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Genetic and Environmental Influences of Maternal Psychosocial and Antisocial Tendencies on the Development, Stability, and Continuity of Problem Behaviors in Adoptees from the Texas Adoption Project: A Life Course Investigation of Risk, Resilience, and Vulnerability

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by

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Utilizing a 30 year longitudinal investigation of 300 adoptive families, the influence of both general and specific maternal psychological functioning on the development, stability, and continuity of problem behaviors was investigated. In the first part of the investigation, biological and adoptive mothers' scores on eight subscales from the Minnesota Multiphasic Personality Inventory were investigated to discover whether general psychosocial functioning, defined as the number of elevated subscales scores, or specific subscales were related to problem behavior development during childhood, adolescence, and adulthood. Based on earlier findings from the Texas Adoption Project (Loehlin, Willerman, & Horn, 1982, 1987), it was predicted that birth mothers' general psychosocial functioning would predict problem behavior development in their adopted away offspring during adolescence and adulthood, but that the adoptive mothers' general functioning would predict behavior problems during childhood. I also predicted that the birth mothers' specific subscales, namely the psychopathic deviate scale, would be the strongest predictor of adoptee behavior problems across the entire life span. These

hypotheses were generally supported. In the second part of the investigation, the stability and continuity of problem behaviors were assessed to explore whether mean and intra-individual trends in behavior, from childhood through middle-adulthood, differ as a function of gender, adoptive status, and relative risk status. Genetic and shared environmental influences on problem behavior development and continuity were also investigated using correlations between biologically related and non-related sibling pairs. Trends in both mean behavioral stability and intra-individual continuity were found to differ between groups and genetic effects were found for the development of, but not continuity in, problem behaviors. Finally, individual and family environmental characteristics were investigated as potential risk or protective factors for two groups of adoptees that varied in the amount of genetic risk they faced for problem behavior development. Findings from the investigation highlight the necessity for using genetically informative, longitudinal samples to investigate the influence of maternal psychological functioning on the development of problem behavior. The importance of conducting analyses of the influences of genetics and environmental factors separately for males and females, as well as for Higher-Risk individuals, is also addressed.

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Chapter 1: General Introduction

Researchers from a number of areas within psychology have attempted to identify the antecedents of, and factors influencing the development of, problem behaviors during childhood, adolescence, and (to a limited extent) adulthood. Researchers from within the fields of Developmental Psychology, Behavior Genetics, and Developmental Psychopathology have investigated how the behaviors of proximal individuals, such as parents and siblings, influence behavioral outcomes throughout the different stages of life. While the goal of the researchers from within each of these areas is the same—to uncover what factors contribute to or hinder the development of problem behaviors—the interpretation of the results from different theoretical standpoints may lead to very different practical implications, each lending to potentially different policy or treatment recommendations. Accordingly, the first chapter of this dissertation is dedicated to outlining the differences between the research methods, findings, and interpretations of results for problem behavior development in these three areas of psychology. This chapter, therefore, provides both a brief history of the research on problem behavior development and a rationale for the methods used in the current investigation, followed by an outline of the remaining chapters.

Socialization Hypothesis

The association between family and other social factors that predict the likelihood of developing and maintaining problem behaviors is a popular research topic within the area of Developmental Psychology. Parental mental illness is widely thought to influence problem behavior development in children and adolescents. This relationship is, therefore, a very popular one to study. The family climate, or care giving environment, created by having a mentally ill parent (particularly a mentally ill mother) has been found to be associated with problem behavior development in toddlers (Carter, Garrity-Rokous, Chazan-Cohen, Little & Briggs-Gowen, 2001; Field, 1995; Gross, Conrad, Fogg, &

Wothke, 1994), children (Henderson, Sayger, & Horne, 2003; Miller, Warner, Wickramaratne, & Weissman, 1999; Sheppard, 1994), and adolescents (Frye & Garber, 2005; Leve, Kim & Pears, 2005) alike. Maternal depression for example has been associated with increased tantrums and acting out in toddlers (Field, 1995), increased aggression in children (Park, Essex, Zahn-Waxler, Armstrong, Klein & Goldsmith, 2005), and increased rates of delinquency in adolescents (Sanders & Ralph, 2005). Similarly, parental antisocial behaviors, such as hitting, bullying, neglecting, or otherwise abusing their children have also been linked to like behaviors in their offspring, during the childhood years (Rhule, McMahon, & Spieker, 2004).

Additional social factors that have been identified as antecedents to childhood and adolescent behavior problems include indicators of family stress (Compas, Howell, Phares, Williams, & Giunta, 1989; Matjasko, Grunden, & Ernst, 2006), socioeconomic disadvantage (Adams, Hillman, & Gaydos, 1994; Achenbach, Stevenson, Richman, & Graham, 1985; Verhulst, Edelbrock, Baron, & Akkerhuis, 1987), negative peer affiliations (Patton, 1995; Sussman, Dent, McAdams, Stacy, Burton, & Flay, 1994) and harsh parental practices (Baumrind, 1993; Maccoby & Martin, 1983). All of these factors have been found to predict whether adolescents are likely to engage in delinquent and risky behaviors, such as truancy, unprotected sexual intercourse, smoking, drug and alcohol use/abuse, and criminal activity. What this line of research cannot tell us, however, is the directionality of the relationships, what factors mediate them, or whether the relationships are causal at all.

What most developmental psychologists traditionally had not taken into account was the possibility that something other than the environment created by having a mentally ill parent, growing up in a poor family, or hanging around with a bad group was acting on children and adolescents to create externalizing, antisocial behaviors and attitudes. Some developmental psychologists balked at the possibility that individuals might be acting on their environments (Plomin & Bergeman, 1991; Scarr & McCartney, 1983), choosing those "bad" friends, or eliciting harsh punitive responses from their parents. A few, however, did begin thinking about this possibility earlier. Bell (1968), for

example, set forth the notion that children's behaviors were not only influenced by the behaviors of their parents, but the children's actions influenced the behaviors of their parents toward them as well. These so called child-effects models have become increasingly popular, finding evidence for the existence of these person-environment correlations both within the laboratory (e.g., Anderson, Lytton, & Romney, 1986) and within the home (e.g., Patterson, 1982).

Behavior Genetics

In 1983 Scarr and McCartney pushed the notion of person-environments even further, purporting that the characteristics of the environment acting upon the children may be influenced by individuals' genetically determined propensities. Using methods from behavior genetics, O'Connor, Deater-Deckard, Fulker, Rutter, and Plomin (1998) investigated a traditionally developmental phenomenon, the development of antisocial behavior, using genotype-environment correlations, or correlations between biological parents and their adopted away children. Genotype-environment correlations, they stated, allow researchers to investigate how variations in genetic risk and social risk factors influence the development of antisocial behaviors.

The basic premise behind the theory of behavior genetics is that behaviors, just like physical characteristics, develop in part as a result of individuals' genetic make-up. Contrary to what many believe, behavior geneticists do not attempt to prove that behaviors are 100 percent genetic. Rather, researchers using the theory and methods of behavior genetics attempt to uncover what percent of the development of a given behavior can be accounted for by genetic factors. Some behaviors have been found to be highly genetic in nature, for example extraversion—the tendency to be highly social and a bit impulsive—has been found to be about 70% genetic (Canter, 1969; Price 1969; Shields 1962), but others, such as agreeableness (Loehlin, 1992), have been found to have much smaller heritabilities. Whatever is not accounted for by genes (or errors of measurement) must, therefore, be due to environmental factors. What behavior

geneticists then try to determine is how much of the differences in the trait between individuals is due to shared environmental factors (things in the environment shared between individuals) and how much is a result of non-shared environmental factors (aspects of the environment not shared between individuals).

Because behavior genetic researchers have attempted to parse the amount of a trait that developed as a result of genetic factors, shared environmental factors, and non-shared environmental factors a few special populations of individuals have been frequently utilized. These populations include monozygotic twins (twins who originated from a single egg and sperm but randomly split shortly after fertilization and developed as two distinct, but 100% genetically alike, individuals) who were reared in different families, monozygotic twins reared in the same home, dizygotic twins (twins that originated from the fertilization of two eggs and two sperm and who are no more alike, genetically, than siblings born at different times), and adopted children. Each of these populations can be very informative to study because of the differences in the degree to which each of the groups overlap in both their genes and environmental factors.

Ignoring, for the moment, such complications as correlations and interactions between genes and environments, the variance of a trait can be broken down as follows: Monozygotic twins reared apart (MZA) share 100 percent of their genetic composition but zero percent of their environment, when adopted away shortly after birth and when they are not adopted to similar families—two suppositions that will be discussed shortly. Genetic effects on the development of behaviors among these populations are assessed using correlation coefficients. The extent to which MZA twins correlate represents the estimate of the genetic effect for a given behavior. Given that the expected range of the correlation coefficients is from 0.0 – 1.0, subtracting the correlation coefficient from one yields the estimate of the effect for a given behavior that is due the non-shared environmental factors and errors of measurement.

As noted earlier, for the estimates of the genetic and non-shared environmental effects to be reliable when MZA are used requires that a couple of assumptions are true. The first assumption that must hold is that the MZA were adopted away shortly after

birth (and that the prenatal environment had no influence on the outcome of interest). If this assumption was not met, and the twins did share the same rearing environment during infancy and/or childhood, than the correlation cannot be assumed to be purely due to the fact that they share 100% of their genes in common—resulting in an overestimation of genetic effects. The second assumption that must be true is that the MZA twins were not adopted by biological family members. If MZA twins were adopted into the homes of genetically related family members than the correlations would also result in an overestimation of genetic effects—because genetically related individuals would likely have similar rearing strategies and, therefore, would likely provide some environmental factors that could be argued to be shared. Similarly, if the twins were adopted by families with similar characteristics to one another, genetic effects might also be overestimated. Given that adoptive families are generally a more homogeneous sample of the population than non-adoptive families, which is discussed more fully later, this may be a weakness of the use of twins reared apart to estimate genetic effects.

Falconer (1960) put forth another way to estimate genetic and environmental influences on behavioral characteristics using both monozygotic (MZ) and dizygotic (DZ) twins. As stated earlier, monozygotic twins share 100 percent of their genes, while DZ twins are no more alike than non-twin siblings who share an average of 50 percent of their genes in common. Therefore, Falconer applied the correlations for a particular trait for both MZ and DZ twins into the equation 2(MZ-DZ), which yielded an estimate of the amount of the variance in that behavior that was due to the variation of the genes within a particular population, or heritability. Subtracting the heritability estimate from the MZ twin correlation yields an estimate of the amount of the variance of a particular trait is due to shared environmental factors and subtracting the MZ correlation from 1.0 (as with the MZA comparisons) provides an estimate of the non-shared environmental effects.

Some assumptions must also be met for the estimates of the Falconer's method to reliably estimate both genetic and non-shared environmental effects. One is the equal environments assumption. In order for the estimate of genetic effects to be reliable, the environments of monozygotic twins should be no more similar than the environments of

the dizygotic twins. For example, if it was found that parents treat MZ twins more alike than DZ twins a priori (i.e. not just as a result of their differences in behavior), this assumption would be put into question and genetic effects may be overestimated. Research into the question of whether MZ twins' environments are more similar has been undertaken and generally found not to account for the similarity in personality and IQ between twins (e.g., Loehlin & Nichols, 1976; Scarr & Carter-Saltzman, 1979). Another assumption is that twin samples generally representative of the general population. Due to their high rates of premature birth and the environmental effects of sharing a womb, twins tend to be lower in verbal abilities (Rutter & Redshaw, 1991) although this difference usually disappears by middle childhood (Wilson, 1983). In general, twins have not been found to differ from singletons, as far as prevalence rates are concerned, in either personality or rates of psychopathology (Christensen, Vaupel, Holm, & Yashlin, 1995).

Another genetically informative design is the adoption method. In these samples children were reared by parents, and share environments with siblings, with whom they share no naturally varying genes. Again, correlation coefficients have been estimated to detect the amount of similarity there was between sibling behaviors—correlations here have served as an estimate of the effect of common environmental factors—while parent-child correlations served as a measure of the influence of parenting practices and behaviors on behavioral development in adopted children. The generalizability of studies from these adopted samples too is limited, because both adopted children and the parents who adopt them are not randomly sampled from the general population. For example, adopted children have biological parents who display a greater percentage of defiant tendencies (Horn, Loehlin, & Willerman, 1982) than the general population, and adoptive parents tend to be older, more educated, and higher in socioeconomic status than then general population (Loehlin, Willerman, & Horn, 1981). However, the heritability estimates found using adoptive samples have often been similar in strength and direction

to those found using twin samples[1] and the adoption method allows investigators to parse out the influence of genetic and shared environmental effects in some ways that twin methods cannot.

Despite the limitations to the research conducted using genetically informative samples, results from all the three major methods described have yielded similar results, namely that both problem behaviors and psychological disorders characterized by high amounts of problem behaviors, such as antisocial personality disorder, conduct disorder, and attention deficit hyperactive disorder, show at least moderate heritability (American Psychiatric Association, 1994).

While informative about the nature of problem behavior development, providing estimates of the amount of variance accounted for by genetic, shared environmental, and non-shared environmental factors, these results do not tell us at which stage in the life cycle specific environmental factors become important in predicting the development of behavior or whether the influence of specific environmental agents can deflect a particular developmental pattern. For answers to these sorts of questions we turn to the area of developmental psychopathology.

Developmental Psychopathology

The focus of developmental psychopathology is to gather an understanding of not only the factors that lead to maladaptive behavior but normative behavior as well (Overton, 2004). Using methods employed within the area of developmental psychopathology, researchers search for *risk factors*, factors that increase the likelihood of maladaptation; *promotive factors*, factors that increase the likelihood of positive adaptation; and *protective factors*, factors that help decrease the likelihood of maladaptation in the face of high risk. Developmental psychopathology unites the major premises of both socialization and behavior genetic theories of behavior in that most

[1] Although twin heritabilities can sometimes be substantially higher, suggesting non-additive genetic effects are important for the traits involved.

models consider factors from many aspects of the social environment, individual characteristics, and biological factors as well—either by accounting for genetic effects (e.g., Reiss & Neiderhiser, 2000) or by investigating the role that biological factors, such as the onset of puberty (e.g., Eccles, Lord, & Roeser, 1996), play in the development of certain behaviors.

Another important distinction between the research done within the scope of developmental psychopathology and the research utilizing theories of behavior genetics or socialization is that, as a developmental theory, developmental trends (or trajectories) of behavior are often the subject of interest. While developmental psychopathologists, like behavior geneticists and social learning theorists, often study the antecedents to the development of problem behaviors, they also attempt to uncover how certain factors can influences changes in development over time, often for distinctly different groups of individuals.

For example, Lenzenweger and Castro (2005) used the "neurobehavioral model within an individual growth curve framework" to investigate the stability and continuity of borderline personality disorder (BPD) among persons with the disorder who were treated versus persons with the disorder who were not treated. In this way, Lenzenweger and Castro were able to assess both the rates of change and important predictors of change in clinical features of BPD among two distinct subgroups of people. Using samples of both treated and untreated individuals with borderline personality disorder (rather than treated individuals alone, which had been done in the majority of studies before them) Lenzenweger and Castro uncovered a more nuanced pattern of the development of symptoms of BPD, which depended both on whether an individual received treatment and the amount of incentive motivation and negative emotion each individual maintained.

The methodological approach used by the developmental psychopathologist allows researchers to uncover both main effects and interactions from various environmental sources (e.g., families, schools, neighborhoods), as well as important individual characteristics and biological factors, leading to a more holistic understanding

of the antecedents to and development of behavioral functioning. The current investigation utilizes this approach to uncover the effects of individual characteristics, the genes, and the family environment on the development and continuity of externalizing problem behaviors across the lifespan of individuals who were adopted at birth, in hopes of uncovering potential risk and protective factors that may promote resilience (the development of positive functioning despite being at risk for negative outcomes).

The Current Investigation

The data used for this dissertation came from a genetically informative sample of subjects, in order to investigate questions regarding risk and protective factors for the development and stability of problem behaviors across three major life stages; childhood, adolescence, and adulthood. Thus, the current investigation utilized the conceptual framework of developmental psychopathology and behavior genetic methodology to test both socialization and behavior genetic hypotheses regarding the development of problem behaviors from early childhood through middle adulthood.

Subjects came from the Texas Adoption Project (TAP), a 30-year investigation of 300 Texas families. Each of the families had at least one child adopted from a particular adoption agency which served as a home for unwed mothers. Each biological mother filled out personality questionnaires, took IQ tests, and received psychological interviews while residing in the home. Each of the adoptive parents later filled out the same personality questionnaires and took the same (or similar) tests of intelligence. The adopted children were first assessed on personality and measures of IQ during childhood (average age of approximately 8 years old) and were followed at two time points, one approximately 10 years after the first, the other about 12 years following the second. At the first follow-up, measures of personality and intellectual ability were assessed. During the third data collection phase, the principal investigator, Joseph M. Horn, and I were able to conduct detailed, semi-formal interviews with a little over half of the original parents from the 300 Texas families. Information acquired during these interviews served

as the primary source of data upon which behaviors throughout the life span of the participants were assessed for this project.

The TAP has a number of advantages from a scientific standpoint. Not only were the children adopted away within days of birth (in the majority of cases) but all of the adoptions were closed record adoptions. This limits the amount of time spent with the biological mother and allows us to draw conclusions about genetic effects because we are relatively certain that the children had no contact with their biological mother during childhood[2]. In addition, the adoptive parents were often told little about the biological parents—beyond disclosing the birth mother's age and educational attainment. Riggins-Caspers (1997) found that adoptive parents who were told that the birth parents had antisocial problems were more likely to seek professional counseling for their children than adoptive parents who were not told anything about the psychological histories of the birth parents, among a group of adoptees with no distinguishable problems. Therefore, having adoptive parents with little or no knowledge of the birth mothers' (or fathers') psychological functioning enables us to draw firmer conclusions about genetic effects, should evidence of them be found. The adoption agency did attempt to place infants into homes where the physical characteristics (e.g., hair and eye color) of the adoptive parents resembled those of the biological mother—which could potentially result in a slight overestimation of genetic effects. A main advantage of the TAP, from a research perspective, is that 46% of the families also had at least one biological child of their own—a group which serves as an important comparison group.

Research Questions

The TAP data provided a unique opportunity to assess questions regarding the development of problem behaviors over time. Due to the consistency of measurement

[2] Although a number of adoptees have since located their biological mothers, this was not done (to our knowledge) prior to the age of 16.

between the biological mothers and the adoptive mothers of the adoptees the following three questions could be investigated:

1. Do biological mothers with identifiable psychological maladjustment leave their adopted away offspring at heightened risk for developing problem behaviors in childhood, adolescence, and/or adulthood?

2. How do problem behaviors develop over time for different groups of individuals, such as adopted children, children reared by their biological parents, or adoptees that vary in the amount of genetic risk they face for problem behavior development?

3. Once genetic factors are controlled for, what individual and family characteristics serve as protective factors for individuals at risk for developing problem behaviors, and which serve as risk factors for individuals who are not at increased genetic risk?

Few studies have been able to use a genetically informed, longitudinal sample to investigate the link between genes, environment, and the development and progression of problem behaviors from childhood into mid-adulthood. Of those that do exist (e.g., the Colorado Adoption Project, Plomin & DeFries, 1983), few have had access to high quality, reliable measurements of maternal psychological functioning (especially the same measures for both biological and adoptive mothers) and been able to link these measures to their offsprings' behavioral outcomes—a gap this thesis will attempt to fill.

Outline of the Dissertation

Chapter Two of this dissertation addresses the question of whether biological and/or adoptive mothers who showed clear indications of psychological and/or behavioral difficulties left adoptees vulnerable toward developing problem behaviors during childhood, adolescence, and adulthood. To this end, both an index of psychosocial

functioning and individual indicators of various psychological dysfunctions were used to investigate whether general maternal psychosocial malfunctioning or specific psychological difficulties predict problem behaviors in the adoptees. Following this, an initial assessment of genetic and environmental effects on problem behavior development was made, using parent-child correlations.

Chapter Three addresses how problem behaviors developed among the biological and adopted individuals from the Texas Adoption Project. In addition, differential patterns of behavior between Higher-Risk and Lower-Risk adoptees, as defined by the findings from Chapter Two, were investigated. Most work on problem behavior development has found a general increase in defiant, externalizing types of behaviors between childhood and adolescence, followed by a decline of problem behaviors as individuals mature into adulthood. This investigation explored whether adoptees, in general, follow this same pattern of development and, breaking the sample down further, whether individuals whose biological mothers were defiant or psychologically troubled showed different developmental trajectories than adoptees whose biological mothers were not. Sex differences within each of these groups were also explored and the degree to which genes and the shared family environment influenced the development and stability of problem behaviors were also investigated.

Chapter Four explores a set of individual and stable family characteristics that may serve as protective factors promoting resilience toward problem behavior development, for individuals who were classified as Higher-Risk. These same individual and family characteristics were also investigated as potential risk factors for individuals displaying vulnerability (i.e., displaying negative outcomes despite the lack of risk factors). In this largely exploratory chapter, an adoptive sample is used to test socialization hypotheses regarding the influence of maternal care giving and other family factors that have been found to predict problem behavior development. I also explore the hypothesis that individuals' characteristics such as childhood IQ and early temperament protect Higher-Risk adoptees from developing antisocial behaviors, despite their genetic risk.

The final chapter provides a brief review of the findings from Chapters Two through Four. In this summary chapter I also discuss possibilities for future research on problem behavior development and outline the implications of my findings for treatment and for individuals involved in the adoption process.

