMP Composite of multiple scales
CONN Conners Parent Questionnaire
IND Independet type of Assessment
MEI Mannheim Parent Interview
RBS Richman Behavior Scale
RUT Rutter Behavior Scale
TRF Achenbach Teacher Report Form

C. Dependent Measure [DEPMEASR] _____

This is a broad categorical type of dependent measure. There were no measures of ADD/ADHD in the data set

1 ANTISOCIAL BEHAVIOR
2 ADHD/ADD
3 ODD
4 OTHER ABNORMAL BEHAVIOR
5 DELINQUENCY
6 MIXED
99 MISSING

D. Official Delinquency **[OFFDEL]** _____

What is the source of the delinquent measure (if it was a delinquency measure, and not an aggression measure)

1 YES (POLICE REPORTED)
2 NO – UNOFFICIAL OR SELF REPORTED
99 MISSING

E. Delinquency Source **[DELSOURC]** _____

What is the source, or who is doing the reporting of the measure

1 SELF-REPORT
2 THERAPIST/TEACHER/COUNSELOR
3 SCHOOL RECORD
4 POLICE/ COURT/ PROBATION REPORT
5 OTHER
6 MIXED
99 MISSING

F. Scale of the Delinquent Measure **[DELSCALE]** _____

How is this measure scaled within the individual article?

1 DICHOTOMY
2 SUMMED DICHOTOMY
3 FREQ/ RATE
4 SEVERITY INDEX
5 CONTINUOUS SCALE
6 OTHER
99 MISSING

V. INDEX OF METHODOLOGICAL QUALITY

These are items that are used to judge the quality of the overall article, and of the value created for the effect size to be used.

A. Sample Heterogeneity **[SAMPHETY]** _____

Representativeness of the sample

1 NONE
2 LOW
3 MODERATE
4 HIGH (FULLY REPRESENTATIVE)
99 MISSING

B. Description of Subjects **[QUALITY1]** _____

Was there a description of the subjects/sample involved?

1 YES
0 NO

C. Biosocial Measure described **[QUALITY2]** _____

Was there a discussion of the biosocial measure in the study?

1 YES
0 NO

D. Quality of the Statistic/Statistical Technique **[QUALITY3]** _____

Was there a discussion about the statistic/statistical technique used in the analysis?

1 YES
0 NO

E. Response Rate at T_1 **[QUALITY4]** _____

Was the initial wave sample close to the overall initial sample?

1 YES
0 NO
99 MISSING

F. Response Rate at T_k **[QUALITY5]** _____

What was the attrition from wave 1 to wave k?

.00 GrThn a 50% reduction
1.00 40.1 to 50% reduction
2.00 30.1 to 40% reduction
3.00 20.1 to 30% reduction
4.00 10.1 to 20% reduction
5.00 0 to 10% reduction

VI. STATISTICAL INFORMATION

A. Statistic Used for Sample **[STAT1]** _____

What is the statistic that was used to calculate the effect size

1 *t*
2 F
3 r
4 X^2
5 *d*

6 proportion probit
7 Odds Ratio
8 P Value
9 *B* to r

B. Statistical Value **[STAT2]** _____
What is the value used for STAT1, what is the raw score

C. R Value **[R]** _____
The calculation of the value of **stat1** into r

D. Zed R Value **[ZR]** _____
This is the transformation of the r into a z score, so they may be comparable with each other.

E. Sample Size **[N]** _____
This is the sample size for that particular article

F. Sample Size Minus 3 **[NMIN3]** _____
This is calculated by N – 3, to account for the variance of each study when using them as a group, in both random-effects and fixed-effect models.

G. Effect Size **[ZPLUS]** _____
This is the multiplication of the zr * nmin3, which is the weighted mean effect size.

Appendix C. List of Study Author (first author), Year, Effect Size, and Sample Size

Author	Year	*r*	N
Andrews	1998	.261	54
Arsenault	2002	.066	849
Asbury	2006	.076	525
Ashman	2004	.361	138
Bailey	2004	.125	499
Barbin	1998	.380	43
Bendersky	1998	.499	77
Bendersky	2006	.180	187
Bennett	1999	.091	12,544
Bijur	1986	.509	11,966
Blair	2002	.249	409
Breslau	1996	.096	801
Breslau	1996	.072	801
Brown	1991	.427	46
Brown	1991	.556	46
Chasnoff	1998	.337	122
Chasnoff	1998	.338	122
Clarke	1999	.170	73
Clarke	1999	.430	73
De Cubas	1993	.368	40
Delaney-Black	2000	.222	471
Dietrich	2001	.510	186
Fried	1992	.387	126

Ge	1996	.349	45
Gibbins	2000	.190	236
Haddars	1988	.094	363
Hansen	1997	.601	44
Harbor	1999	.080	1,695
Horwood	1998	.469	1,313
Hoy	1992	.140	366
Laucht	2000	.021	219
Laucht	2001	.165	337
Lewis	1977	.173	162
Linares	2005	.326	187
Liu	2004	.119	541
Liu	2001	.385	2,966
Liu	2004	.091	982
Liu	2004	.071	1,044
Makin	1991	.271	91
Maughan	2004	.274	1,784
O'Connell	1991	.381	56
Olds	2004	.167	461
Orlebeke	1999	.107	1,077
Orlebeke	1999	.082	1,077
Orlebeke	1997	.097	1,233
Rantikallio	1992	.210	6,007
Slinning	2004	.310	92
Sood	2001	.225	183

Taylor	1998	.167	133
Wakschlag	2002	.247	77
Wakschlag	2006	.269	448
Wakschlag	2001	.279	129
Waldrop	1978	.320	59
Walther	1982	.364	50
Weitzman	1992	.168	2,039
Wilks	2000	222	150

Appendix D. Institutional Review Board Exemption Letter

UNIVERSITY OF Cincinnati

Institutional Review Board
Medical Center
University of Cincinnati

University Hall – Suite 300
51 Goodman Drive
Cincinnati, OH 45221
Phone (513) 558-5259
Fax (513) 558-4111

TO: David Carter, M.A.
Department of Criminal Justice

FROM: Mike Linke, Ph.D., Chairman
University of Cincinnati
Institutional Review Board #1-2

DATE: May 5, 2011

RE: Early Life Problems: A Systematic Review

Please be advised that I have reviewed the study referenced above as outlined in your submission to the IRB, and have determined that the work described in this project is not research involving human subjects as described in 45CFR46.102(d, e, f).

Thank you for your continued compliance with the Board's requirements with regard to your research activities.

Please note: This approval is through the U.C. IRB only. You may be responsible for reporting to other regulatory officials (e.g., VA Research and Development Office, UC Health- University Hospital). Please check with your Institution and Department to ensure you have met all reporting requirements.