Chapter Two: Assessing the Environmental and Genetic Influence of Maternal Psychosocial Functioning on Problem Behavior Development from Childhood to Middle Adulthood

Maternal psychosocial functioning, broadly defined as maladaptation in one or more areas of psychological or behavioral adjustment, has been found to be a moderately strong predictor of problem behaviors among offspring during childhood and adolescence. Maternal depression, for example, has been associated with offspring externalizing behaviors and conduct disorder during childhood and delinquency during adolescence (Frye et al., 2005; Gelfand & Teti, 1990; Hammen, 1999; Luoma, Tamminen, Kaukonen, Laippala, Puura, Salmelin, & Almqvist, 2001). Similarly, maternal antisocial behaviors have been linked with childhood conduct problems and adolescent delinquency (Ehrensaft, Wasserman, Verdelli, Greenwald, Miller, & Davis, 2003; Rhule, et al., 2004).

Far less research has been conducted on the association between maternal mental health and offspring outcomes beyond the adolescent years. Much of the existent literature on the topic of intergenerational patterns of externalizing goes only into young adulthood and often only compares fathers and sons. Of the studies that do investigate the association between maternal externalizing and offspring antisocial behaviors, it has been found that childhood and adolescent histories, as well as abusive parental behaviors, do predict externalizing behaviors in their young adult offspring, but only significantly for their daughters (Verona & Sachs-Ericsson, 2005). Scaramella and Conger (2003) have also found that hostile parenting practices were passed down from mothers to their adult daughters. These harsh parenting practices included behaviors such as hitting, slapping, or pinching, being behaviorally controlling, and/or using statements of personalized disapproval. Defined as such, these types of harsh parental practices are conceptually similar to typical measures of externalizing, antisocial behaviors, such as bullying and physical aggression, and support the notion that antisocial behaviors can be passed down from one generation to the next.

Findings such as these have led researchers in many directions in search for the pathways of transmission between maternal psychopathology[3] and offspring problem behaviors. For example, some have found that the genes a depressed or antisocial mother passes on to her offspring may leave them at increased risk for problem behavior development (Lemery & Goldsmith, 1999) especially when the pathology is profound (i.e., symptoms developed early on and were pervasive throughout her lifespan) (Viding, Blair, Moffitt, & Plomin, 2005). Others have found that such mothers tend to be overly critical (Goodman, Adamson, Riniti, & Cole, 1994; Webster-Stratton, & Hammond, 1988), generally negative (Garber, Braafladt, & Zeman, 1991; Jaffee, Belsky, Harrington, Caspi, & Moffitt, 2006; Lovejoy, Graczyk, O'Hare, & Newman, 2000), and unresponsive toward their children's needs (Cox, Puckering, Pound, & Mills, 1987). These environments are thought to elicit the conduct problems observed among depressive and antisocial mothers' offspring (Jaffee, et al., 2006; Moffitt, 2005). Still other researchers (e.g., Plomin & Ashbury, 2005; Scarr, et al., 1983) argued that it is difficult to disentangle the effects of the maternal caregiving environment and the effects of the maternal genetic disposition, because they likely act together to create offspring outcomes.

Indeed, most genetically informed investigations have shown that both genetic and environmental factors contribute to the development of problem behaviors across the life span (Caspi, Moffitt, Morgan, Rutter, Taylor, Kim-Cohen & Polo-Tomas, 2004; Kim-Cohen, Moffitt, Taylor, Pawlby, & Caspi, 2005). For example, Kim-Cohen et al., (2005) found that both the genes passed on by depressed mothers (and their mates) and the caregiving environments created by these depressed mothers influenced problem behavior development in children between the ages of 5- and 7-years-old. Caspi et al., (2004), also found both genetic and environmental effects when identifying factors that

[3] The link between paternal psychosocial functioning and offspring outcomes has also been studied extensively (e.g., Mednick, Gabrielli, and Hutcheson, 1983). Because we do not have data on biological fathers, however, I could only investigate the relationship between mothers' adjustment and offspring behavioral outcomes.

influence antisocial problem behavior development. However, many of these studies, including Kim-Cohen et al. and Caspi et al., compared concordance rates (a measure of similarity between a pair of individuals) among twins, both identical and fraternal. In twin studies the shared environmental component is parsed out, and shared environmental effects are estimated by the remainder of what is not accounted for by genetic and non-shared environmental effects (and error). Since what we are interested in, when investigating the relationship between maternal psychosocial well-being and offspring outcomes are both the genetic and the shared environmental effects, it may be more informative to use samples of individuals where the non-shared, rather than the shared, environmental effects are parsed out.

Adoptive samples provide the ability to do such an investigation. Using parent-child correlations, the influence of birth mother psychopathology and adoptive mother psychological functioning can be assessed independently, allowing us to determine which influences the development of problem behaviors throughout the life span. The adoption method, therefore, may help detect the separate influence of maternal environmental effects and maternal genetic effects on problem behavior development better than the twin method, especially when the subjects were adopted away shortly after their birth and the same measures are available for both the biological and the adoptive mothers.

One study of this nature has been conducted investigating the relationship between parent and offspring criminal behavior. Mednick, Gabrielle and Hutchings (1983) conducted a study using an adoptive sample from Denmark—where both adoptive and criminal records are public record. Using this archival data, Mednick and his colleagues investigated the correlation between biological and adoptive parents' criminality (number of felony convictions) and criminality in their adopted away offspring.

Mednick's findings were striking. First, it was found that adoptees, in general, had elevated rates of criminal convictions (13.5% vs. 10% national average). Second, when a biological parent had a criminal record, but the adoptive parents did not, the adopted away offspring were much more likely to have also been convicted of a felony crime

(20%). However, when an adoptive parent had a criminal conviction but neither biological parent did, the adopted offspring were no more likely to have been convicted than the adopted children with neither biological or adoptive parents having a conviction (14%). Lastly, when both a biological and an adoptive parent had criminal convictions, these adopted away offspring were most likely, of the four groups, to have been convicted (24.5%). These findings suggest that adoptees were at increased risk for criminality (an extreme problem behavior), genetics plays a moderate to large role in predicting criminal behavior, and that the genes interact with environmental factors making adoptees with both genetic and environmental risk factors most vulnerable toward developing problem behaviors during adolescence and adulthood.

The current investigation used data from a 30-year longitudinal adoption project, the Texas Adoption Project, which (similar to the Mednick et al. study) included the same measures for both the birth parent and the adoptive parent, to estimate the influence of maternal psychosocial characteristics on adoptee problem behavior development across the life span. Using T-scores from the Minnesota Multiphasic Personality Inventory (MMPI) (Dahlstrom, Welsh, & Dahlstrom, 1960), both general levels of psychosocial functioning (the summation of 8 MMPI subscale T-scores) and specific subscales were tested as predictors of problem behavior development during childhood, adolescence, and adulthood. In this way, I was able to investigate whether the birth mothers' genetic propensity and/or the adoptive mothers' psychological functioning influenced problem behavior development well into the adopted individuals' adult years (upper 30s and 40s).

This question was addressed in the following manner. Using linear regressions, the current analyses assessed whether birth mothers' index scores of general psychosocial functioning (described above), adoptive mothers' index scores, or the interaction between the two influenced the development of problem behaviors in the adopted away offspring during childhood, adolescence, and/or adulthood. Earlier findings from the Texas Adoption Project (Loehlin, Willerman, & Horn, 1982, 1987) suggested that adoptees were mildly similar to their adoptive parents in personality and IQ during childhood, but did not resemble their adoptive parents at all during adolescence; instead they moderately

resembled the mothers who gave them up at birth. Similar to these previous findings, I expected adoptive mothers' levels of psychosocial functioning to predict the development of childhood behavior problems in the adopted sample, but that the birth mothers' general levels of psychosocial functioning would predict problem behavior development during adolescence and adulthood.

Generality vs. Specificity of Transmission

Another question addressed in this chapter has to do with the specificity with which problem behaviors are transmitted from one generation to the next. For example, does maternal psychosocial adjustment, broadly defined as the summation of elevated subscales, predict behavioral adjustment in the offspring or do specific subscales predict problem behavior development? In other words does having a mother with comorbid symptomology influence problem behavior development? Secondly, do specific psychological deficits in the mother leave her offspring at greater risk for developing externalizing, antisocial behaviors throughout the life span? Prior research suggests that both maternal depression and maternal antisocial disorders are associated with offspring displays of externalizing behaviors during childhood and adolescence. These two disorders, however, have been found to be highly comorbid with one another, especially among female adolescents (Keenan, Loeber, & Green, 1999; Zoccolillo, 1992). Therefore, the current investigation sought to uncover whether maternal antisocial tendencies alone, or the number of psychological maladjustments combined, indicate who is at greater risk of developing problem behaviors.

Another set of regressions was run, this time using scale scores for indicators of eight specific indicators of maternal psychological maladjustment; including depression, psychopathic deviance, hypochondriasis, schizophrenia, hypomania, and paranoia, hysteria, and psychasthenia. This set of regressions was done to assess the specificity with which problem behaviors may be transmitted. For example, did adoptees that were raised by mothers with high scores on the depression subscale display similar levels of

problem behaviors to adoptees reared by mothers who had high scores on the paranoia subscale? Did having a birth mother with obvious signs of depression predict problem behavior development as well as having a birth mother with signs of antisocial tendencies? Based on the results from Mednick et al. (1983), it was hypothesized that the genetic transmission of problem behaviors would be specific, such that having a biological mother with deviant or antisocial tendencies would predict problem behavior development across the life span. No specific predictions were made with respect to the influence of the adoptive mothers' subscale scores, except that none were expected, for the same reason listed above, to occur beyond the childhood years.

METHOD

Subjects

Data for this investigation came from the Texas Adoption Project, a longitudinal study of 300 Texas families with at least one adopted child. There were three primary data collection phases from TAP. During Time 1 (1979) 691 children, both adopted and biological, from the 300 families were interviewed and administered IQ tests, while their parents (most often the mothers) filled out a questionnaire assessing each child's personality. The average age all of the subjects during Time 1 was approximately 8 years old. Almost all of the adoptees where Caucasian, as were the adoptive parents. In addition to extensive data on the children IQ, personality, and psychological profiles were assessed for the biological mothers (by the participating agency prior to the beginning of the TAP) and both adoptive parents (by the TAP in 1979).

The second data collection phase occurred approximately 10 years later. During Time 2 the, now adolescent (average age of 17 years), subjects were re-assessed. They completed age appropriate measures of personality and IQ, and their mothers rating them again (using the same measure as at Time 1) on personality. During Time 3, which began in the summer of 2000, letters were sent to the last known address for each of the 300 families. When letters were returned via the post office an internet search using Lycos was conducted—entering the adoptive father's name and last known city of residence. In

total 186 of the original 300 families were located and agreed to participate in the third data collection phase of TAP. Of them, 167 were actually interviewed; the remaining 19 had scheduling conflicts and were not interviewed. Thirty-two families explicitly declined participation, 6 sets of parents were reported to be deceased (often by one of children who received the letter), 39 families could not be located (either we had no current address for them or the post office returned the letter with no forwarding address), and 37 families did not respond.

For the 167 families that were interviewed, one of two interviewers (Joseph M. Horn or I) traveled to their homes and conducted detailed semi-formal[4] interviews with the parents. Information on the life course of each of their children was acquired, including infant, childhood, adolescent, and current physical health (major illnesses), scholastic achievements, general disposition, accomplishments, accidents, problems with drugs, alcohol, and the law, psychological diagnoses, and marital and reproductive histories (see Appendix 2A for a list of probes used during the interviews) . Though data are available for both the biological and adopted offspring, the research presented in this chapter deals only with the adopted subjects. The biological offspring will, however, be utilized in Chapter Three.

IQ scores for the adoptees' birth mothers were not included in the adoption records in many instances, limiting the number of subjects in the current analyses to 181. T-tests were computed to test for systematic differences between adoptees with and without data on birth mothers' IQ scores. Those individuals with relatively complete data differed by their age, adoptive mother rated extraversion during childhood, and by their adoptive mothers' age (see Table 2.1). These adoptees were younger, more extraverted during childhood, and had younger adoptive mothers than the adoptees without IQ scores for their biological mothers.

The tendency for adoptees with birth mother IQ data to be younger most likely reflects the change in practice at the adoption agency regarding IQ testing, which began

[4] The interviews followed no specific detailed clinical protocol, but a uniform set of probes was used to guide the parents through the life histories of each of their children, from infancy up to the present.

in 1973. The differences in the level of extraversion is likely associated with the age difference—as the extraversion scale is negatively correlated with age (i.e., younger adoptees also tended to be more extraverted in this sample). The differences between these two groups—those with and without birth mother IQ data—are not likely to have created a big problem for the analyses presented in the project as age is controlled for, when appropriate.

Measures

Problem behaviors. During the interviews described above extensive notes were taken on each member of the family. To estimate the amount of problem behaviors of each participant, two independent raters and I read through the interview notebooks and filled out an index of problem behaviors (IPB), created for the purpose of this investigation (see Appendices 2B and 2C). The items included on this index were based on research regarding the symptomology of antisocial personality disorder, conduct disorder, and existing measures of problem behaviors (such as Achenbach's [1991] Behavior Problem Checklist). Accordingly a majority of the items for the childhood, adolescent, and adulthood life stages represent antisocial, externalizing types of behaviors. The items included in the infant portion of the index were based on Thomas & Chess's (1977) conception of the easy vs. difficult infant temperament and were not included as a dependent variable in any of the analyses in this chapter, or the next. However, infant items and total scores were utilized as predictors of problem behavior in Chapter Four.

Each independent rater was trained on the interpretation and use of the behavioral index. A pilot sample of five families was randomly selected. Each rater read the interviews and rated each of the children according to the checklist. Each rater then compared his rating with that of the author. Discrepancies were discussed and an additional three families were rated to verify that each rater conceptually paralleled each other as to what constituted specific problem behaviors throughout the life span. Following the training exercise, each of the three raters then rated all of the children,

adopted and biological, in each of the 167 families. Each rater was blind to the adoption status of the individuals being rated and only the first names of the subjects were visible to the raters for identification purposes—although it was sometimes evident toward the end of the interview when parents often wanted to tell the interviewer about their opinion of adoption, a story of their child locating their biological mother, or something along those lines. Though hints of the adoptive status of some of the subjects were apparent in the interview notes, it should not have greatly affected the ratings of behavior because the independent raters were unaware of the specific hypotheses of this investigation. They were told simply that I was interested in the development of problem behaviors across the lifespan.

Initial interrater reliabilities were calculated for the sample as a whole using Cronbach's alpha, item by item. Cronbach's alpha is thought to be a good measure of interrater consistency when there are more than two raters, so long as each rater has rated all of the participants, because it allows systematic differences between judges to be detected (Stemler, 2004). The individual item alphas were then averaged within each of the life stages to summarize the reliability of ratings for each life stage. The individual item alphas ranged from 0.58-0.95 during childhood, with a mean alpha of 0.75, alphas could not be computed for three of the items (out of 14) because too few participants were rated as displaying the behavior. For the adolescent period, the item alphas ranged from 0.11-0.94, with a mean alpha of 0.82, and for adulthood the items ranged from 0.40-0.98 with a mean of 0.82 (alphas could not be computed for four of the adulthood items). While the average initial interrater reliabilities were reasonable, further measures were taken to assure that the coding received by each subject was as complete and correct as possible.

Following the initial reliability calculations, to assess the reason for any discrepant ratings and attempt to reach consensus ratings, the three raters met to discuss items on which they differed from one another on their respective ratings. Ratings were considered discrepant when 1) two of the three raters differed from one another by more than 1 point on Likert-type items, 2) all three raters differed on any item, 3) at least two

of the raters differed on dichotomous items (e.g., inappropriate sexual behavior during childhood), or 4) two of the raters differed by more than 2 counts on the open number items (e.g., number of arrests during adolescence). In instances where two raters agreed, and the third was off by 1 point, for the Likert-type and open ended items, the item was coded according to the two agreeing parties. If, however, the third rater was off by more than one point the three raters discussed the case and attempted to resolve the discrepancy. For example, if raters one and two rated an individual as having "little or no problems with tantrums" in childhood, while the third rater rated him as have "some problems with tantrums" in childhood, the final rating was "little or no problems with tantrums". However, if the third rater rated the individual as having "a lot of problems with tantrums" in childhood, the three raters reviewed the individual's notes, re-read the relevant information, assessed whether any of the raters missed something, and discussed what the appropriate rating should be. The final rating was than based on this discussion. Though absolute consensus was not always reached, in all cases the three raters were able to come within at most one point of each other. Again, final coding went to the "two out of three rule." Reliability analyses were then calculated again, using the average of the individual Cronbach alphas for each item within a developmental period. The resulting interrater reliability estimates were .84 for childhood, .92 for adolescence, and .94 for adulthood.

Once the ratings for each item were finalized, positive items were reverse scored and the items were summed for each of the three life stages: childhood (ages 4-12), adolescence (ages 13-19), and adulthood (ages 20 and over)[5]. Higher scores indicated more problem behaviors. The following paragraphs describe the scale composition for the measure of problem behavior at each life stage: childhood, adolescence, and adulthood. Appendix 2B provides a list of all of the items as well as a rubric for how each item was

[5] As previously noted, although measures of infant behaviors were also assessed on the Index of Problem Behavior they were not used in this investigation as a measure of problem behavior. The infant items will, however, be used in Chapter Four as predictors of problem behavior development during subsequent life stages.

scored for analysis. Appendix 2C provides the item response frequencies for each of the IPB items.

Problem behaviors during childhood (ages 4-12): included acting out in school or at home (tantrums, disregard for rules, frequent defiance), physical and verbal aggression, truancy, cruelty to animals, inappropriate sexual behavior, theft, and frequent lying. For the Likert-type items (items 1-9 on the IPB) responses were coded 1=rarely, 2=sometimes, 3=a lot of the time, except for item number one, "type of student," 0=good (A/B student), 1= average (C student), 2=poor (D/F student). For the dichotomous items, "cruelty to other children," "cruelty to animals," "inappropriate sexual behavior," and "diagnosed with a disorder," items were coded as 2=Yes (the mean of the possible number of points on the Likert-type items), 0=No. In this way the dichotomous items, because they tend to be more serious problem behaviors, are weighted more heavily in the overall score. This is the case at each of the three life stages measured in this dissertation project. On all items, if the behavior was not specifically indicated in the interview the rater checked the not indicated option and the items were coded as zero. Table 2.2 presents the descriptive statistics for all of the childhood items as well as the total scale score for the 381 subjects for whom we had interview data. All items were then summed for a theoretical range of 0-37. The sample range was 0-18, with a mean of 2.29 (SD= 2.48, Skewness= 2.154). The SPSS program for calculating scale reliability (Cronbach's alpha) for the childhood section of the Index of Problem Behavior was used (alpha= 0.56).

In order to provide a measure of the congruent validity of the IPB measure, correlations were calculated between items on the childhood Index of Problem Behavior and scales constructed from parent ratings during childhood at Time 1. These scales were based on a factor analysis of the mother's ratings on the bipolar rating scales in the original study (see Appendix A in Loehlin, et al, 1981). Table 2.3 lists the items that made up each of the scales; Extraversion, Well-Socialized, and Emotional Stability. Results from the correlations are presented in Table 2.4. The Extraversion scale was not correlated with any of the IBP items. The Well-Socialized scale was significantly,

negatively correlated with 5 of the 14 items: rule abiding, physical aggression, threw tantrums, manipulative, and bullied others. All the other items on the IPB also had a negative relationship with the Well-Socialized scale, though not significantly so. Finally, mother rated Emotional Stability was significantly, negatively correlated with throwing tantrums and having been diagnosed with a disorder during childhood. As with the Well-Socialized scale, all other estimates were in the negative direction, but were not significant. These results support the use of the Index of Behavior Problems as a valid indicator of behaviors during childhood, despite the fact that the index was rated on retrospective accounts, because previous, concurrent ratings given by the mother showed significant correlations to the retrospective accounts given during the interview in many instances. In addition, all relations between concurrent measures and retrospective measures of childhood behavior were in the right direction (i.e., being rated as well-socialized by their mothers during childhood was negatively associated with the problem behaviors they reported them having in childhood during the interview, twenty years later), even if statistical significance was not reached for each of the individual items.

Problem behaviors during adolescence (ages 13-19) included: truancy, drug use, alcohol use, theft, sneaking out or staying out past curfew, disregard for rules, getting into fights, frequent speeding tickets, frequent at fault car accidents, multiple sexual partners, destruction of property, and number of arrests and convictions. Items were scored in the same manner as the childhood items and summed for a total score indicating the amount of problem behaviors during adolescence. Scores ranged from 0-32, with a mean of 5.24 (SD= 5.44, Skewness= 2.04) and an alpha of 0.76. Table 2.5 presents the descriptive statistics for the adolescent IPB items.

To assess the congruent validity of the IPB for measuring adolescent problem behaviors, correlations were run between each of the adolescent IPB items and the mother rated scales of extraversion, socialization, and emotional stability from Time 2 (when the participants were an average age of 17 years). In Table 2.6, similar to the childhood correlations, many relationships between the contemporaneous measures of personality and the IPB ratings were significant and in the direction one would expect.

For example, adolescents who were *not* rated by their adoptive mothers as being well-socialized during adolescence were also rated by the three independent raters as having displayed problems with academic performance, truancy, lying, stealing, running away from home, and they were more likely to have been diagnosed with a disorder during their adolescent years. Lower scores on adoptive mother ratings of emotional stability were also related to many of these same problem behaviors, as rated by the three independent raters. Therefore, the adolescent index of problem behaviors also appears to be a valid measure of problem behaviors, at least as judged by consistency across time and method.

Problem behaviors during adulthood (ages 20 and up) included physical and verbal aggression, alcohol and drug use, destruction of property, gambling, credit card or check fraud, sexual assault, child abandonment or abuse, as well as the number of convictions, arrests, warrants, divorces, and illegitimate pregnancies. Items were coded and summed, as with the childhood and adolescent measures, for a resulting scale range of 0-27, mean= 2.10 (SD= 4.13, Skewness= 3.04), and a Cronbach's alpha of 0.77. Individual item descriptive statistics are presented in Table 2.7.

The adult portion of the IPB was validated by correlations between the IPB and two items on the self-questionnaire that was sent out to each of the participants following the parental interviews. The two items from the self-report questionnaire asked the subjects to circle a number between 1 and 9 that best represented their current level of problems with drugs and alcohol (1= no problems at all, 9= many problems) and the law (1= no problems at all, 9= many problems). These items were then correlated with similar items from the adulthood IPB measure. Self reported problems with drug and alcohol correlated 0.60 ($p< .001$) with our ratings of adulthood alcohol use and 0.49 ($p< .001$) with our ratings of drug use. Self-reported problems with the law correlated 0.53 with the number of arrests rating on the IPB and 0.38 with the number of ticket or warrants, both were significant at the $p< .01$ level. These results, like those from the childhood and adolescent correlations, partially validate the IPB as a measure of problem behaviors during adulthood.

IPB percent scores. There were two potential issues with the use of raw scores from the IPB as the dependent variable throughout this dissertation. First, the lack of developmentally consistent indices of problem behaviors and, second, the unequal number of possible problem behaviors across different life stages. As an example of the first issue, parental disobedience was a problem behavior that was measurable in both childhood and adolescence but, because children leave their parent's home when they reach adulthood, it was not an appropriate measure of adulthood problem behavior. Rather, social disobedience, measured by arrests, convictions, and tickets or warrants, was considered a good indicator of adult problem behavior and conceptually paralleled obedience in earlier life stages. Second, the number of potential behaviors that individuals can display that are considered as problematic may differ with age. Consequently, more items need to be included in the later life stages to cover the full range of possible problem behaviors—rendering the use of raw scores problematic. For example, a score of 4 in childhood is not equivalent to a score of 4 in adolescence, because the total possible scores are different—37 in childhood and 73 in adolescence. A score of four represents a much higher proportion of the total possible score during childhood than it does during adolescence (11% versus 5%, respectively). Therefore, percent scores were used as the measure of latent behavior problems in all of the analyses in this dissertation. IPB percent scores were calculated by dividing the total score within an age range by the total possible within that age. Mean percent scores were 7% during childhood (SD= 0.07, range= .00 - .41), 8% during adolescence (SD= 0.08, range= .00 - .41), and 3% during adulthood (SD= 0.06, range = .00 - .38) In Chapter 3 of this dissertation, I also investigate the correlations in rank order across the life stages to gain a sense of the individual-level stability of problem behaviors across the life span.

Specific indicators of Birth/Adoptive mother's adjustment. The Minnesota Multiphasic Personality Inventory (MMPI) T-scores were the basis for rating both the biological and adoptive mother's psychological functioning. The MMPI is a highly valid and reliable measure of both personality and state of psychological functioning (Butcher & Tellegen, 1966). The MMPI was administered to the biological mothers by a staff

clinical psychologist at the home/agency from which the participants were adopted. The adoptive parents were also administered the MMPI upon entry into the Texas Adoption Project. Because nearly all of the adoptive mothers were the primary care givers (therefore acting as the primary socialization agent) only the mothers' scores were used.

The MMPI is comprised of nine subscales (Dahlstrom, Welsh, & Dahlstrom, 1960): *Hypochondriasis* (Hs), chronic worrying over ones health despite lack of evidence for a medical diagnosis; *Depression* (D), severe and prolonged feeling of sadness, hopelessness, and persistent thoughts of death; *Hysteria* (Hy), the use of physical symptoms to deal with conflict; *Psychopathic deviate* (Pd), total disregard for social convention, rules, and norms, lack of empathy, compassion, anxiety, or fear of punishment, and moral bankruptcy; *Masculinity-femininity* (Mf), designed to detect "male sexual inversion" (i.e., males with female gender orientation); *Paranoia* (Pa), delusional beliefs; *Psychasthenia* (Pt), obsessive ruminations and compulsive behaviors (i.e., obsessive compulsive disorder); *Schizophrenia* (Sc), bizarre thought and/or behaviors; and *Hypomania* (Ma), hyperactivity, emotional excitement, and flight of ideas. T-scores on all of the subscales, except Mf, were used to predict problem behaviors in the adopted and biological offspring. Table 2.8 gives the average scores on each of the subscales for the adoptive and biological mothers. The birth mothers and the adoptive mothers had small and positive correlations on three of the MMPI sub-scale—Hypochondriasis, Psychopathic Deviance, and Psychasthenia. These relations should be considered when interpreting any outcomes based on mothers' sub-scale scores as they may inflate the relationship of either the genetic or environmental estimates based on these measures. I attempted to control for the influence of these relationships by controlling for birth mothers' scores, when the effects of the adoptive mothers' scores are being investigated, and vise versa.

General measures of Birth/Adoptive mother psychosocial adjustment. All MMPI subscale T-scores, except the masculinity/femininity scale, were used to construct an index of overall psychosocial functioning for both the biological and adoptive mothers. For each subscale that the mothers scored two standard deviation above the normative

sample mean (i.e., T-score = 70 or more) the subjects received a "1." These were then summed, for a possible scale range of 0-8, and used as an index of psychosocial adjustment for each mother. The birth mother's index of psychological adjustment ranged from 0-6 (mean= 0.51, SD= 1.12, Skewness= 1.58), while the adoptive mothers' index scores ranged from 0-5 (mean= 0.23, SD= 0.72, Skewness= 4.52). Note that these scales, particularly for the adoptive mothers, were highly skewed. Many of the mothers had no scale scores above 70.

Birth/adoptive mothers' IQ was measured using Revised Beta Examination standardized scores (Kellogg, Morton, Lindner, & Gurvitz, 1946). The Revised Beta is a valid measure of intelligence, scores from which correlate 0.92 with Wechsler IQ scores. This measure was also administered in the home for unwed mothers by a trained, in-house psychiatrist. IQs for these mothers ranged from 70-124, or in the ranges of Defective to Superior (Kellogg et al., 1946). The mean IQ of the biological mothers in this sample was 108 (SD= 8.77), or in the Average range. The adoptive mothers' IQs ranged from 89-127, Below Average to Superior. The mean adoptive mother IQ was 114.05 (SD= 7.07), in the Above Average range.

Demographic Variables

Adoptees' age at Time 1 was entered only into the regression equations that did not use scores on the Index of Problem Behaviors, since these scores were coded according to each individual during specific periods of their development. The mean age of this sample at Time 1 was 7.07 (SD=2.31).

Adoptees' sex. Because of the robust findings in the literature regarding sex differences in problem behaviors (e. g., Else-Quest, Hyde, Goldsmith & Van Hulle, 2006; Hammarberg, & Hagekull, 2006; Winsler & Wallace, 2002), sex of the adoptee was included as a control variable in the regression equations. Sex was coded as a dichotomous variable (0= male, 1= female). This sample was approximately 54 percent male.

Adoptive parent's socio-economic status. SES was calculated in prior research from the Texas Adoption Project (Horn, Loehlin, & Willerman, 1982) using the summation of the z-scores for both fathers and mothers' education and fathers' occupation. Father's occupation was coded according to a modified Warner's scale (McGuire & White, 1955; Warner, Meeker, & Eells, 1949), with the highest status occupations (e.g., doctors, lawyers, CEOs) receiving a "1" and the lowest occupations (e.g., busboys, janitors, unskilled laborers) receiving a "7". Education level was coded as 1-6 (1= elementary school, 2= 1-3 years of high school, 3= 4 years of high school, 4= 1-3 years of college, 5= 4 years of college, 6= more than 4 years of college). The occupation scale was reversed prior to summing and arbitrary scaling factors applied to eliminate negative signs and insure that each of the components in the equation received equal weights. Higher scores reflect higher socioeconomic status. SES ranged from 109-210, with the average SES for this sample of adoptive parents equal to 169.26 (SD= 23.12).

Analyses

First, to test whether the prevalence of adoptee problem behaviors differed as a function of the birth or adoptive mothers' index of psychosocial functioning (i.e., the total number of elevated MMPI subscales) linear regressions were performed. Block entry was used to detect the effect of the variables within the model when entered together. In this series of regressions, control variables (sex, SES, and adoptive and biological mothers' Beta IQ scores) were entered into the first block. The adoptive mothers' index of psychosocial functioning scores were entered as block two, biological mothers' index scores as block three, and the interaction between biological and adoptive mothers' index scores as block four. Due to the significant correlations between the birth mothers' and adoptive mothers' scale scores (see Table 2.8), the adoptive mothers' scores were entered before the birth mothers' psychological profile scores. Doing so maximized the chance of detecting maternal environmental effects, should they occur. Cohen's (1992) effects sizes (f^2) for multiple regressions were calculated after each block entry, as an estimate of the importance of any significant findings within that block. Following Cohen's convention,

an effect size of 0.02 was considered a small effect, while effects sizes of 0.15 and 0.35 were considered to be moderate and large, respectively.

Second, to estimate the specificity of the origin of behavioral tendencies another set of linear regressions, using the mothers' individual MMPI sub-scale T-scores rather then an index indicating the number of elevated sub-scales, were calculated. As with the first set of regressions, controls were entered into the first block and each of the subscale scores were then entered into block two. This was done separately for the birth mothers and the adoptive mothers. Based on prior findings that have shown a specific and direct genetic influence between parent and offspring antisocial social behaviors (e.g., Mednick et al, 1983), it was predicted that the birth mothers' psychopathic deviate subscale scores would predict problem behavior development in the adopted away offspring, during each developmental phase.

Results

The Development of Behavior Problems as a Function of Biological/Adoptive Mothers' General Psychosocial Functioning

In all the tables presenting regression models in this chapter, results are presented as standardized beta coefficients. The model coefficients, therefore, should be interpreted as, using the Block 4 equation from Table 2.9 for example, for every standard deviation increase in birth mothers' index score there was 0.09 of a standard deviation decrease in adoptees childhood IPB percent score, or a decrease of .6 percentage points (.09 * .07= .006). The R^2 values illustrate the cumulative effect of the model after each block and the f^2 values illustrate the effect size of the variable entered in a specific block only. Taking block 4 of Table 2.9 as an example again, the cumulative effect of the entire model is 0.03, meaning that 3% of the variance in childhood problem behavior development is accounted for by the adoptees sex, adoptive family SES, adoptive mothers' IQ, birth

mothers' IQ, maternal index scores, and the interaction between both mothers' index scores. The effect size of entering the interaction term alone is 0.01, which means that it accounts for only 1% of the variance in IPB scores (if it were significant). Although effect sizes are of primary interest for significant findings, for consistency I calculated them after all block entries.

Tables 2.9, 2.10, and 2.11 display the results of the regression models using adoptive mothers' and biological mothers' general psychosocial functioning to predict the development of childhood, adolescent, and adulthood behavior problems, respectively. Adoptees' sex, SES, adoptive mothers' IQs, and birth mothers' IQs were entered first as controls. Consistent with what was predicted; adoptive mothers' index of psychosocial functioning scores did not predict problem behavior development during any stage of the adoptees development from childhood up through middle adulthood. Contrary to the hypothesis that birth mothers' psychosocial profiles would predict the development of problem behaviors across the life span, results found from the linear regressions failed to show that the birth mothers' general psychological functioning predicted behavior, during childhood or adolescence, as measured by the Index of Problem Behaviors. While the birth mothers' index score did significantly and positively influence problem behaviors in their adult offspring, this result failed to reach significance once the interaction between adoptive mother and biological mother functioning was added into the model. These results suggest that problem behavior development among adoptees from the Texas Adoption Project is not significantly related to the overall psychosocial well-being of either the birth mothers or the adoptive mothers.

Although entered as a control variable, it was also found that adoptive mothers' IQ had a significant and positive influence on the development of adoptee problem behaviors during adulthood (Table 2.11). This result suggests that adoptees with brighter adoptive mothers had more problem behaviors in adulthood. For every 10 point (1 standard deviation) increase in adoptive mother IQ there was an increase of 0.16 percentage points in adulthood problem behaviors.

The Development of Behavior Problems as a Function of Biological/ Adoptive Mothers' MMPI T-scores

Linear regressions were used to estimate the influence of each of the biological mothers' individual MMPI subscale T-scores on problem behavior development in childhood, adolescence, and adulthood, separately. Results from these analyses can be found in Table 2.12. As with the presentation of the regression models testing general maternal psychosocial functioning, these models display the standardized beta coefficients, R^2, and f^2 for each block of the entry in each model. In this set of models controls were entered as the first block and the individual MMPI T-scores were entered together in the second block. Beyond the prediction that the biological mothers' Pd T-scores would be the strongest predictor of behavior problems in their adopted away offspring, results suggest that psychopathic deviance (Pd) scale was the *only* significant sub-scale to predict problem behavior development among the adopted away offspring. This was found to be the case during each stage of development. This means that for every 10 point increase (1 SD) in birth mothers' Pd there was a .21 of a standard deviation increase in offspring IPB percent score, which corresponds to a 1.5 percentage point increase in problem behaviors during childhood, 2.2 percentage point increase during adolescence, and 1.6 percentage point increase during adulthood.

The same series of regressions was run for the adoptive mothers' MMPI subscale scores to assess whether specific personality or psychological characteristics of the primary care givers influenced behavior problem development throughout the life course. Results (Table 2.13) indicated that during childhood there was a significant, negative relationship between adoptive mothers' Hs T-scores and problem behavior development. Adopted children whose adoptive mothers displayed fewer problems with "imagined" physical dysfunctions had higher problem behavior scores than those whose adoptive mothers had higher scores on the MMPI hypochondriasis sub-scale. None of the adoptive mother subscale scores appeared to predict adolescent problem behavior development, and during adulthood only the birth mothers' psychological profile score significantly

predicted adulthood problem behavior development. These results supported the hypothesis that adoptive mothers' psychological well-being would have no influence on the development of behavior problems in their adopted offspring beyond the childhood years.

Although the effect sizes of adding the birth mothers' and the adoptive mothers' MMPI T-scores were small and none of the models themselves reached statistical significance, these results indicated that problem behavior development appeared to have at least a small genetic component and that the influence was specific, rather than general.

Parent-Child Correlations on Indicators of Problem Behaviors

From the regression models it appeared as though only the biological mothers' Pd T-scores had an influence on the development of problem behaviors, except for a possible effect of adoptive mothers' Hs scores in childhood. To further investigate the influence that the birth mothers' behavioral tendencies had on problem behavior development a series of post-hoc parent-child correlations were run between the mothers' Pd T-scores and the adoptees IPB percent scores for each of the three life stages; childhood, adolescence, and adulthood. Then, despite the somewhat surprising finding from the regressions that sex did not influence behavior development, these correlations were run on both the female adoptees and the males adoptees separately. This set of correlations was done to get a sense of whether genes or the environment influence behavior development differentially for males and females.

Results from the parent-child correlations for all the adoptees (Table 2.14) suggested that, during childhood, neither genes nor the family environment influenced problem behavior development. However, during adolescence and adulthood genetic factors appeared to play a positive and significant role in the development of defiant, externalizing behaviors. This relationship appears to become stronger with age, as is

evident from the increasing strength of the relations between the birth mother-child correlations from childhood through adulthood.

When the parent-child correlations were run for males and females separately (Tables 2.15 and 2.16) surprising results were found. While the biological mothers' Pd T-scores remained strongly and positively related to the adoptees' behavior problem scores in adolescence and adulthood for the male adoptees, they did not show any significant relationship for the female adoptees. Of particular interest is the strength of the correlation between male adoptees' IPB scores in adulthood and the MMPI Pd T-score of their biological mothers. Given that each parent passes exactly 50% of their genes on to their child, the strongest possible relationship one can hope to find between one parent and a child is 0.50. Although, the possible correlation might be slightly higher if assortative mating occurred; which is likely the case. The male adoptee/biological mother correlation of 0.45 for adulthood problem behaviors, therefore, suggests that for males adult behavioral outcomes may be almost entirely determined by genetic factors. However, for females neither the genetic nor the environmental factors measured here appeared have a substantial influence on the development of problem behaviors at any point during the life span[6].

Discussion

The purpose of the current investigation was to determine whether biological and/or adoptive maternal indications of psychosocial functioning influenced problem behavior development among a group of individuals who were adopted away at birth. Also of interest was the question of general verses specific modes of transmission of

[6] This surprising finding led me to complete a series of supplemental regressions on the male adoptees only. The results from these analyses can be seen in appendix 2D. Results from the regressions using general indicators of maternal psychosocial functioning suggest that adoptive mothers have a stronger influence on problem behaviors, beginning in adolescence, than the birth mothers. Results from regressions using specific indicators of maternal psychological functioning predicting problem behavior development for male adoptees were similar to those predicting all adoptees' behavior problems, as far as Pd is concerned. There were, however, some interesting differences regarding the Hs and Hy subscales.

problem behaviors. Therefore, using biological and adoptive mothers' T-scores on MMPI subscales, a general index of psychosocial functioning was created and specific subscale T-scores were examined as potential risk factors for the development of problem behaviors during childhood, adolescence, and adulthood. Finally, a post-hoc analysis of the genetic effects of problem behavior development was assessed using parent-child correlations on indicators of behavior problems. Because I was surprised not to have found an effect of gender on problem behavior development in the regression models, I ran the parent-child correlations both together and separately for males and females. From this set of correlations I hoped to uncover whether the influence of maternal genetic and environmental effects differed between males and females.

Genetic Risk for Problem Behavior Development

While many studies have found maternal (and paternal) mental illness to be associated with behavior problems among offspring (e.g., Burt, Van Dulmen, Carlivati, Egeland, Sroufe, Forman, Appleyard & Carlson, 2005; Foley, Pickles, Simonoff, Maes, Silberg, Hewitt, & Eaves, 2001; Rhule, et al., 2004; Verona et al., 2005), suggesting that mental illness, in general, is linked to problem behavior development. This relationship is difficult to assess unless genetically informed samples are used to investigate the question. If mental illness, in general, has an impact on problem behavior development then we should have found that 1) general psychosocial deficits in the biological mothers were associated with problem behavior development in their adopted-away children, 2) other biological mother MMPI sub-scale T-scores, including the depression sub-scale, were related to problem behaviors in the adoptees, and 3) that biological parent-child correlations were the same regardless of gender. None of these were found to be true.

Instead it was found that the birth mothers' psychopathic deviate (Pd) T-scores, but not their general psychosocial functioning, predicted problem behavior development in their adopted away offspring across the entire lifespan. In addition, when the male and female adoptees were investigated separately to see how similar they were to their

biological mothers on measures indicating defiant and externalizing behaviors, males were found to be moderately similar to their biological mothers during adolescence and very similar to them in adulthood. Together, these results suggest that it is not the number of different elevated subscales (i.e., level of general psychosocial functioning) that influence problem behavior development later in life for the adopted-away offspring, but rather that problem behavior development is very specifically associated with the behavioral tendencies (i.e., psychopathic deviance) of their biological mothers. In addition, this specific relationship appears to get stronger with age and may hold true for males alone.

Though few studies have investigated the transmission of maternal antisocial behaviors to their adopted away offspring from childhood into middle adulthood, the conclusion that behavioral tendencies are transmitted through genetic factors is supported by several other studies that have used genetically informed samples. For example, the Colorado Adoption Project (DeFries, et al., 1994) is another longitudinal investigation of adopted individuals and their families that has found a relationship between biological mothers' behavioral tendencies and the behaviors of their adopted away children. Using a subset (N=88) of adoptees for whom biological mothers' antisocial data (a short inventory assessing how often the birth mothers got into fights, ran away from home, or skipped school) was available, O'Conner, et al. (1998) also found a significant parent-child correlation between birth mothers' antisocial tendencies and externalizing in the adopted away offspring from age 7-12 years old. Gender was not considered as a factor in the O'Conner et al. study. Another particularly relevant finding was that of Mednick et al. (1983), mentioned in the introductory section of this chapter. Though Mednick and his colleagues looked at the relationship between criminal convictions of biological fathers, adoptive fathers and their adopted away sons and we looked at the biological and adoptive mothers and all adopted offspring; both studies investigated the same data for both the birth and adoptive parents—making them unique and very informative samples to study. These results support the conclusion that individuals, males in particular, inherit a biological vulnerability toward problem behavior development from their birth parents.

However, neither of these studies helps to explain why biological mothers' defiance would predict behavior problems in their sons but not their daughters. One explanation may lie in the typical measurement of externalizing behaviors. While the Index of Problem Behaviors, as well as other previously validated measures of externalizing, antisocial behaviors, tapped into what is typically thought of as problem behaviors, many of the items may be measuring more typical male externalizing behaviors—especially during adolescence. Some researchers of gender differences in aggressive behaviors have found that male and female aggressions tend to take different forms. Specifically, males have been found to aggress with more direct physical and verbal methods, while females tend to act out using more indirect, relational aggression, such as gossip (Coyne, Archer, & Eslea, 2006). Therefore, it is possible that had the IPB included items capturing the use of gossip, correlations between birth mother Pd T-scores and female adoptees' behavior may have been higher. Future research using a longitudinal behavior genetic design and measures including more female-typical forms of aggression would be informative in answering this question.

Environmental Risk for Problem Behavior Development

To test the hypothesis that the psychosocial functioning and deviant tendencies of the adoptive mothers would render adopted children vulnerable toward problem behavior development, the same set of linear regressions were run using the adoptive mothers' psychosocial characteristics as predictors of behavioral outcomes across the life span. In the childhood model using adoptive mothers' MMPI sub-scale T-scores as predictors of childhood IPB percent scores, a significant relationship between the adoptive mothers' functioning and the behavioral tendencies of the adoptees emerged. Specifically, adoptees with more problem behaviors during childhood had adoptive mothers who displayed fewer problems with hypochondriasis (physical complaints of illness in the absence of medical proof). In addition, when investigating the role of birth and adoptive mothers' general psychosocial functioning on adulthood problem behavior development, the IQ of

the adoptive mothers was found to have a positive effect—suggesting that adoptees with brighter adoptive mothers were more likely to develop problem behaviors during adulthood. There were no specific predictions with regard to the effects of the adoptive mothers' specific areas of deficit. But it was predicted that if there was an association between adoptive mothers' psychosocial functioning and the adoptees problem behavior development it would only occur during the childhood years. This expectation was realized. Thus, while some significant relations between adoptive mothers' adaptation and problem behavior development in their adopted children, the relationships found may not prove viable in future attempts at replication.

There are a number of possible reasons for finding a positive association between adoptive mother's characteristics and problem behavior development in their adopted children. First, adoptive mothers' levels of psychological functioning could be influencing problem behavior development in their adopted children. This conclusion would be consistent with the socialization hypothesis, that individuals develop behavioral tendencies based on their environment (Bandura, Ross, & Ross, 1961). However, the results from the adoptive parent-child correlation for Pd, which yielded correlations of essentially zero, do not support this conclusion. Second, children with a lot of problem behaviors may cause their adopted mothers to have more problems with their own psychosocial and behavioral adjustment. This conclusion would be consistent with findings from Finley and Aguiar (2002) that adoptive parents' levels of psychological functioning are negatively affected by the ill behaviors of their adopted children. However, the effect found here, that adoptive mothers who had fewer problems with hypochondriasis had adopted children with more problem behaviors, is in the opposite direction than would be expected if the adopted children were negatively influencing the psychosocial well-being of the adoptive mothers. In addition, the adoptive mothers were measured at Time 1, before most of the problem behaviors had appeared. Therefore, parental response to child pathology does not appear to be a plausible explanation for the results found here.

Finally, the trend observed in this analysis, between adoptive mother characteristics and problem behaviors in their adopted children might be an artifact of the method of data collection. Recall that the Index of Problem Behaviors was coded based on the interviews with the parents of the adopted children. It might be the case that the characteristics of the parents who agreed to the Time 3 interview biased the way in which the adopted children were viewed. One way to address the possibility of obtaining these results due to selective attrition would be to test whether those parents who did not agree to be interviewed (or could not be located) at Time 3 were different from those who did. Table 2.17 presents a series of post hoc t-tests assessing mean differences in the characteristics of the adopted children, their biological mothers, the adoptive mothers and their ratings of the adopted children (taken during Times 1 and 2) between families who took part in the Time 3 interviews and those who did not. It does appear that the parents who consented to an interview in the time 3 data collection phase of the Texas Adoption Project were different in some respects from those who did not. Wealthier adoptive parents and smarter and more educated mothers were more likely to grant us an interview than those who did not. In addition, the parents who participated had children with less deviant biological mothers. These results indicate that there was some amount of selective attrition going on, and that it was influenced by the characteristics of the adoptive parents. However, since there did not appear to be any significant differences in the way the adoptive mothers rated their children during childhood and adolescence, it seemed unlikely that mothers of particularly "good" or particularly "bad" kids chose to participate.

Limitations

One possible limitation of this investigation is the validity of the measure of problem behavior. Though the results from the correlations between prior, contemporaneous mother ratings and the rating from the three independent raters provided evidence of congruent validity for the use of the IPB scales, and the t-tests

comparing interviewed to non-interviewed families did not appear to invalidate the use of the latent measure of problem behaviors, the reliability of the childhood scale was less than 0.70. Perhaps other researchers who are interested in tracking the inheritance of behavior problems using interviews or questionnaire methodologies could benefit from using a previously validated measure of behavior problems, such as Achenbach's (1991) Child Behavior Checklist, or use a clinically diagnostic inventory. This would be especially helpful when attempting to assess childhood problem behaviors. In addition, most items on the Index of Problem Behaviors were positively skewed. While most participants scored on the low end of the distribution on the items, most statistical procedures are robust enough to handle skewness (Graziano & Raulin, 2004), especially when all the items are skewed in the same direction. It is also relevant to note that skewness for item endorsement is typical in other measures of problem behaviors, such as the Child Behavior Checklist, and that adopted samples tend to have similarly skewed distributions to non-adopted samples (Moffitt, 2005).

Finally, with regard to the potential limitations of the Index of Problem Behavior, a review of Appendix 2C reveals that each item was most often rated as "not indicated." Items rated in this way should not be interpreted as not having occurred. The raters simply had to check "not indicated" when there was no mention of the behavior in the interview notes. It is possible, even probable, that individuals actually participated in a number of behaviors that the raters had no knowledge of. In a number of cases, for example, parents reported that their child used a lot of drugs during their teen years, but made no specific mention of his or her alcohol use. While it is likely that one who uses a lot of drugs also drinks alcohol, the independent raters and I made no assumptions and, in instances like these, marked "not indicated" for alcohol use. Scores on the IPB should therefore be viewed as conservative estimates of problem behavior among the participants of the Texas Adoption Project.

As is always an issue with longitudinal investigations, the Texas Adoption Project was only able to locate and interview a little over 55 percent of the original 300 families. While the sample of families who agreed to the Time 3 interview did not appear to differ

based on the personality of their children, they did systematically differ on the amount of education obtained by the adoptive mothers, the adoptive mothers' Beta IQ scores, and the adoptive families' SES. In addition, the adoptees in the families we interviewed had birth mothers with lower Pd T-scores than those whose parents declined an interview or could not be located. Therefore, it is possible that we missed out on the opportunity to interview families with children who displayed more severe problem behaviors. The inclusion of those individuals, however, would likely have strengthened the results, rather than weakened them.

It is also possible that selective placement, on the part of the adoption agency, may have influenced the ability to detect true effects. For example, if the agency attempted to place infants from the less troublesome birthmothers into the wealthier or more educated families, restriction of range in the predictors (i.e., limited range in SES or maternal education) could keep significant effects from being detected. In fact, a slight negative correlation ($r = -.18$, $p = .001$, $N = 350$) between adopted parents' SES and birthmothers' Pd scores was found to exist. Although the relationship is relatively small, it is possible that the genetic effects found in the analyses presented in this chapter were underestimated due to restriction of range.

Despite these limitations, the current investigation did find a link between measures of problem behavior tendencies of the biological mothers and the amount of problem behaviors displayed by their adopted away offspring from childhood through mid-adulthood. This connection appears to get stronger with age, but may be confined to males.

Future Research

With the establishment of a genetic relationship between maternal antisocial tendencies and offspring behavior problems it is possible to look for potential protective factors that decrease the likelihood for high-risk individuals to develop externalizing, antisocial behaviors across the life span. One possibility would be to investigate the ability of the adoptive environment, given the advantages that it confers on the adoptees

as far as access to educational and emotional resources, to act as a buffer between biological vulnerability and the actual display of problem behaviors. This could be done in several ways. First, trajectories of problem behavior development could be estimated. These trajectories could then be used to compare the relative changes in problem behaviors across the lifespan between adoptees and biological children within the same families. In this way it could be determined whether the genetic, or environmental, factors are associated with the stability and change in problem behaviors over time. For example, trajectories of problem behavior development could be plotted separately for both adopted children and children reared by their biological parents to determine whether both samples have similar patterns of development. Then intraclass correlations could be run between biologically related siblings and biologically unrelated siblings at each stage of development to get a sense how alike people are, behaviorally speaking, when they are reared in the same household but either share, or do not share, genes in common. Finally, intraclass correlations on change scores between life stages between biologically related and biologically unrelated siblings could be run to assess the degree to which changes in problem behaviors throughout the life span are genetically or environmentally influenced. This series of analyses is presented in Chapter Three of this dissertation.

Another possible way in which the influence of the adoptive environment can be investigated is presented in Chapter Four. In particular, the characteristics of the adoptees and their families were used as predictors of problem behaviors. Models for higher-risk (i.e., vulnerable) and lower-risk adoptees were run separately, with risk defined by the birth mothers' Pd T-scores. In this way, factors of the adoptive family environment were investigated as potential protective factors for the development of problem behaviors across the lifespan.

Table 2.1

T-tests for mean differences between adoptees from the Texas Adoption Project with and without available IQ Scores from their Birth Mothers.

Variables	*Mean (SD) for Adoptees with BM IQ Scores (N=181)*	*Mean (SD) for Adoptees without BM IQ Scores (N=346)*	*t value*
Age (T1)	7.07 (2.31)	10.06 (4.07)	-8.211***
Sex	1.46 (0.50)	1.51 (0.50)	-0.944
Wechsler IQ	111.74 (11.50)	111.66 (10.79)	-0.230
Extraversion (T1)	49.23 (7.62)	46.93 (8.83)	2.672**
Well-Socializd (T1)	32.37 (7.04)	33.04 (6.90)	-0.849
Em. Stability (T1)	47.73 (6.05)	47.82 (6.07)	-0.136
Extraversion (T2)	44.61 (8.02)	44.95 (8.54)	-0.316
Well-Socializd (T2)	31.51 (8.22)	33.03 (7.24)	-1.503
Em. Stability (T2)	46.57 (6.14)	47.26 (6.23)	-0.870
AM age	37.26 (4.80)	39.05 (4.87)	-3.769***
AM Beta IQ	113.82 (7.69)	114.28 (6.38)	-0.598
AM education	5.47 (1.24)	5.50 (1.19)	0.214
AM Pd T-score	13.66 (3.36)	13.47 (2.95)	0.543
AP SES	169.26 (23.12)	169.60 (22.08)	-0.139
BM age	19.52 (3.65)	19.07 (3.45)	0.489
BM Beta IQ	108.01 (8.97)	-	-
BM Pd T-score	64.86 (10.47)	61.17 (9.28)	1.187

Note: AM = adoptive mother, AP = adoptive parents, BM = biological mother, T1= Time 1, T2 = Time 2, Pd = MMPI psychopathic deviance scale.
*p< .05, ***p< .001.

Table 2.2

Descriptive Statistics for the Childhood IPB Items and Total Raw Score.

Item	*Min.*	*Max*	*Mean (SD)*	*Skewness*
Type of student	0	3	0.91 (.833)	0.64
Rule abiding	0	3	0.54 (.772)	1.56
Phys. Aggres	0	3	0.11 (.501)	4.88
Tantrums	0	3	0.09 (.456)	5.55
Truant	0	3	0.02 (.234)	10.24
Petty theft	0	3	0.04 (.305)	7.80
Manipulative	0	3	0.07 (.439)	6.19
Lied	0	3	0.08 (.438)	60.7
Bullied others	0	3	0.08 (.407)	5.53
Cruelty to childrn	0	2	0.06 (.274)	4.71
Cruelty to anim	0	2	0.06 (.229)	3.91
Inap. sex behav	0	2	0.04 (.215)	6.45
Ran away	0	2	0.05 (.224)	4.97
Dx w/ disorder	0	2	0.15 (.533)	3.18
Tot. Child Score	0	18	2.29 (2.48)	2.57

Table 2.3

Items that make up the childhood and adolescent personality scales, as rated by the adoptive mothers during Time 1 and Time 2.

Extraversion
Warm-hearted
Happy-go-lucky
Socially bold
Unrestrained
Critical (-)
Well-Socialized
Conscientious
Controlled
Careless of social rules (-)
Frivolous (-)
Unresponsive to threats (-)
Affected by feelings (-)
Emotional Stability
Emotionally stable
Tense (-)
Apprehensive (-)
Unfrustrated
Complacent.

Note: items marked with a (-) indicate items that were reverse scored for scale construction.

Table 2.4

Correlations between Time 3 Index of Problem Behavior items and Time 1 mother rated personality scales[b].

	Childhood Personality Scales		
	Extraversion	*Well-Socialized*	*Emotional Stability*
Childhood IPB Items			
Type of Student	0.06	-0.02	-0.02
Rule abiding (r)	0.05	-0.25***	-0.10
Physically aggressive	0.03	-0.20***	-0.05
Threw tantrums	0.00	-0.18**	-0.22***
Truant from school	0.09	-0.11	0.05
Petty theft	-0.06	-0.10	-0.08
Manipulative	0.11	-0.20**	-0.08
Told lies	-0.06	-0.07	-0.06
Bullied others	0.06	-0.19**	-0.04
Cruelty to other children	-0.06	-0.08	-0.02
Cruelty to animals	a	a	a
Inappropriate sexual behavior	-0.06	0.05	-0.08
Ran away from home	0.02	-0.05	-0.01
Diagnosed with a disorder	0.05	-0.09	-0.13*

Note: (r) indicates reverse coded items.
a. no child with complete data reported to display this behavior, therefore, correlation estimate could not be calculated.
b. (N= 164) limited to participants with complete data who were between 4-12 years-old at Time 1.
* $p < .05$, ** $p < 01$, *** $p < .001$.

Table 2.5

Descriptive Statistics for the Adolescent IPB Items and Total Score.

Item	*Min.*	*Max*	*Mean (SD)*	*Skewness*
Type of student	0	3	1.36 (.856)	0.39
Truant	0	3	0.12 (.515)	4.80
Rule abiding (r)	0	3	0.84 (.984)	1.00
Lied	0	3	0.17 (.650)	3.74
Physically Aggressive	0	3	0.18 (.655)	3.57
Verbally Aggressive	0	3	0.17 (.629)	3.67
Manipulative	0	3	0.13 (.584)	4.45
Snuck out	0	3	0.33 (.839)	2.47
Destruction of property	0	3	0.02 (.217)	13.75
Alcohol use	0	3	0.37 (.863)	2.25
Drug use	0	3	0.48 (.863)	1.82
Theft (major)	0	2	0.15 (.481)	3.24
Sex assault (perpetrator)	0	2	0.02 (.161)	8.50
Promiscuous	0	2	0.09 (.356)	4.36
Arson	0	2	0.03 (.210)	7.92
Self-mutilation	0	2	0.04 (.283)	9.74
# at fault car accidents	0	4	0.21 (.742)	3.88
# arrests	0	4	0.09 (.383)	5.71
# convictions	0	2	0.01 (.114)	15.68
# tickets/warrants	0	4	0.13 (.624)	5.20
# illegitimate pregnancy	0	1	0.04 (.201)	4.59
# ran away	0	4	0.12 (.592)	5.62
# suicide attempts	0	3	0.02 (.204)	11.51
Dx w/ disorder	0	2	0.13 (.496)	3.52
Tot. Teen Score	0	32	5.24 (5.44)	2.04

Note: (r) indicates reverse coded items, Dx=diagnosed

Table 2.6

Correlations between Time 3 adolescent Index of Problem Behavior items and Time 2 mother rated personality scales[b].

	Adolescent Personality Scales		
	Extraversion	*Well-Socialized*	*Emotional Stability*
Adolescent IPB Items			
Type of Student	-0.12	-0.31***	-0.40***
Truant from school	-0.10	-0.29***	-0.23**
Rule abiding (r)	0.04	-0.15	-0.11
Told lies	0.03	-0.29***	-0.14
Physically aggressive	-0.06	-0.12	-0.19*
Verbally Aggressive	-0.09	-0.10	-0.14
Manipulative	0.05	-0.19*	-0.13
Snuck out/stayed out past curfew	0.02	-0.12	-0.10
Destruction of property	a	a	a
Used alcohol	0.05	-0.08	-0.04
Used drugs	-0.05	-0.22	-0.15
Theft	-0.07	-0.27***	-0.17*
Sexual assault (perpetrator)	-0.02	-0.08	-0.03
Promiscuous	-0.02	-0.07	-0.03
Incidence of arson	a	a	a
Incidence of self mutilation	a	a	a
# of at fault car accidents	0.00	-0.09	-0.04
# of arrests	-0.10	-0.03	-0.02
# of convictions	0.12	0.06	0.24**
# of tickets/warrants	0.08	-0.07	-0.04
# of illegitimate pregnancies	-0.2	0.00	0.01
# of time ran away	-0.08	-0.30***	-0.20*
# of suicide attempts	-0.17*	-0.06	-0.16*
Diagnosed with a disorder	0.09	-0.17*	-0.02

Note: (r) indicates reverse coded items.

a. no child with complete data reported to display this behavior, therefore, correlation estimate could not be calculated.

b. (N= 142) limited to participants with complete data who were between 13-19 years-old at Time 2.

* $p < .05$, ** $p < 01$, *** $p < .001$.

Table 2.7

Descriptive Statistics for the Adulthood IPB Items and Total Score.

Item	*Min.*	*Max*	*Mean (SD)*	*Skewness*
Physical Aggression	0	3	0.09 (.443)	5.61
Verbal Aggression	0	3	0.11 (.517)	4.82
Tells lies	0	3	0.09 (.491)	5.52
Manipulative	0	3	0.12 (.565)	4.75
Destruction of property	0	3	0.01 (.155)	19.37
Alcohol use	0	3	0.26 (.791)	2.93
Drug use	0	3	0.21 (.702)	3.36
Gambling	0	3	0.01 (.186)	14.41
Theft (major)	0	2	0.06 (.337)	5.32
Sex assault (perpetrator)	0	4	0.03 (.246)	12.42
Promiscuous	0	2	0.05 (.298)	6.24
Arson	0	2	0.01 (.115)	8.52
Self-mutilation	0	2	0.01 (.115)	8.52
Child abandon	0	2	0.04 (.045)	6.66
Child abuse	0	2	0.02 (.185)	8.54
Adultery	0	2	0.02 (.185)	8.54
Check/credit fraud	0	2	0.07 (3.65)	4.89
# divorces	0	4	0.30 (.640)	2.52
# illegitimate pregnancy	0	4	0.06 (.345)	7.30
# at fault car ac.	0	4	0.05 (.344)	8.66
# arrests	0	4	0.09 (.462)	5.91
# convictions	0	4	0.04 (.320)	10.65
# tickets/warrants	0	4	0.06 (.431)	7.77
# suicide attempts	0	3	0.02 (.199)	10.92
Diagnosed w/ disorder	0	4	0.23 (.677)	2.80
Tot. Adult Score	0	27	2.10 (4.13)	3.04

Table 2.8

Average MMPI sub-scale T-scores for the biological and adoptive mothers from the Texas Adoption Project.

MMPI Sub-Scale	*Biological Mothers (n=181)*	*Adoptive Mothers (n=246)*	*Correlation Between AM and BM Scores*
Hs***	53.4	50.3	0.19**
D***	56.8	50.6	0.05
Hy	57.8	55.6	0.01
Pd**	66.0	53.0	0.19*
Pa***	59.9	54.7	-0.07
Pt***	58.9	52.1	0.21**
Sc***	60.6	51.3	0.04
Ma***	59.1	51.6	0.00
Psychosocial Index***	0.51	0.20	0.13*

Note: The normative T-score on all subscales is 50. Hs=hypochondriasis, D=depression, Hy= hysteria, Pd= psychopathic deviate, Pa= paranoia, Pt= psychasthenia, Sc= schizophrenia, Ma= hypomania, BM= biological mothers, AM= Adoptive mothers. N for correlations was 178. Asterisks next to the Sub-scale labels indicate significant differences in the mean scores between the Biological and Adoptive mothers' scores. *p < .05, **p < .01, ***p< .001.

Table 2.9

*Predicting **childhood** percent scores on the Index of Problem Behavior from biological and adoptive mothers' psychosocial profile scores and the interaction between them.*

	Block 1 Standardized β	*Block 2 Standardized β*	*Block 3 Standardized β*	*Block 4 Standardized β*
Sex	-0.11	-0.11	-0.10	-0.09
SES	-0.08	-0.08	-0.09	-0.09
AM Beta IQ	0.00	0.01	0.00	0.02
BM Beta IQ	0.02	0.02	0.02	0.04
AM profile score		0.02	0.02	-0.07
BM Profile score			-0.04	-0.09
AM profile * BM profile				0.16
F-value	0.714	0.579	0.531	0.734
R^2	0.02	0.02	0.02	0.03
f^2	-	0.00	0.00	0.01

Note: AM= adoptive mother, BM= Biological mother
N=173.

Table 2.10

*Model predicting **adolescent** percent score on the Index of Problem Behavior from biological and adoptive mothers' psychosocial profile scores and the interaction between them.*

	Block 1 Standardized β	*Block 2 Standardized β*	*Block 3 Standardized β*	*Block 4 Standardized β*
Sex	-0.04	-0.04	-0.05	-0.05
SES	0.04	0.04	0.06	0.06
AM Beta IQ	0.11	0.13	0.14	0.14
BM Beta IQ	0.04	0.04	0.04	0.05
AM profile score		0.12	0.10	0.09
BM Profile score			0.11	0.10
AM profile * BM profile				0.02
F-value	0.964	1.232	1.347	1.153
R^2	0.02	0.04	0.05	0.05
f^2		0.02	0.01	0.00

Note: AM= adoptive mother, BM= Biological mother
N=174.

Table 2.11

*Model predicting **adulthood** percent score on the Index of Problem Behavior from biological and adoptive mothers' psychosocial profile scores and the interaction between them.*

	Block 1 Standardized β	*Block 2 Standardized β*	*Block 3 Standardized β*	*Block 4 Standardized β*
Sex	-0.01	0.00	-0.01	-0.01
SES	0.01	0.00	0.03	0.03
AM Beta IQ	0.13	0.16*	0.16*	0.16*
BM Beta IQ	0.03	0.03	0.03	0.03
AM profile score		0.15	0.13	0.13
BM Profile score			0.16*	0.16
AM profile * BM profile				-0.01
F-value	0.841	1.415	1.876	1.160
R^2	0.02	0.04	0.06	0.06
f^2		0.02	0.02	0.00

Note: AM= adoptive mother, BM= Biological mother
N=173.
* $p < .05$.

Table 2.12

*Model predicting problem behaviors across the life span from **biological** mothers' MMPI sub-scale T-scores.*

	Childhood		*Adolescence*		*Adulthood*	
	Block 1 Stand. β	Block 2 Stand. β	Block 1 Stand. β	Block 2 Stand. β	Block 1 Stand. β	Block 2 Stand. β
Controls						
Sex	-0.10	-0.09	0.01	0.00	-0.04	-0.04
SES	-0.09	-0.14	0.01	-0.01	0.05	0.03
AM Beta IQ	0.01	0.00	0.16	0.17*	0.13	0.13
BM Beta IQ	0.05	0.06	0.02	0.03	0.05	0.03
AM profile score	0.03	0.00	0.16*	0.17*	0.13	0.11
MMPI Sub-Scale T-scores						
Hs		-0.05		-0.02		-0.04
D		-0.11		-0.04		-0.13
Hy		-0.13		-0.02		0.04
Pd		0.21*		0.27**		0.26**
Pa		-0.19		0.03		-0.13
Pt		0.10		0.03		0.07
Sc		0.05		-0.06		-0.05
Ma		-0.07		0.01		0.010
F-value	0.627	1.117	1.409	1.292	1.302	1.492
R^2	0.02	0.09	0.04	0.10	0.04	0.12
f^2	-	0.08	-	0.07	-	0.09

Note: AM=adoptive mother, BM=biological mother, Hs=hypochondriasis, D=depression, Hy=hysteria, Pd=psychopathic deviate, Pa=paranoia, Pt= psychasthenia, Sc=Schizophrenia, Ma=Hypomania. N=163 for childhood model, 162 for adolescent model, and 161 for adulthood model.

Table 2.13

*Model predicting problem behaviors across the life span from **adoptive** mothers' MMPI sub-scale T-scores.*

	Childhood		*Adolescence*		*Adulthood*	
	Block 1 Stand. β	Block 2 Stand. β	Block 1 Stand. β	Block 2 Stand. β	Block 1 Stand. β	Block 2 Stand. β
Controls						
Sex	-0.10	-0.10	-0.05	-0.04	-0.02	0.00
SES	-0.08	-0.12	0.06	0.07	0.04	0.02
AM Beta IQ	0.00	0.03	0.12	0.15	0.14	0.17*
BM Beta IQ	0.02	-0.01	0.05	0.05	0.03	0.02
BM profile score	-0.04	-0.05	0.12	0.12	0.17*	0.16*
MMPI Sub-Scale T-scores						
Hs		-0.24*		0.00		-0.07
D		0.14		0.07		0.14
Hy		0.04		-0.19		-0.03
Pd		0.10		0.00		0.10
Pa		0.03		-0.03		0.06
Pt		-0.08		0.09		-0.19
Sc		-0.04		0.11		0.09
Ma		0.16		0.03		0.10
F-value	0.622	1.034	1.432	1.289	1.681	1.139
R^2	0.02	0.08	0.04	0.10	0.05	0.09
F^2	-	0.07	-	0.07	-	0.04

Note: AM=adoptive mother, BM=biological mother, Hs=hypochondriasis, D=depression, Hy=hysteria, Pd=psychopathic deviate, Pa=paranoia, Pt= psychasthenia, Sc=Schizophrenia, Ma=Hypomania. N=175 for childhood model, 174 for adolescent model, and 173 for adulthood model.

Table 2.14

Pearson product moment correlations between adoptees problem behavior development and indicators of psychopathic deviance in their biological and adoptive mothers.

	MMPI Psychopathic Deviancy T-scores	
	Birth Mothers (N=181)	Adoptive Mothers (N=246)
IPB raw scores during		
Childhood	0.08	0.03
Adolescence	0.17*	0.04
Adulthood	0.25**	0.03

* $p < .05$, ** $p < .01$

Table 2.15

*Pearson product moment correlations between **male** adoptees problem behavior development and indicators of psychopathic deviance in their biological and adoptive mothers.*

	MMPI Psychopathic Deviancy T-scores	
	Birth Mothers (N=98)	Adoptive Mothers (N=130)
IPB raw scores during		
Childhood	0.16	0.02
Adolescence	0.22*	-0.03
Adulthood	0.45***	0.04

* $p < .05$, *** $p < .001$

Table 2.16

*Pearson product moment correlations between **female** adoptees problem behavior development and indicators of psychopathic deviance in their biological and adoptive mothers.*

	MMPI Psychopathic Deviancy T-scores	
	Birth Mothers (N=83)	Adoptive Mothers (N=116)
IPB raw scores during		
Childhood	0.02	0.05
Adolescence	0.13	0.11
Adulthood	0.08	0.03

* $p < .05$, ** $p < .01$

Table 2.17

T-tests for mean differences between Texas Adoption Project participants whose parents did or did not participate in the Time 3 interview.

Variables	*Mean (SD) for Ss with Time 3 Interview (N=358)*	*Mean (SD) for Ss without Time 3 Interview (N=306)*	*t value*
Age	8.51 (3.60)	8.00 (3.69)	-1.746
Sex	1.49 (0.50)	1.45 (0.50)	-1.022
Wechsler IQ	111.71 (11.15)	111.39 (11.92)	-0.343
Extraversion (T1)	47.51 (8.23)	48.51 (7.78)	1.524
Well-socialized (T1)	32.67 (6.98)	32.48 (5.99)	-0.362
Emotional Stability (T1)	47.77 (6.05)	48.51 (7.78)	1.466
Extraversion (T2)	44.77 (8.25)	45.36 (8.67)	0.652
Well-socialized (T2)	32.22 (7.80)	31.81 (7.69)	-0.489
Emotional Stability (T2)	46.90 (6.18)	47.79 (6.88)	1.296
AM age	37.66 (4.86)	37.44 (4.89)	-0.586
AM Beta IQ	114.05 (7.07)	111.50 (7.62)	4.421***
AM education	5.49 (1.21)	5.20 (1.21)	-3.006**
AM occupation	4.53 (2.56)	4.27 (2.34)	-1.345
AP SES	169.43 (22.58)	162.51 (26.81)	-3.563***
AM Pd *t*-score	52.98 (7.88)	52.95 (8.29)	0.160
BM Beta IQ	108.01 (8.97)	109.26 (8.72)	-1.342
BM Pd *t*-score	64.61 (10.42)	67.46 (12.51)	-2.322*

Note: AM = adoptive mother, AP = adoptive parents, BM = biological mother, T1= Time 1, T2 = Time 2, Pd = MMPI psychopathic deviance scale.
*p< .05, ***p< .001.

Appendix 2A

List of Interview Probes

Please write down for us the full names and birthdates of each of your children from oldest to youngest.

Beginning with your oldest child, Jimmy, how old was he when you brought him home (if they then said this was a natural child we inquired about the delivery/term of pregnancy)

As an INFANT:
Was he a good sleeper, eater?
Did he have any unusual illnesses/health problems?
Did he cry a lot?
How would you describe him as a baby, fairly easy, difficult, or somewhere in between?

As a TODDLER:
Some babies, when you hold them, mold themselves to you and appear to enjoy the contact. Other babies squirm, go rigid, or cry when held? In general, how would you say Jimmy was when you held and tried to cuddle with him?
How active was he as a toddler?
Was he a risk taker or was he cautious as a toddler?
Was he a climber?
When he was about 3 years old and playing with same age friends would you say he more often led the activities or follow what the other children were doing?

CHILDHOOD:
Did he go to Kindergarten?
How was he on his first day of school? Was he clingy, tearful or was he ready to go?
In grade school, what kind of student was he? Did he like school?
Did he participate in any extra-curricular activities?
Did he have a favorite subject?
Did he have any problems with friends or teachers?
Did he have a lot of friends or one or two close friends he always played with?
How about Junior High? Type of student, extracurricular activities, favorite subjects?

ADOLESCENCE:
Once he was in high school (same as above), what percentile of his class did he graduate in?
Did he have a lot of friends or one or two close friends he always hung around with?
How old was he when he started dating? Did he date a lot?
Any problems during his adolescent years with behavior?

List of Interview Probes Cont.,

ADOLESCENCE cont.,
Did he drink alcohol? Do any drugs?
Was there ever any problem with the law?
How old when got drivers license? Car?
Any major car accidents? Were they his fault?
Any tickets?
Did he ever sneak out at night or stay out past curfew?
Did he work while he was in HS?
What did he do after graduation?

ADULTHOOD:
Did he ever marry? If no, was he ever close? Is he still married? Ever Divorced
Has he changed jobs frequently?
Does he still have problems with (something named during adolescent period)?
How often would you say he drinks alcohol?
Does he have any children?
What kind of father is he?
Would you describe him as a responsible, mature person?
What would you say is his best quality? His worst?
Anything else you would like us to know?

The same series of questions was then asked of the subsequent children, going from oldest to youngest. Each interview took approximately 45 minutes per child to complete.

Appendix 2B

Index of Behavior Problems Scoring Rubric

Book # _____ Family # _____ Sib # _____

Infancy (age 0-3)

Type of sleeper:	__1__good	__2__average	__3__poor	__0__not indicated
Frequency of crying	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Liked to be cuddled	__3__rarely	__2__sometimes	__1__a lot of the time	__0__not indicated
Generally happy?	__3__rarely	__2__sometimes	__1__a lot of the time	__0__not indicated
Shy with strangers?	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Anxious/Nervous?	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Threw tantrums	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Activity level	__1__low	__2__moderate	__3__high	__4__very high __0__ni

Diagnosed with a disorder __2__yes __0__no if so what? _____

School Age (age 4-12)

Type of student	__1__good	__2__average	__3__poor	__0__not indicated
Rule abiding	__3__rarely	__2__sometimes	__1__a lot of the time	__0__not indicated
Physically aggressive	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Threw tantrums	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Truant from school	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Petty Theft	__1__1-5 times	__2__5-10 times	__3__more than ten times	__0__not indicated
Manipulative	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Told lies	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Bullied others	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Cruelty to other children	__2__yes	__0__no		__0__not indicated
Cruelty to animals	__2__yes	__0__no		__0__not indicated
Inappropriate sexual behavior	__2__yes	__0__no		__0__not indicated
Ran away from home	__2__yes	__0__no		__0__not indicated
Diagnosed with a disorder	__2__yes	__0__no	if so what? _____	

Adolescence (age 13-19)

Type of student	__1__good	__2__average	__3__poor	__0__not indicated
Truant from school	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Rule abiding	__3__rarely	__2__sometimes	__1__a lot of the time	__0__not indicated
Told Lies	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Physically aggressive	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Verbally aggressive	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Manipulative	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Snuck/Stayed out	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Destruction of Property	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Alcohol	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Soft Drugs	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Hard Drugs	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Major Theft	__2__yes	__0__no		__0__not indicated
Sexual Assault	__2__yes	__0__no		__0__not indicated
Promiscuous	__2__yes	__0__no		__0__not indicated
Incidence of Arson	__2__yes	__0__no		__0__not indicated

Index of Behavior Problems Scoring Rubric continued..,

Adolescence continued..,

Incidents of self-mutilation	__2__yes	__0__no		__0__not indicated
Number of "at fault" car accidents		__0-4_		
Number of arrests		__0-4_		
Number of convictions		__0-4_		
Number of ticketable offenses (class B misdemeanor or above)		__0-4_		
Number of Illegitimate Pregnancies		__0-4_		
Number of times ran away from home		__0-4_		
Number of suicide attempts		__0-4_		

Diagnosed with a disorder __2__yes __0__no if so what? _____

Adulthood (age 20 and up)

Physically aggressive	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Verbally aggressive	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Told lies	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Manipulative	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Destruction of Property	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Used Alcohol	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Used Drugs	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated
Gambled	__1__rarely	__2__sometimes	__3__a lot of the time	__0__not indicated

Major Theft	__2__yes	__0__no	__0__not indicated
Sexual Assault (perp)	__2__yes	__0__no	__0__not indicated
Promiscuous	__2__yes	__0__no	__0__not indicated
Incidence of Arson	__2__yes	__0__no	__0__not indicated
Incidents of self-mutilation	__2__yes	__0__no	__0__not indicated
Child Abandonment	__2__yes	__0__no	__0__not indicated
Child Abuse (accused, caught or convicted)	__2__yes	__0__no	__0__not indicated
Adultery (accused, caught, or admitted)	__2__yes	__0__no	__0__not indicated
Check or Credit Fraud	__2__yes	__0__no	__0__not indicated

Number of divorces	__0-4_
Number of Illegitimate Pregnancies	__0-4_
Number of "at fault" car accidents	__0-4_
Number of arrests	__0-4_
Number of convictions	__0-4_
Number of ticketable offenses (class B misdemeanor or above)	__0-4_
Number of suicide attempts	__0-4_

Diagnosed with a disorder __2__yes __0__no if so what? _____

Please write any other major problem behaviors or events that are not indicated above and indicate the approximate age during which it/they occurred.

_____
_____
_____
_____
_____
_____

Appendix 2C

Index of Behavior Problems Rating Frequencies

Book # _____ Family # _____ Sib # _____

Infancy (age 0-3)

Type of sleeper:	78 good	16 average	24 poor	267 not indicated
Frequency of crying	16 rarely	14 sometimes	18 a lot of the time	333 not indicated
Liked to be cuddled	59 rarely	19 sometimes	159 a lot of the time	144 not indicated
Generally happy?	13 rarely	5 sometimes	73 a lot of the time	290 not indicated
Shy with strangers?	41 rarely	4 sometimes	18 a lot of the time	308 not indicated
Anxious/Nervous?	9 rarely	4 sometimes	6 a lot of the time	362 not indicated
Threw tantrums	5 rarely	2 sometimes	6 a lot of the time	368 not indicated
Activity level	2 low	27 moderate	40 high	34 very high 278 ni

Diagnosed with a disorder 7 yes 374 no if so what? _____

School Age (age 4-12)

Type of student	165 good	65 average	17 poor	134 not indicated
Rule abiding	16 rarely	18 sometimes	121 a lot of the time	226 not indicated
Physically aggressive	8 rarely	5 sometimes	8 a lot of the time	360 not indicated
Threw tantrums	7 rarely	3 sometimes	7 a lot of the time	364 not indicated
Truant from school	0 rarely	3 sometimes	1 a lot of the time	377 not indicated
Petty Theft	2 1-5 times	4 5-10 times	2 more than ten times	373 not indicated
Manipulative	0 rarely	3 sometimes	7 a lot of the time	371 not indicated
Told lies	4 rarely	2 sometimes	7 a lot of the time	368 not indicated
Bullied others	2 rarely	9 sometimes	3 a lot of the time	367 not indicated
Cruelty to other children	3 yes	18 no		360 not indicated
Cruelty to animals	0 yes	21 no		360 not indicated
Inappropriate sexual behavior	2 yes	1 no		369 not indicated
Ran away from home	1 yes	16 no		364 not indicated
Diagnosed with a disorder	2 yes	0 no	if so what? _____	

Adolescence (age 13-19)

Type of student	190 good	96 average	46 poor	49 not indicated
Truant from school	9 rarely	4 sometimes	9 a lot of the time	359 not indicated
Rule abiding	40 rarely	38 sometimes	123 a lot of the time	180 not indicated
Told Lies	5 rarely	8 sometimes	15 a lot of the time	353 not indicated
Physically aggressive	6 rarely	11 sometimes	14 a lot of the time	350 not indicated
Verbally aggressive	6 rarely	12 sometimes	12 a lot of the time	351 not indicated
Manipulative	3 rarely	4 sometimes	13 a lot of the time	361 not indicated
Snuck/Stayed out	15 rarely	17 sometimes	25 a lot of the time	324 not indicated
Destruction of Property	0 rarely	0 sometimes	2 a lot of the time	379 not indicated
Used Alcohol	25 rarely	19 sometimes	26 a lot of the time	311 not indicated
Used Drugs	66 rarely	22 sometimes	24 a lot of the time	269 not indicated
Major Theft	20 yes	16 no		345 not indicated
Sexual Assault (perp)	1 yes	6 no		374 not indicated
Promiscuous	9 yes	15 no		357 not indicated
Incidence of Arson	3 yes	0 no		378 not indicated
Incidents of self-mutilation	2 yes	0 no		379 not indicated

Index of Behavior Problems Rating Frequencies continued..,

Adolescence continued..,

Number of "at fault" car accidents	346= 0, 10= 1, 13= 2, 4= 3, 8= 4
Number of arrests	354= 0, 22= 1, 3= 2, 1= 3, 1= 4
Number of convictions	379= 0, 1= 1, 1= 2, 0= 3, 0= 4
Number of ticketable offenses (class B misdemeanor or above)	364= 0, 2= 1, 5= 2, 4= 3, 6= 4
Number of Illegitimate Pregnancies	365= 0, 16= 1, 0= 2, 0= 3, 0= 4
Number of times ran away from home	359= 0, 11= 1, 4= 2, 0= 3, 7= 4
Number of suicide attempts	376= 0, 3= 1, 1= 2, 1= 3, 0= 4

Diagnosed with a disorder __25__yes _356_no If so what? _____

Adulthood (age 20 and up)

Physically aggressive	__6__rarely	__4__sometimes	__6__a lot of the time	_359_not indicated
Verbally aggressive	__8__rarely	__4__sometimes	__9__a lot of the time	_354_not indicated
Told lies	__0__rarely	__3__sometimes	__9__a lot of the time	_363_not indicated
Manipulative	__4__rarely	__1__sometimes	__13_a lot of the time	_357_not indicated
Destruction of Property	__0__rarely	__0__sometimes	__1__a lot of the time	_374_not indicated
Used Alcohol	__7__rarely	__9__sometimes	__24_a lot of the time	_335_not indicated
Used Drugs	__11_rarely	__7__sometimes	__18_a lot of the time	_339_not indicated
Gambled	__0__rarely	__1__sometimes	__1__a lot of the time	_373_not indicated

Major Theft	__10_yes	__4__no	_361_not indicated
Sexual Assault (perp)	____yes	____no	____not indicated
Promiscuous	__8__yes	__2__no	_365_not indicated
Incidence of Arson	__0__yes	__5__no	_370_not indicated
Incidents of self-mutilation	__0__yes	__5__no	_370_not indicated
Child Abandonment	__4__yes	__7__no	_364_not indicated
Child Abuse (accused, caught or convicted)	__2__yes	__5__no	_368_not indicated
Adultery (accused, caught, or admitted)	__2__yes	__5__no	_368_not indicated
Check or Credit Fraud	__12_yes	__4__no	_359_not indicated

Number of divorces	289= 0; 66= 1; 13= 2; 6= 3; 1=4
Number of Illegitimate Pregnancies	358= 0; 13= 1; 2= 2; 1= 3; 1= 4
Number of "at fault" car accidents	367= 0; 3= 1; 2= 2; 2= 3; 1= 4
Number of arrests	356= 0; 9= 1; 6= 2; 2= 3; 2= 4
Number of convictions	366= 0; 7=1; 0= 2; 0= 3; 2= 4
Number of ticketable offenses (class B misdemeanor or above)	366= 0; 2= 1; 3= 2; 1= 3; 3= 4
Number of suicide attempts	368= 0; 6= 1; 0= 2; 1= 3; 0= 4

Diagnosed with a disorder __41_yes _333_no if so what? _____

Appendix 2D

Supplemental Analyses on Male Adoptees Only

Table D.1

*Predicting **childhood** percent scores on the Index of Problem Behavior from biological and adoptive mothers' psychosocial profile scores and the interaction between them, **for males only.***

	Block 1 B (Std. Error)	Block 2 B (Std. Error)	Block 3 B (Std. Error)	Block 4 B (Std. Error)
SES	-0.10	-0.11	-0.11	-0.12
AM Beta IQ	0.04	0.07	0.07	0.09
BM Beta IQ	0.08	0.09	0.09	0.09
AM profile score		0.14	0.14	0.05
BM Profile score			-0.01	-0.05
AM profile * BM profile				0.15
F-value	0.395	0.732	0.580	0.609
R^2	0.01	0.03	0.03	0.04
f^2	-	0.02	0.00	0.01

Note: AM= adoptive mother, BM= Biological mother
N=92.

Table D.2

*Predicting **adolescent** percent scores on the Index of Problem Behavior from biological and adoptive mothers' psychosocial profile scores and the interaction between them, **for males only.***

	Block 1 B (Std. Error)	Block 2 B (Std. Error)	Block 3 B (Std. Error)	Block 4 B (Std. Error)
SES	0.06	0.04	0.05	0.06
AM Beta IQ	0.03	0.09	0.10	0.08
BM Beta IQ	0.06	0.08	0.09	0.08
AM profile score		0.27*	0.26*	0.35*
BM Profile score			0.05	0.10
AM profile * BM profile				-0.15
F-value	0.364	1.941	1.583	1.453
R^2	0.01	0.08	0.08	0.09
f^2	-	0.08	0.00	0.01

Note: AM= adoptive mother, BM= Biological mother
N=91.

Table D.3

*Predicting **adulthood** percent scores on the Index of Problem Behavior from biological and adoptive mothers' psychosocial profile scores and the interaction between them, **for males only.***

	Block 1 B (Std. Error)	Block 2 B (Std. Error)	Block 3 B (Std. Error)	Block 4 B (Std. Error)
SES	0.10	0.08	0.12	0.13
AM Beta IQ	0.05	0.13	0.15	0.13
BM Beta IQ	0.06	0.08	0.10	0.10
AM profile score		0.34***	0.29**	0.39**
BM Profile score			0.25*	0.30*
AM profile * BM profile				-0.17
F-value	0.622	3.292*	3.853**	3.425**
R^2	0.02	0.13	0.18	0.20
f^2	-	0.13	0.06	0.03

Note: AM= adoptive mother, BM= Biological mother
N=91.

Table D.4

*Model predicting problem behaviors across the life span from **biological** mothers' MMPI sub-scale T-scores, **for males only**.*

	Childhood		*Adolescence*		*Adulthood*	
	Block 1 B (S.E)	Block 2 B (S.E)	Block 1 B (S.E)	Block 2 B (S.E)	Block 1 B (S.E)	Block 2 B (S.E)
Controls						
SES	-0.10	-0.16	0.07	0.11	0.11	0.09
AM Beta IQ	0.10	0.06	0.11	0.09	0.13	0.12
BM Beta IQ	0.11	0.18	0.10	0.10	0.09	0.14
AM profile score	0.16	0.12	0.30**	0.26*	0.37***	0.21
MMPI Sub-Scale T-scores						
Hs		-0.38*		-0.18		-0.33*
D		0.14		-0.12		-0.01
Hy		0.13		0.21		0.27*
Pd		0.13		0.21		0.33*
Pa		-0.31		-0.21		-0.17
Pt		0.14		0.08		0.09
Sc		0.23		0.05		0.26
Ma		0.18		0.20		-0.12
F-value	0.854	1.291	2.298	1.992*	3.684**	3.161***
R^2	0.04	0.17	0.10	0.24	0.15	0.34
F^2	-	0.16	-	0.18	-	0.29

Note: AM=adoptive mother, BM=biological mother, Hs=hypochondriasis, D=depression, Hy=hysteria, Pd=psychopathic deviate, Pa=paranoia, Pt= psychasthenia, Sc=Schizophrenia, Ma=Hypomania. N=92 for childhood model, 91 for adolescent model, and 91 for adulthood model.

Table D.5

*Model predicting problem behaviors across the life span from **adoptive** mothers' MMPI sub-scale T-scores, **for males only**.*

	Childhood		*Adolescence*		*Adulthood*	
	Block 1 B (S.E)	Block 2 B (S.E)	Block 1 B (S.E)	Block 2 B (S.E)	Block 1 B (S.E)	Block 2 B (S.E)
Controls						
SES	-0.10	-0.18	0.08	0.01	0.15	0.10
AM Beta IQ	0.05	0.06	0.05	0.09	0.10	0.12
BM Beta IQ	0.08	0.02	0.08	0.06	0.09	0.06
BM profile score	0.03	0.04	0.11	0.14	0.31**	0.31**
MMPI Sub-Scale T-scores						
Hs		-0.36		-0.18		-0.16
D		0.20		0.15		0.14
Hy		0.21		-0.01		0.08
Pd		0.12		-0.17		0.11
Pa		-0.09		-0.09		-0.02
Pt		-0.04		0.27		-0.10
Sc		-0.08		0.12		0.12
Ma		0.30*		0.19		0.17
F-value	0.307	0.997	0.518	1.559	2.624*	1.339
R^2	0.01	0.13	0.02	0.19	0.11	0.17
F^2	-	0.14	-	0.21	-	0.07

Note: AM=adoptive mother, BM=biological mother, Hs=hypochondriasis, D=depression, Hy=hysteria, Pd=psychopathic deviate, Pa=paranoia, Pt= psychasthenia, Sc=Schizophrenia, Ma=Hypomania. N=92 for childhood model, 91 for adolescent model, and 91 for adulthood model.

Chapter Three: Stability and Change in Patterns of Problem Behavior Development as a Function of Gender, Adoptive Status, and Risk Status

The study of the developmental trend of problem behaviors is not a new topic. Many investigations of problem behavior development show stability of behavior across time (e.g., Farrington, 1994; Olweus, 1979; Stattin & Magnusson, 1989; van den Oord & Rowe, 1997; van der Valk, Verhulst, Neale, & Boomsma, 1998). However, few have investigated stability across a significant period of time (e.g., more than 3 or 4 years), or beyond early adulthood. One notable exception is the work of Terrie Moffitt and her colleagues, who have followed a cohort of individuals born in Dunedin, New Zealand between 1972 and 1973 (e.g., Moffitt & Caspi, 2001, 2005; Moffitt, Caspi, Harrington, Milne, 2002). The current study used longitudinal data, which allowed us to map trends of problem behaviors over the course of three and a half decades. Results from this investigation add to the evidence of developmental trends over an extended period of time and through multiple life stages.

An important consideration when investigating developmental trends is whether all groups follow the same predictable trend. While it has generally found that most individuals peak in the amount of problem behaviors they display during adolescence (Patterson, Capaldi, & Bank, 1991), Moffitt (1993) identified two separate, yet salient, trajectories for criminal and antisocial problem behaviors. Moffitt defined the individuals who fell into these two developmental patterns as adolescent-limited (characterized by antisocial behavior that is only manifest during the adolescent phase) and life-course-persistent (characterized by externalizing, delinquent, and antisocial tendencies throughout childhood, adolescence, and adulthood). Moffitt and her colleges also identified another category of individuals who showed an increase in criminal behavior in adulthood, but this was rare (Moffitt, 1993). Loeber and Stouthamer-Loeber (1998) challenged that there also exist a group of individuals who show signs of externalizing behaviors, specifically aggression, only during childhood—outgrowing the tendency by adolescence. These results suggest that there is no one predictable path of behavior,

which suggests that groups selected by various criteria may also show differential patterns of problem behaviors over time.

Little research to date has distilled samples, beyond gender, to investigate whether there are between-group differences problem behaviors from early childhood through middle adulthood. For example, do adoptees follow the same developmental trend as children reared by their biological parents? And, do those who are classified as higher-risk follow the same developmental trend as those classified as lower-risk? In those studies that do exist, adoptees have been found to display higher levels of problem behavior than their non-adopted siblings (Weinberg, Waldman, van Dulmen, & Scarr, 2004) and individuals who are at higher risk for developing problem behaviors tend to display more externalizing behaviors than those who are at lower risk (Crowel, Beauchaine, Gatzke-Kopp, Sylvers, Mead & Chipman-Chacon, 2006; Hastings, Zahn-Waxler, Robinson, Usher, & Bridges, 2000; Polaha, Larzelere, Shapiro, & Pettit, 2004; Puttler, Zucker, Fitzgerald & Bringham, 1998), though risk is defined in different ways. Hastings et al. (2000), for example, defined risk according to mother and teacher ratings of behavior problems at one point in time (either 4-5 years or 6-7 years) to predict problem behavior two years later. Puttler et al. (1998) used alcoholic family subtypes (antisocial alcoholics, non-antisocial alcoholics, and non-alcoholic families) to investigate the development of behavior problems in early to mid-childhood. Only one of these studies (Hastings et al., 2000), however, followed individuals over time to track developmental patterns—finding that the amount of concern for others a child has early on in development mediates the relationship between early and later externalizing.

As so little research has been done to investigate the difference in behavioral trajectories between adopted and non-adopted samples, which could have important implications for individuals involved in the adoptive process, the current investigation divided the sample according to both sex and adoption status to ascertain whether overall mean stability and/or intraindividual continuity differs between these groups. In addition, because of the findings in Chapter Two, which revealed that biological mothers' Pd T-scores influenced problem behavior development in adoptive individuals and because risk

status has been found by others (cited above) to influence developmental trends, I also divided the adoptive sample according to their relative risk for behavior problem development (based on their birth mothers' Pd scores) to investigate the question of between-group differences in the stability of problem behaviors from childhood through adulthood.

The first goal was to assess the group differences in the mean level stability of problem behaviors using independent samples *t*-tests. Among studies that have mapped growth curves, or trajectories, of problem behaviors into adulthood it has been shown that a definite upward trend exists between childhood and adolescence (e.g., Moffitt, 1993). Based on these findings, it was hypothesized that the mean level of problem behaviors would increase from childhood to adolescence, and decrease between adolescence and adulthood, regardless of group membership. However, because of the rate at which the birth mothers scored markedly above the norm on the Pd scale and the association found between birth mothers' scores and problem behavior development (in Chapter Two), I expected the adoptive sample to show higher average rates of delinquent behaviors than the biological children of the adoptive parents at each point in the life span, but to follow a similar pattern (i.e., peaking during adolescence).

Next, to explore whether mean differences emerge as a function of relative risk status, the adopted individuals identified as Higher-Risk toward behavior problem development, based on indications of elevated deviance in their biological mothers, were compared to adoptees that were identified as Lower-Risk. Derived from van den Oord and Rowe's (1997) findings, which suggested moderate genetic effects on problem behavior development, I expected adoptees that had mothers with highly elevated Pd T-scores to exhibit more problem behaviors than the adoptees whose mothers were moderately elevated on the MMPI Pd sub-scale. Also, based on Moffitt's (1993) research I expected the Higher-Risk adoptees to show more behavioral stability across time than the Lower-Risk adoptees.

Finally, because of the frequency with which sex differences that have been found, with males displaying higher rates of externalizing problems than females, males

were predicted to display more problem behaviors within each of the group comparisons. In other words, I expected male biological offspring, male adoptees, Higher-Risk males, and Lower-Risk males to display more problem behaviors than their female counterparts at each stage of development.

The second goal of this investigation was to assess the intra-individual continuity of problem behaviors across the life span for each of the groups (adopted, biological, Higher-Risk, Lower-Risk), using correlations between rank order on the amount of problem behaviors at one point in time (e.g., childhood) with the rank order on the amount of problem behaviors at another point in time (e.g., adolescence). One of the most robust findings with regard to problem behavior research is that earlier problem behaviors predict later problem behaviors (Bardone, Moffitt, Caspi, Dickson, Stanton, & Silva, 1998; Keenan & Wakschlag, 2002; Moffitt, 1993; Farrington, 1991, 1994; Patterson, 1992; Stattin & Magnusson, 1989; Caspi, Elder, & Bem, 1987; Olweus, 1979). It has also been found that those who are the most persistent (i.e., stable) in displaying delinquent and antisocial behaviors are those who are the most deviant (Loeber, 1982; Loeber & Farrington, 1998; West & Ferrington, 1973). Therefore, it seemed likely that those who ranked the highest during childhood, which I predicted would be the Higher-Risk adoptees, would also be among the highest in rank order during adolescence and adulthood. Therefore, I predicted that the Higher-Risk adoptees would display the greatest continuity of behavior across the life span.

Factors that Influence the Development and Continuity of Problem Behaviors

In addition to the investigation of developmental trends, developmental researchers have turned to behavior genetic methodology to investigate the how genetic factors influence the trends we observe in problem behavior development over time. Using data from the National Longitudinal Survey of Youth, van den Oord and Rowe (1997), followed a group of biologically related individuals (full and half siblings, and first cousins) from mid-childhood into early adolescence, finding that both genetic and

stable family environmental factors were sources of liability that influenced the stability of problem behaviors across time.

Building on the findings of van den Oord and Rowe, the final goal of the analyses presented in this chapter was to assess the influence of both genetic and within-family environmental sources of liability on the development and continuity of problem behaviors during each of three life stages: childhood, adolescence, and adulthood. To this end, a series of intra-class correlations were performed on both biologically related and biologically unrelated sibling pairs from the Texas Adoption Project (TAP). Similar to the findings in Chapter Two as well as other studies from TAP (e.g., Loehlin, et al., 1985, 1987), which found no similarity between adoptive mother and child, I expected to find *no* similarity between biologically unrelated siblings, reared in the same home, on either the development or stability of problem behaviors throughout the life course; however, I did expect to find a positive relationship between biological siblings on both the development and stability of problem behaviors across time.

In summary, the analyses presented in this chapter build upon the existing literature of stability and continuity of problem behaviors by following a sample of adopted and biological individuals over a 30 year time span, investigating whether gender, adoptive status, or level of genetic risk influence the pattern of development between groups, or the intra-individual continuity of problem behaviors within groups. Based on prior research, males, adoptees, and those at high risk of developing problem behaviors were predicted to show more problem behaviors across the lifespan and Higher-Risk adoptees (males in particular) were predicted to show the greatest amount of behavioral continuity. Finally, the influence of common genetic factors and common environmental factors on the development and continuity of problem behaviors was assessed, with common genes, *not* common environments, predicted to influence both the development and continuity of behavior problems among siblings.

Method

Subjects

Subjects (N=381) for this investigation came from the Texas Adoption Project, a longitudinal adoption project which began in 1979. The participants in this study included both the adopted and biological children of 300 Texas families who adopted at least one child from a particular adoption agency within the state of Texas. Data has been collected at three time points, roughly 10 years apart, covering childhood (average age 8), adolescence (average age 17), and adulthood (average age 30) (for detailed description of data see the method section in Chapter Two). All adoptees in this study were adopted away at birth and all adoptions were closed record adoptions. Virtually all participants were of Caucasian decent and 54% of the sample was male.

To assess whether there are any stable within-family differences that exist among participating families with and without biological children a series of t-tests were conducted. Table 3.1 presents the results of the t-tests, showing that TAP families who had at least one biological child included more children in the household and had adoptive mothers with more emotional stability.

Measures

Problem behaviors. As described in detail in Chapter Two, each individual was scored on the number of problem behaviors to create a latent problem behaviors variable for each of the three life stages: childhood (age 4-12), adolescence (age 13-19), and adulthood (age 20 and over). Higher scores indicated more problem behaviors. Because the number of behaviors measured at each of the life stages differed, and because the same underlying characteristic may manifest itself differently from one life stage to the next, percent scores (rather than raw scores) on the IPB were used as a measure of problem behaviors across the life span. Percent scores for each life stage were calculated by summing the ratings on all of the items within a developmental stage and dividing by the number of total possible "points" for that stage. Percent scores during childhood

ranged from 0-0.49 (mean = 0.062, SD= 0.067, skewness= 2.56), 0-0.44 (mean= 0.072, SD= 0.075, skewness= 2.04) during adolescence, and 0-0.38 (mean= 0.029, SD= 0.057, skewness= 3.04) during adulthood. The distribution of percent scores was markedly skewed during each of the three developmental stages, an issue which was addressed in Chapter Two.

Risk status. According to the results found in Chapter Two, having a biological mother with an elevated score on the Minnesota Multiphasic Personality Inventory (MMPI) psychopathic deviance (Pd) sub-scale may leave biological children, even though adopted away at birth, at increased risk for developing problem behaviors throughout their life span. Therefore, I used the biological mothers' MMPI Pd T-scores as an indicator of genetic liability toward problem behavior development. Pd T-scores equal to or greater than 65 represent a score that is at least one and a half standard deviations above the normative adult sample (normative mean = 50, SD= 10) and is predictive of individuals diagnosed with antisocial personality disorder (Dahlstrom, et al., 1960). The average Pd T-score of the biological mothers within this sample was 64.61 (SD= 10.42). Given that adolescents tend to score above the normative mean (Dahlstrom, et al., 1960) in general, and the average age of the biological mothers in this sample was 19 years, this definition of liability is appropriate for determining whose biological mothers were truly problematic—including about the top third of the women in this age group. Since the children born to these women were adopted away within 30 days of their birth, any similarity between the birth mothers and their adopted away offspring was assumed to be the result of genetic overlap[7] (Loehlin, et al., 1982).

Sex. Because of the robust findings in the literature regarding sex differences in problem behaviors (e.g., Else-Quest, et al., 2006), and because of the findings presented in Chapter Two of this dissertation (Tables 2.12 and 2.13), the t-tests and correlations between rank order were also conducted separately for each group by sex. Sex was coded as 0=male, 1=female, and the sample was 54% male.

[7] Although this assumption may not be entirely accurate due to the fact that some selective placement did occur; the adoptive and biological mothers are correlated on IQ (r= 0.15) and some of the MMPI scale scores (Table 2.8).In addition, prenatal.environmental effects cannot be ruled out.

Analyses

Four sets of analyses were carried out. First, to test for overall (i.e., mean) stability of problem behaviors across the three life stages, paired *t*-tests were run between Time 1 and 2 (i.e., childhood and adolescence) percent scores on the Index of Problem Behavior (IPB) ratings and between Time 2 and 3 (i.e., adolescence and adulthood). Second, in order to see whether individuals' behaviors remain relatively stable, each participant was ranked at each life stage according to his or her score on the IPB and Pearson correlations between the rank orders at each life stage were estimated. Significant correlations support the conclusion that individuals' behaviors at one point in time are associated with the amount of problem behaviors they display at another point in time (Matjasko, Ernst, Grunden, and Ammon, 2006) and suggest continuity in problem behaviors across the life span. Third, to estimate the influence of both genetics and the shared family environment on the development of problem behaviors from childhood to adulthood, sibling intraclass correlations were calculated. In this set of analyses, any similarity between genetically unrelated (i.e., adopted) siblings was assumed to be the result of environmental factors alone, while similarity between biologically related siblings was assumed to be the result of both genetic and environmental overlap (Loehlin et al., 1981, 1982). Finally, in order to assess the influence of genetics and the family environment on the stability of problem behaviors, intraclass correlations were calculated on the IPB change scores between siblings, both biological and unrelated, between childhood and adolescence and between adolescence and adulthood.

Results

Mean Level of Problem Behaviors across the Life Span

To test for changes in the level problem behaviors over time, paired *t*-tests were run on the IPB percent scores between childhood and adolescence and between adolescence and adulthood. These analyses were done for males and females separately to ascertain whether mean level stability differs as a function of sex. In addition, to gauge whether adopted children are more stable than children raised by their biological parents, paired T-tests were also conducted for the following four groups: adopted males, adopted females, biological males, and biological females. Again, based on prior research, it was predicted that problem behaviors would rise between childhood and adolescence and taper off thereafter, that males would show more problem behaviors than females, adoptees more than biological offspring, and Higher-Risk adoptees more than Lower-Risk adoptees.

Percent scores were calculated by summing the ratings on all of the items within a developmental stage and dividing by the total possible score for that stage. Mean percent scores were than compared, using paired t-tests, to assess changes in problem behaviors between childhood, adolescence, and adulthood. Figure 3.1 shows that, indeed, behavior problem across the life span did peak during adolescence for both males and females. The mean percent scores for behavior problems showed an increase from childhood to adolescence for both males and females, $t(190)= -2.532$, $p< .05$ and $t(181)= -4.134$, $p<.001$, respectively, followed by a decrease between adolescence and adulthood, $t(187)= 9.768$, $p<.001$ for males and $t(179)=10.813$, $p<.001$ for females. Figure 3.2 illustrates the mean difference in percent scores between the adopted males and females and biological males and females. Paired t-tests indicated that while the adopted children differed significantly in the amount of problem behaviors they displayed between childhood and adolescence, $t(135)= -2.954$, $p<.01$ for adopted males and $t(121)= -4.620$, $p<.001$ for adopted females, children reared by their biological parents did not, $t(54)=$

0.281, p= .78 for biological males and t(59)= -0.033, p=.97 for biological females. In fact, from the trend line pictured in Figure 3.2, it appears that both the biological males and females actually decrease somewhat in their amount of problem behaviors between childhood and adolescence. Lastly, as can be seen in Figure 3.2, all four groups did display significant decreases in the amount of behavior problems between adolescence and adulthood, t(133)= 8.268, p<.001 for adopted males and t(120)= 9.573, p<.001 for adopted females, t(53)= 5.709, p< .001 for biological males, and t(58)= 5.382, p< .001 for biological females. This figure indicates that, while the adopted sample indeed followed the predicted pattern of problem behaviors across the life span, the children who were born naturally to the adoptive parents showed relatively little mean change between childhood and adolescence, before declining in the amount of problem behaviors into adulthood. In other words, the biological offspring of the adoptive parents in this sample showed greater behavioral stability than did the adopted children, as a group. However, only the adoptees trend followed prediction.

Breaking down the adoptive sample further, I looked into whether individuals who may have been more at risk for problem behaviors, due to having a biological mother with indications of defiant behaviors herself, exhibited more problem behaviors than individuals who were not genetically at risk. According to the findings in chapter 2, adoptees whose mothers had elevated scores on the MMPI Pd scale were more likely to exhibit problem behaviors during childhood, and adolescence. Therefore, the following analysis sought to uncover whether these "Higher-Risk" adoptees showed differing patterns of behavior across the life span than did the "Lower-Risk" adoptees. The results in Figure 3.3 illustrate that while both the Higher-Risk and Lower-Risk adoptees showed the same general pattern, with behavior problems peaking in adolescence, the rise in percent scores from childhood to adolescence was only significant for the Higher-Risk group, $\underline{t}(74)= -2.177$, $\underline{p}< .05$. As predicted, the Higher-Risk adoptees displayed higher percent scores across the life span. However, the behavioral difference between the two groups was only significant during adulthood, $\underline{t}(177)= -2.830$, $\underline{p}< .01$.

When breaking the Higher-Risk and Lower-Risk samples down by gender (Figure 3.4), I found, as predicted, that Higher-Risk males exhibited the highest amounts of problem behaviors throughout the life span. Higher-Risk females, while starting out relatively low in childhood problem behaviors, were higher than both the Lower-Risk males and Lower-Risk females during adolescence and adulthood. The Higher-Risk female group was the only group to have a significant increase in problem behaviors from childhood to adolescence, $t(33) = -2.222$, $p < .05$. The other three groups, while showing small increases in their percent scores from childhood to adolescence, remained relatively stable between these two time periods; $t(40) = -1.028$, $p = .310$ for the Higher-Risk Males, $t(48) = -1.048$, $p = .300$ for the Lower-Risk females, and $t(55) = -1.167$, $p = .248$ for the Lower-Risk males. All four groups did show significant declines between adolescence and adulthood; $t(33) = 4.883$ for the Higher-Risk Females, $t(40) = 3.672$ for the Higher-Risk males, $t(47) = 5.770$ for the Lower-Risk females, and $t(55) = 6.902$ for the Lower-Risk males (all at the $p < .001$ level). These results suggest that an adolescent peak in problem behaviors may only occur among Higher-Risk adopted females, with Higher-Risk adopted males and Lower-Risk adoptees showing relative behavioral stability between childhood and adolescence. Higher-Risk males appear to be the most problematic across the life span.

Individual Level Continuity of Behavior

To test for continuity of behavior across the life span, Pearson correlations were estimated on the rank order of the participants between childhood, adolescence, and adulthood. To ascertain whether individuals within certain groups differ on intra-individual continuity, these correlations were run separately on the male and female sub-samples of the following groups: the full sample, the biological sample, the adopted sample and then also on Higher-Risk and Lower-Risk adoptees. Results showing the relationship between rank order across the life span for the full, adoptive, and biological samples can be seen in Table 3.2. These findings support the hypothesis that an

individual's rank order at one time (e.g., childhood) was predictive of the individual's rank order at another (e.g., adolescence). Results were, however, different when comparing the adoptive and biological sub-samples. For the adoptive samples the correlations were stronger between each of the life stages, when compared to the biological sample. The adoptive sample also showed moderate stability of problem behaviors across the entire life span. The biological sample, on the other hand, showed only moderately low correlations between adjacent life stages (i.e., childhood to adolescence and adolescence to adulthood).

The next table (Table 3.3) shows the results from the rank order correlations for the male and female sub-samples and compares them to the entire sample. This picture is very similar to that of the adopted versus biological samples. Males were moderately stable in the amount of problem behaviors they displayed from childhood up through their mid- to late thirties. Females, on the other hand, were found to be moderately stable from childhood to adolescence and highly stable from adolescence to adulthood. However, when individuals were grouped according to both sex and adoption status a more differentiated picture emerged (Table 3.4). From these results it appeared that only adopted males showed stability in the amount of problem behaviors they display from childhood through adulthood and that adopted females were moderately stable between childhood and adolescence but highly stable in problem behaviors from adolescence to adulthood. Biological males were also moderately stable from childhood to adolescence and from adolescence to adulthood, but less so than adopted males in both instances. Biological females showed only moderate behavioral stability from adolescence to adulthood.

Finally, when the adopted individuals were classified as Higher-Risk or Lower-Risk, based upon their birth mothers' MMPI Pd T-scores (Tables 3.5 and 3.6), I found that while both groups showed moderate to high stability on the amount of problem behaviors they displayed across the life span when sex is not accounted for, Higher-Risk males are clearly the most stable from childhood through adulthood. Higher-Risk females showed no significant relationship between rank order during one life stage to their rank

order during another life stage. In fact, the Lower-Risk females appeared to show more behavioral stability than the Higher-Risk adoptees did.

Genetic and Environmental Influence on Problem Behavior Development and Stability

In Chapter Two, I made an initial attempt to uncover the influence of genes and the family environment on problem behavior development by looking at the relationship between adoptive and biological measures of psychosocial and behavioral functioning and the development of problem behaviors during childhood, adolescence, and adulthood. Using a series of regressions I generally found that biological mothers' Pd T-scores did predict higher scores on the problem behavior indicator, at least during adolescence and adulthood. In Chapter Two I also conducted a series of parent-child correlations, which indicated that there is a moderate to strong relationship between biological mothers' Pd T-scores and adolescent IPB scores during adolescence and adulthood, but that this relationship may hold true only for males.

Another way to assess the influence of genetics and the shared family environment is to look at the relationship between siblings on measures of problem behaviors. To this end, a series of Multivariate Analysis of Variances (MANOVAs) were computed with 'Family ID' as the independent variable and total scores on the IPB during childhood, adolescence, and adulthood as the dependant variables. Among families with more than one biological child only one—the oldest—was included in the analysis. Although this forced me to omit 54 biological siblings from analysis , it insured that all sibling pairs in the analysis were unrelated, genetically, to one another and did not include the same individuals in the analysis more than once. Due to sample size restrictions, these comparisons were could not be done separately for males and females or for the Higher-Risk verses Lower-Risk sub-samples.

Following the MANOVAs, intraclass correlations were computed using the equation:

$$r = [MSb - MSw]/[MSb + (m-1)MSw]$$

where MSb= mean squares between families, MSw= mean squares within families, and m= mean number of siblings per family.

If a positive intraclass correlation was found it would indicate that siblings were more alike than one would expect given the general variation in the sample. If a negative correlation were found it would suggest that siblings were less alike than randomly paired members of the sample. Finally, a correlation of zero would have indicated that siblings were no more alike than randomly paired members of the sample. The F-test from the MANOVA served as the test of significance for the intraclass correlation (McNemar, 1969).

As predicted, results (Table 3.7) indicated that during all three life stages—childhood, adolescence, and adulthood, siblings reared within the same home but who shared no (naturally varying) genes in common resembled each other no more than randomly paired individuals from within the sample. Given the positive correlations between the biological sibling pairs, it was found that the genetically related siblings did resemble one another more than random pairs, though only significantly so during adulthood. These findings support the theory that problem behavior development, especially during adulthood, is influenced more by one's genetic makeup than by one's family environment. In addition, similar to the biological parent-child correlations found in Chapter Two, the resemblance between biologically related siblings appears to get stronger with age.

To test for the influence of genes and the environment on the *stability* of problem behaviors throughout the life course, intraclass correlations were also estimated on the change scores between childhood and adolescence and between adolescence and adulthood for both biologically related and unrelated sib-pairs. As can be seen in Table 3.8, neither the biological siblings nor the unrelated siblings were similar to one another at the $p < .05$ level, though the number of biologically related sib pairs may have been too small to detect a relationship (n=27). According to these results, the stability of problem

behaviors over time is related to neither genetic nor shared environmental factors. However, the direction of the relationship between the biologically related siblings is in the proper direction (i.e., positive correlation), suggesting a relationship may exist, but was could not be established.

Discussion

There were three goals for this chapter. The first goal was to assess the stability and continuity of problem behaviors among the children of 300 Texas families having at least one adopted child. The second goal was to determine whether groups differ as a function of sex, adoption status, or risk status, in mean level stability and/or individual continuity of problem behaviors across a thirty year time span. The final goal for this chapter was to uncover to what extent genes and shared family environments influence the development and stability of problem behaviors from early childhood through middle adulthood.

Mean Stability and Individual Continuity of Behavior for Adoptive, Biological, Higher-Risk, and Lower-Risk Males and Females

Results generally supported the hypothesis that mean levels of problem behaviors would peak during adolescence, but that adopted individuals would display higher means across the life span than the biological offspring of the adoptive parents. However, as a group the biological children in this sample appeared to be relatively stable on mean level of problem behaviors between childhood and adolescence, with mean percent scores remaining in the lowest five to six percent. In addition, once the adoptive sample was divided into groups as a function of gender and relative risk status, more group differences in the relative stability of problem behaviors over time emerged. Specifically, Higher-Risk males and Lower-Risk adoptees in general showed small but insignificant increases between childhood and adolescence. Higher-Risk females comprised the only

group to show significant change between childhood and adolescence, within the adoptive sample.

It was also found that the adopted sample was higher on problem behaviors across each of the three time points, which was predicted to occur because of the number of biological mothers in the sample that had elevated scores on the psychopathic deviancy scale of the Minnesota Mutiphasic Personality Inventory. While previous research has found that adoptive samples tend to show more problem behaviors than children in comparable families who are reared by their biological parents (Brodzinsky, Radice, Huffman, Merkler, 1987; Hutchings & Mednick, 1973), these investigations have taken only a snap-shot view of one time point. This investigation adds to this finding by showing that adoptees from the Texas Adoption Project displayed elevated rates of problem behaviors, compared to their non-adopted siblings, across three decades.

While only 167 of the original 300 parents from the Texas Adoption Project were located and interviewed, it does not appear that selection was responsible for this outcome. *t*-Tests comparing participants whose parents agreed to be interviewed to those whose parents did not, presented in Chapter Two (Tables 2.17), found no individual differences between subjects whose parents were or were not interviewed with respect to general levels of intelligence, mother rated disposition during childhood (Time 1) and adolescence (Time 2), age of the subject at the initial interview, or the subject's sex. A significant difference in birth mothers' Pd T-scores was found between the subjects whose parents did and did not participate: namely, the subjects of the non-participating families had mothers with higher psychopathic deviancy scores, suggesting that some of the worse cases may not have been captured in this study. Therefore, selective attrition does appear to have taken place, but does not explain the finding that the adopted children in this sample tended to have more problem behaviors than the children reared by their biological parents. If anything, the effect may have been underestimated because of the attrition. These findings add to the literature by showing that indeed adoptive samples did persist in displaying higher mean levels of problem behaviors (compared to their non-adopted siblings) well into their adult years.

Based on such findings, some have argued that adoption itself is a risk factor for problem behavior development (Brodzinsky, et al., 1987; Miller, 2005; Weinberg, et al., 2004). However, studies comparing groups of individuals whose parents are mentally ill and are either adopted away or remain with their mentally ill biological parent suggest that adoption is actually a protective factor. For example, Goodwin (1977) studied daughters of alcoholic biological parents, some of whom were adopted away shortly after birth some of whom were not. The adopted away daughters displayed significantly less depression during young adulthood than did the daughters who grew up in the homes with their biological alcoholic parent; although both groups displayed higher rates of alcoholism than was expected from the general population. As was mentioned earlier, individuals who are given up for adoption are not a randomly selected group. Most of their biological mothers are teenagers and teenage pregnancy has been found to be associated with a number other risk factors, such as low SES, self-esteem, and academic achievement, early puberty and troubled family histories (Holden, Nelson, Velasquez & Ritchie, 1993)—all of which have a heritable component. Therefore, the fact that many samples of adopted individuals have shown elevated levels of mental and behavioral problems seems to be more a reflection of the genetic risk possessed by the population of individuals who tend to give their children up for adoption than a reflection of the adoptive process. It should also be noted that while there is a tendency for adopted samples to manifest more behavior problem than their non-adopted siblings, most adopted individuals develop quite satisfactorily.

Finally, the hypothesis that Higher-Risk adoptees would score the highest on the Index of Problem Behaviors across all three developmental stages was supported, though this finding appears to be mostly due to the levels of behavior problems displayed by the Higher-Risk males. These findings are supported by those of Foley, et al. (2001), who also found an increase in oppositional-defiant disorder and conduct disorder in the male offspring of mothers who had a history of antisocial personality disorder (while taking co-morbidity and concordance of paternal disorders into account), but did not find this relationship for the female offspring. While past studies have indicated that a genetic

component exists for defiant behaviors, none has indicated why males who inherit these genes would manifest more stable behavioral patterns than females who inherit them.

Why, for instance, would Higher-Risk females start out among the lowest scoring on a measure of behavior problems during childhood to end up among the highest during adolescence—especially when most studies (using non-adoptive samples) have found that externalizing tends to decrease as females make the transition from childhood to adolescence, even among those females diagnosed with conduct disorder as children (e.g., Patterson & Stoolmiller 1991; Zoccolillo, 1992)? It is possible that this sample of females directly selected for sexual behavior (because they were pregnant teens), not conduct disorder or antisocial behavior disorder. Therefore, the externalizing behaviors in their offspring might not be manifest until puberty. Another possibility may be that defiance is a trait which is associated with a gene on the X chromosome, protecting females and making males more susceptible (because males only have one X, so getting a single copy of the gene affects them, whereas females, having two X chromosomes, may need to have two copies of the gene before being affected). The explanation for this goes beyond the scope of this chapter, but future researchers are encouraged to investigate the possible reasons why these sex differences may have been found.

Another possibility for the gender differences found in behavioral stability may be due to the Index of Problem Behavior's ability to detect problem behaviors among females as well as it does for males. As discussed in Chapter Two, the items on the IPB may be biased toward male-typical behaviors. Other approaches to scale construction may also be useful. For example, some previous research has used factor analyses and found indications of both minor and major delinquency (Center for Human Research, 2002; Matjasko, et al, 2006). Minor delinquency included items such as stealing something worth under $50, skipping school, and experimenting with drugs. Major delinquency, on the other hand, included items with more severe behaviors such as stealing something worth over $50, using a knife, gun, or other weapon against another individual, and being in a physical altercation where they the other person ended up in the

hospital. The use of different factors of problem behaviors seems a fruitful area to explore in future research.

Genetic and Environmental Influences on the Development and Continuity of Problem Behaviors

To further investigate the influence of both genetics and the shared family environment on the development of problem behaviors, a series of intraclass correlations were calculated between biologically related and unrelated sibling pairs. As hypothesized, results indicated that sibling pairs who are reared within the same household, but who share no naturally varying genes in common, are no more alike than randomly paired individuals from within the sample. This finding is contrary to past findings which have shown that there is a considerable shared environmental effect on problem behavior development. Van der Valk, van den Oord, Verhulst, and Boomsma (2003), for example found that shared environmental factors explained nearly 30% of the variation in behavior problems among a sample of 7-year-old twins. However, when van der Valk, Verhulst, Neale, and Boomsma (1998) used an adoptive sample to assess genetic and environmental effects on externalizing behaviors they too found no shared environmental effects. In addition, van der Valk et al. (1998) found genetic effects to account for a majority of the variance (89%) in problem behaviors, using ACE model fitting procedures. The findings from the sibling correlations in this chapter also correspond with the parent-child correlations from Chapter Two of this dissertation. Therefore, it appears that when adoptive samples are used, no shared environmental effects are found.

It is possible that, since twin samples come from a broader range of the population (more variance in SES, parental education, etc), we should expect to find more shared environmental effects in those samples than in adoptive sample. As was mentioned earlier in this dissertation, adoptive parents tend to be older, more educated, and have higher SES than parents from the general population (Loehlin et al. 1983),

resulting in a more homogeneous population of parents than those of twins. Twins (at least prior to the drastic increase in fertility drug use) could occur in any set of parents regardless of the SES or educational attainment of the individuals. With a larger variation of SES and education also come a broader variety of factors associated with those demographic characteristics, such as percent of mothers that stay at home to care for their children, quality of schools the children attend, and neighborhood characteristics. Therefore, it is possible that no shared environmental effects are found within adoptive homes because the homes between adoptive families are too similar to one another.

Moffitt (2005) also pointed out that adoptive samples may interrupt the natural interaction between individuals' genetic make-up and their environment, therefore underestimating the influence of the environment on behavior. For example, a mother with antisocial tendencies not only passes on the genes for these tendencies but also interacts with her problem behavior child in such a way (e.g., hitting, slapping, scolding, or berating) as to reinforce or even exacerbate the problem behavior. This gene-environment interaction may not be as free to act on children whose parents are not their biological parents. One way to test this hypothesis, Moffitt suggests, is to see if environmental factors present in adoptive homes (e.g., harsh putative practices) increases adoptees' problem behaviors more among adoptees whose biological parents themselves had high problem behaviors (indicating genetic risk) than among adoptees whose biological parents did not have high problem behaviors. If harsh parenting increases the amount of problem behaviors among those adoptees with high genetic risk, but not in the adoptees with low genetic risk, than, Moffitt suggests, evidence of a gene-environment interaction is provided.

Similarly, if specific factors are present in the adoptive home, such as maternal warmth, and high-risk adoptees manifest fewer problem behaviors, but lower-risk adoptees do not, a protective gene-environment effect may be occurring. This method was used in Chapter Four to see if adoptees whose birth mothers had elevated Pd scores are protected from developing problem behaviors due to specific environmental factors within their adoptive homes. Similarly, adoptees whose birth mothers did not have

extremely high Pd scores will be assessed to see whether any specific adoptee family characteristics put them at increased risk for developing problem behaviors across the life span.

Also as predicted, the intra-class correlations revealed that biological siblings, also reared in the same household, did resemble one another more than would be expected from random pairings of individuals within the sample—particularly in adulthood. Although this latter set of findings did not reach statistical significance for the childhood and adolescent correlations it should be noted that the calculations were based on only 27 pairs. Studies using twin and family studies have found that biologically related siblings, reared in the same home, typically resemble each other on problem behaviors (van der Valk, et. al, 2003). These findings have led to the conclusion that there is a shared environmental effect on problem behavior development. The findings from the sibling correlations presented here, as well as from other studies using adoptive samples (van der Valk et al., 1998), do not support this conclusion. This may be an indicator of the superiority of the adoption method to detect shared environmental effects because it does not carry the risk of genetic "contamination" of the outcome. However, it is also possible that parents with both biological and adopted children (29% of the TAP families) overemphasize the differences between the two, since the biological children are likely more similar to themselves, making the adoptive child(ren) seem more alien in the home. To investigate this question, future work could investigate the difference scores between siblings during childhood and adolescence using adoptive status a predictor of the difference.

The final set of intraclass correlations was calculated in order to estimate the degree to which either the genes or the shared environment influence the stability of problem behaviors over time. As predicted, the unrelated siblings were no more alike than random pairs of individuals from this population. While the biological sibling correlations were in the positive direction, indicating that they were more similar than randomly paired individuals, these correlations were not significant. However, the number of sibling pairs was rather small, which may account for the lack of statistical

significance found here. In addition, significant findings may not have been found due to the inherent unreliability of change scores. Change scores, because they are the result of the subtraction of scores from two time points, inherit the error of both their constituent parts, making them less reliable than either of the individual scores used to make them. Therefore, had the sample of genetically related sibling pairs been larger the relations found may have reached statistical significance. Future research using a larger sample of siblings that vary in the degree of genetic overlap may be helpful in ascertaining whether intraindividual continuity in problem behavior has a genetic component.

Limitations and Future Research

While the Texas Adoption Project does provide a unique opportunity to investigate both the genetic and shared environmental influences on behavioral development, the longitudinal adoption method is not without its limits. As would be expected with any investigation following the same individuals over a 30 year time span, subject attrition was a potential issue. Out of the original 600+ participants, the current investigation was only able to utilize 381 for whom there was relatively complete data available. However, as noted earlier, those participants whose parents did not agree to be interviewed or who could not be reached did not appear to differ in meaningful ways from those whose parents were reached and agreed to the interview at Time 3.

Another possible limitation of the current investigation was the measure used to assess problem behaviors across the life span. Although the ratings for the measurement of problem behaviors were conducted by three independent raters and the interrater reliability was good, they were based on retrospective parental interviews—sometimes with only one of the two adoptive parents present. Therefore, the behaviors that were reported were subject to several forms of bias including; retrospective bias (e.g., "Jonny is horrible now and always has been"), comparative bias (e.g., "Sarah was always a handful compared to Katie"), and limited awareness of their children's behaviors outside the home.

The issue of retrospective bias was addressed in Chapter Two (Tables 2.4 and 2.6) and suggested that retrospective bias was not a major concern. One possible way to assess whether comparative bias had occurred would be to investigate the influence that sibling rank has on problem behavior development—a factor that will be utilized in Chapter Four where I attempt to uncover individual and family factors that served as risk or protective factors for developing problem behaviors across the life span. Finally, to address the issue of limited parental awareness of adolescent and adulthood behaviors, future research could look at ratings from other sources, such as self-ratings or sibling ratings of problem behaviors. This will be possible, to a limited extent, with additional data collected by TAP between 2002 and 2006, but not ready for use in time for this dissertation project. Some time after the parent interviews were completed the offspring themselves were sent short questionnaires in the mail assessing educational attainment, current occupation and marital status, retrospective accounts of parental closeness, and school behaviors, current accounts of problems with anxiety/depression, drug and alcohol use, and the law, and a brief personality scale. In addition, siblings rated each other on these same items (when mutual consent was given), and the parents filled out these same questionnaires regarding themselves as well as their children. Using data from these questionnaires it will be possible to investigate adult outcomes using multiple sources of data.

Despite these limitations, the research presented in this chapter was able to uncover some interesting differences in trends between adopted children and children reared by their biological parents and between Higher-Risk female adoptees and other adoptees. It was also found that intra-individual continuity of behaviors differs by sex, adoption status, and the relative level of genetic risk faced by an adoptee. Without the use of a genetically informed design and the classification of the adoptees into multiple risk categories, I would have failed to unveil this more nuanced pattern of development for Higher-Risk males. Future research into problem behavior development should consider using similar methods to further tease apart the potential explanation for the sex, and other group, differences in behavioral continuity throughout the life span.

Results from this investigation, if substantiated by further research, may also help practitioners think differently about the prognosis of certain individuals. Should moderate to highly consistent patterns of problem behaviors in Higher-Risk males continue to be found, research into the effectiveness of early intervention strategies may be helpful in determining how Higher-Risk males might be shifted to a behavioral trajectory with fewer problem behaviors.

Table 3.1

Mean differences in the Time 3 participating families with and without biological children.

Family Characteristic	TAP Families w/ Biological Child(ren) *(N=79)*	TAP Families w/o Biological Child(ren) *(N=82)*	t-*value*
SES	168.06 (21.8)	168.45 (23.6)	0.102
AM age	37.06 (4.56)	38.29 (5.01)	1.512
AM IQ	113.63 (6.71)	113.47 (7.63)	-0.126
AM education	5.43 (1.17)	5.44 (1.23)	0.009
AM warmth	5.47 (1.86)	5.48 (1.80)	-0.836
AM emotional stab.	6.80 (1.59)	5.67 (1.71)	-4.023***
AM profile score	0.17 (.513)	0.21 (.695)	0.361
# of children	2.83 (.804)	1.90 (.483)	-8.224***

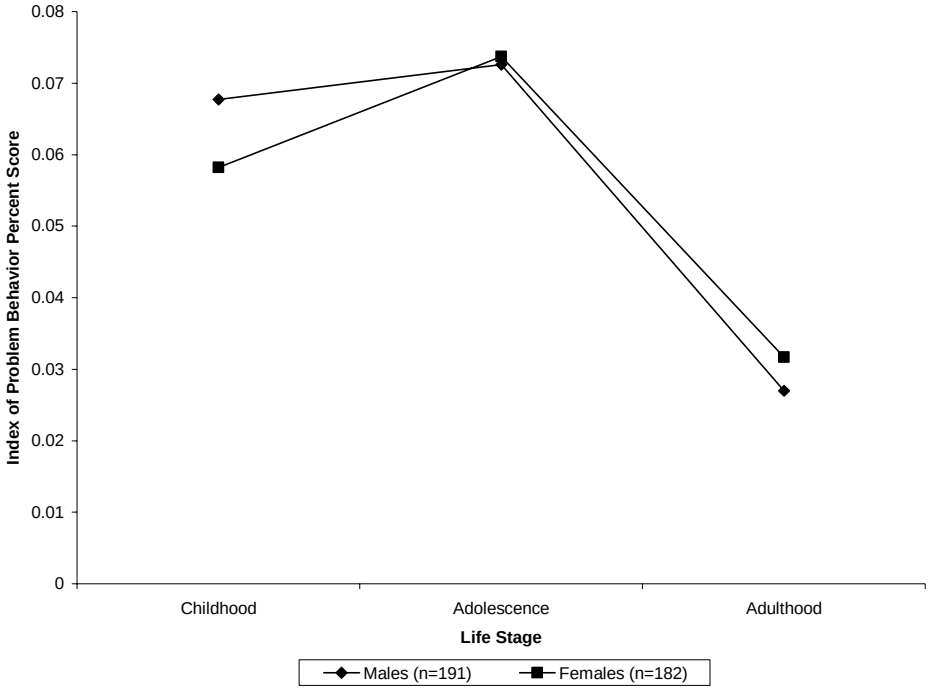

Figure 3.1. Mean level Problem Behavior Percent Scores for Male and Female Participants in the Texas Adoption Project from Childhood through Adulthood.

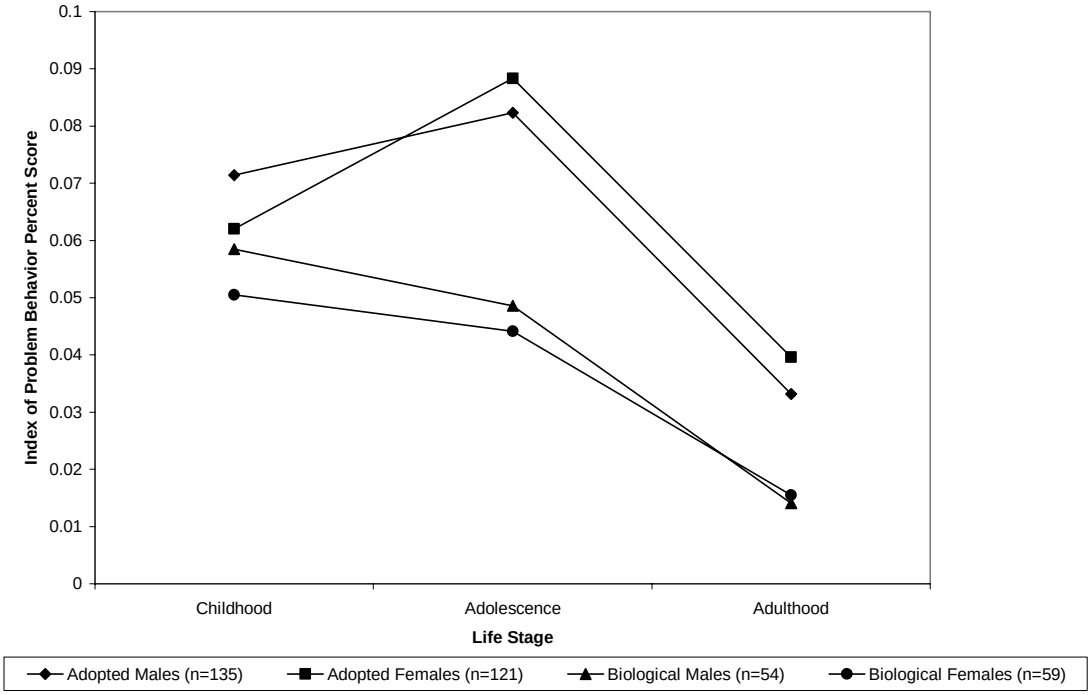

Figure 3.2. Mean Level Problem Behavior Percent Scores as a Function of Gender and Adoptive Status for the Participants in the Texas Adoption Project from Childhood through Adulthood.

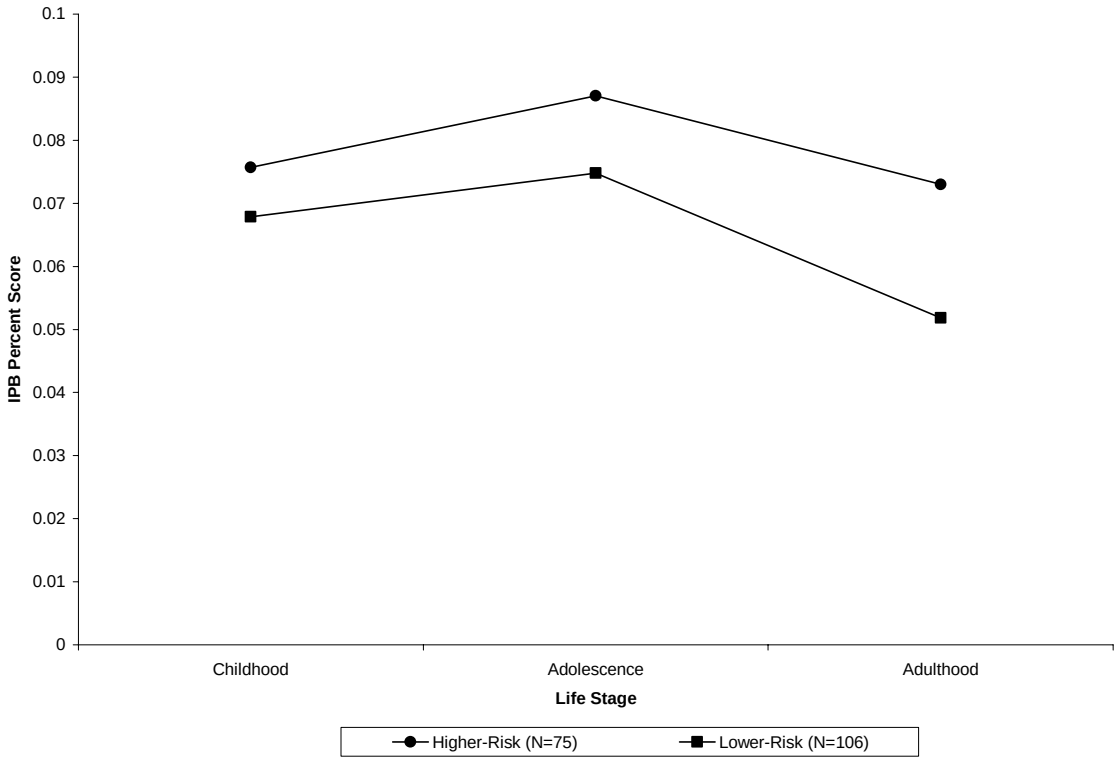

Figure 3.3. Mean Level Problem Behavior Percent Scores as a Function of Risk Status for the Adopted Sample from the Texas Adoption Project, from Childhood through Adulthood.

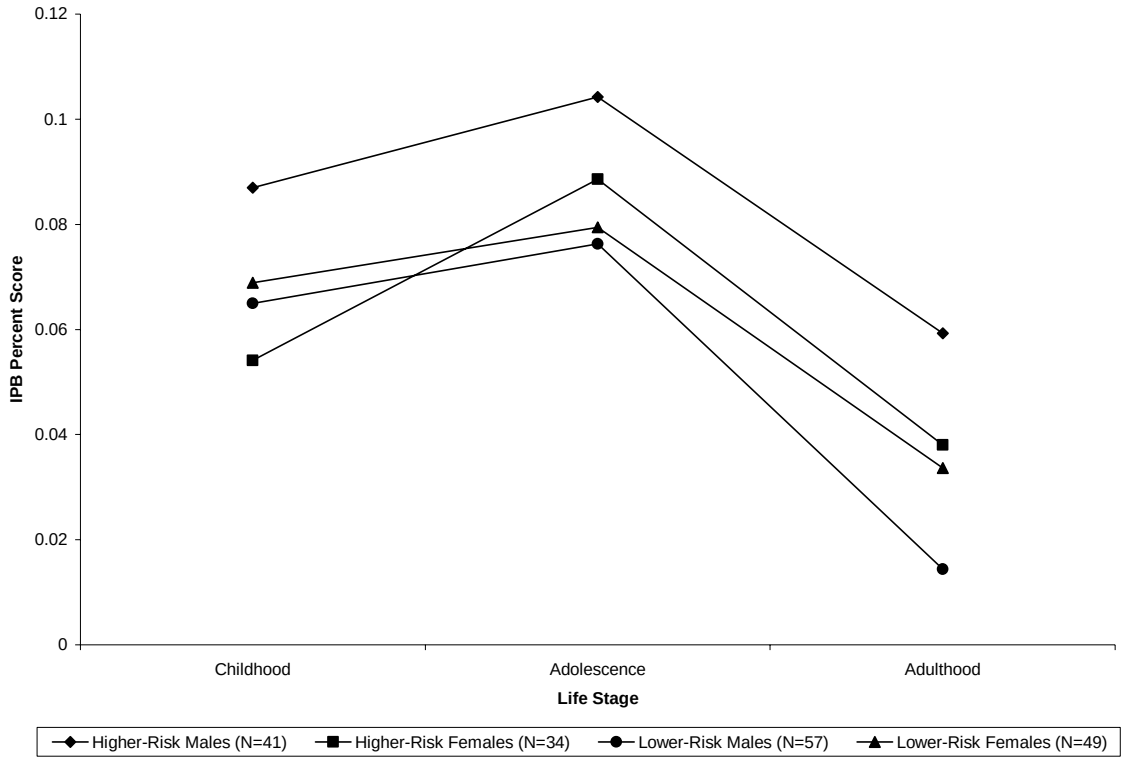

Figure 3.4. Mean Level Problem Behavior Percent Scores as a Function of Gender and Risk Status among the Adopted Sample from the Texas Adoption Project, from Childhood through Adulthood.

Table 3.2

Continuity of problem behaviors over time for the whole sample and the adopted and biological sub-samples of the Texas Adoption Project.

	Whole Sample		**Adoptees Only**		**Biological Only**	
	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank
Adolescent Rank	.32***		.31***		.22*	
Adulthood Rank	.23***	.44***	.26***	.41***	.04	.28**

Ns for whole sample correlations ranged from 375-381, for the adoptee only correlations Ns ranged from 255-258, and for the biological correlations Ns ranged from 113-115.
*p < .05, **p < .01, ***p < .001.

Table 3.3

Continuity of problem behaviors over time for the whole sample and male and female sub-samples of the Texas Adoption Project.

	Whole Sample		**Males Only**		**Females Only**	
	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank
Adolescent Rank	.32***		.36***		.22**	
Adulthood Rank	.23***	.44***	.29***	.35***	.13	.46***

Ns for whole sample correlations ranged from 375-381, for the male only correlations Ns ranged from 188-192, and for the female only correlations Ns ranged from 180-182.
*p < .05, **p < .01, ***p < .001.

Table 3.4

Continuity of problem behaviors over time, differences between sub-groups classified by sex and adoption status.

	Adopted Offspring				**Biological Offspring**			
	Males		**Females**		**Males**		**Females**	
	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank
Adolescent Rank	.37***		.24**		.30*		.14	
Adulthood Rank	.37***	.32***	.15	.50***	.02	.29*	.07	.27*

The range of the Ns for the correlations by group were as follows: 134-137, adopted males; 121-122 adopted females; 54-55 biological males; 59-60, biological females.
*p < .05, **p < .01, ***p < .001.

Table 3.5

Continuity of problem behaviors over time for the adopted sample and the Higher-Risk and Lower-Risk sub-samples from the Texas Adoption Project.

	Adoptees Only		**Higher-Risk Adoptees Only**		**Lower-Risk Adoptees Only**	
	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank
Adolescent Rank	.31***		.24*		.36***	
Adulthood Rank	.26***	.41***	.44**	.43***	.20*	.35***

Ns for the adoptee only correlations Ns ranged from 255-258, n=75 for the Higher-Risk correlations, and 104-105 for the Lower-Risk adoptee correlations.
*p < .05, **p < .01, ***p < .001.

Table 3.6

Continuity of problem behaviors over time, differences between sub-groups classified by sex and risk status.

	Higher-Risk Adoptees				**Lower-Risk Adoptees**			
	Males		**Females**		**Males**		**Females**	
	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank	Childhood Rank	Adolescent Rank
Adolescent Rank	.34*		.09		.31*		.40**	
Adulthood Rank	.67***	.50**	.09	.32	.25	.22	.17	.50***

The range of the Ns for the correlations by group were as follows: 41, High-Risk males; 34, High-Risk females; 56 Lower-Risk males; 48-49, Lower-Risk females.

*p < .05, **p < .01, ***p < .001.

Table 3.7

Intraclass correlations estimating the similarity on problem behavior scores between genetically related and genetically unrelated siblings.

	Genetically Related (27 sibships)	Genetically Unrelated (138 sibships)
IPB raw scores during		
Childhood	0.06	-0.02
Adolescence	0.14	-0.07
Adulthood	0.53***	-0.01

***p< .001

Table 3.8

Intraclass correlations estimating the similarity on the stability of problem behaviors throughout the life course between genetically related and genetically unrelated siblings.

	Genetically Related (27 sibships)	Genetically Unrelated (138 sibships)
IPB change scores from		
Childhood to Adolescence	0.09	-0.09
Adolescence to Adulthood	0.09	-0.04

***p< .001

Chapter Four: An Exploration of Individual and Family Characteristics as Potential Risk/Protective Factors for Problem Behavior Development among Higher-Risk and Lower-Risk Samples of Adoptees

In Chapter Two of this dissertation, it was found that adoptees' rates of problem behaviors were related to their mothers' scores on the MMPI Psychopathic Deviate (Pd) sub-scale during adolescence and adulthood. In Chapter Three I found that classifying the adoptees according to their relative risk toward developing problem behaviors helped to better isolate the stability of behavioral patterns for certain groups from childhood through adulthood. For example, it was found that while Higher-Risk males were moderately to highly stable from childhood through adulthood, Lower-Risk males only showed stable behavioral patterns from childhood to adolescence. Conversely, while Higher-Risk females showed little evidence of behavioral stability across the lifespan, Lower-Risk females were moderately stable from childhood to adolescence and from adolescence to adulthood. The purpose of the analyses presented in the present chapter was to explore individual and family characteristics that serve as risk or protective factors among Higher- and Lower-Risk adoptees.

Classifying adoptees according to their relative risk status allowed me to explore what factors differentiate Higher-Risk adoptees who did display high amounts of problem behavior from those who did not (i.e., predictability vs. resiliency), as well as addressing what factors differentiate Lower-Risk individuals who do display high levels of deviance from those who do not (i.e., vulnerability vs. predictability). Figure 1 illustrates the groups that were compared. Research into the "off-diagonal" outcomes, resilient and vulnerable, has become increasingly cited as an important area of study within the literature on risk and resilience (Kim-Cohen, Moffitt, Caspi, & Taylor, 2004).

Research on risk and resilience has typically focused on 1) identifying factors that are associated with an increase in the probability of negative outcomes (i.e., risk factors) and 2) identifying factors that promote positive developmental outcomes in the face of substantial risk for negative developmental outcomes (i.e., protective factors) (Luthar &

Cicchetti, 2000). While many studies have attempted to identify individual and environmental sources of risk (e.g., Garmezy, 1991, 1993; Gore & Eckenrode, 1996; Masten, Kandel, Mednick, Sorensen, Hutchings, Knop, Rosenberg, & Schulsinge, 1988; Werner, 1993), fewer studies have looked toward genetic factors as sources of risk. Of those that have considered genetic risk factors for problem behavior development (e.g., Jaffee, Caspi, Moffitt, Dodge, Rutter, Taylor, & Tully, 2005) it has been found that environmental factors appear to have stronger influences on individuals with high genetic risk than on individuals with low genetic risk. Jaffee et al. (2005) found that childhood maltreatment increased the probability of being diagnosed with conduct disorder by 2% for 5-year-old children who were at low genetic risk but increased the probability of being diagnosed by 24% among those with high genetic risk. Genetic risk in the Jaffee et al. study was defined by the diagnosis status of a co-twin. Specifically, those children who had a twin with conduct disorder were considered to be at high-risk for developing conduct disorder themselves. Jaffee el al. concluded that "prediction of behavioral pathology can attain greater accuracy if both pathogenic environments and genetic risk are ascertained."

Among the multitude of factors that have been found to influence positive outcomes among individuals at risk for future problem behaviors most can be classified into one of three types 1) *individual characteristics*, such as personality/temperament (Cote, Tremblay, Nagin, Zoccolillo, Vitaro, 2002; Ernst, 2004; Kim-Cohen et.al., 2004; Loukas, Krull, Chassin, & Carle, 2000; Zuckerman & Kuhlman, 2000) and IQ (Ernst, 2004; Masten, et al., 1988); 2) *family environment*, such as maternal warmth/hostility (Harold & Conger, 1997; Kim-Cohen, et al, 2004), and maternal emotional stability (Frye & Garber, 2005; Kim-Cohen, Moffitt, Taylor, Pawlby, & Caspi, 2005); and 3) *social support*, such as having a positive relationship with an adult, whether inside or outside the family (Garmezy, 1991, 1993; Gore et al, 1996; Werner, 1989).

The current investigation classified individuals as being at Higher-Risk and Lower-Risk for problem behavior development, according to their biological mothers' Pd

scale T-scores and explored a number of individual and family characteristics as potential protective factors for individuals who were at greater risk.

The first set of analyses present descriptive findings on the differences in individual, family, and social characteristics between four groups: Higher-Risk adoptees who displayed above average levels of problem behaviors, Higher-Risk adoptees who displayed below average levels of problem behaviors (Resilient adoptees), Lower-Risk adoptees who displayed above average levels of problem behaviors (Vulnerable adoptees), and Lower-Risk adoptees who displayed below average levels of problem behaviors.

Beyond Description to Potential Causation

In her 2005 paper on the interplay of genes and environment on the development of antisocial behavior, Moffitt pointed to the family as an important source of risk/protective factors because of the well established finding that 10 percent of families within any community are responsible for more than half of the crimes committed within that community (Farrington, Jolliffe, Loeber, Stouthamer-Lober, & Kalb, 2001; Rowe & Farrington, 1997). In this same article, Moffitt (2005) also outlined several methodological ways in which genetically informed designs can be used to assess the influence of the within-family environment on the development of externalizing, antisocial behaviors over time. The adoption design was among those that were pointed out as being strong, methodologically, because of the ability to disentangle the potential for genes to confound the influence that family environments may have on the development of problem behaviors. Moffitt asserted that when the adoptive family environment is found to influence the behaviors, over and above the influence of the biological parents, a true within family environmental effect can be confirmed.

A number of investigators have used such adoption designs to test theories of both genetic and environmental influence on problem behavior development. Mednick, et al. (1983), for example, used a Danish adopted sample to study the transmission of

criminality and found that biological fathers' criminal activity greatly predicted the likelihood of their adopted away son's being convicted of a felony crime. However, using the same sample of adoptees, VanDusen, Mednick, Gabrielli, and Hutchings (1983) showed that even after this genetic influence was taken into account the social class environment of the adopted family still had a direct influence on the adoptees' probability of criminal offending. Together, these findings support Moffitt's position that both genetics and the family environment are important in determining who goes on to develop externalizing, antisocial behaviors and who does not. Also, because the ability of genetically informed designs to isolate genetic contributions from environmental ones, conclusions about causation can be asserted better than from studies in which genetic and environmental sources are not isolated (i.e., traditional family studies that do not account for genetic overlap between parents and children, Moffitt, 2005).

Based on Moffitt's theory that genes and family environments are important sources of risk/protective factors in the development of problem behaviors and the findings from the risk and resilience literature that individual characteristics may serve as important risk/protective factors as well, the current investigation used a longitudinal adoption sample to assess the effects of individual characteristics and family environments[8] on the level of problem behaviors manifested in adoptees across three life stages—while controlling for possible confounding genetic effects. Two separate binary regressions were run to assess the influence of these factors on problem behaviors during childhood, adolescence, and adulthood for Higher-Risk and Lower-Risk adoptees. Because problem behaviors have often been found to be predicted by past behaviors, the individual characteristics tested in each of the regressions will be from the participants' previous life stage. For example, childhood behavior problems will be predicted by infant behaviors and characteristics, adolescent behaviors from both childhood and infant characteristics, and so on. As in the descriptive analyses, differences between those who

[8] Unfortunately, no direct measures of social support were available in the data. However, the adoptive parents' SES, adoptive mothers' IQs, and adoptive mothers' education variables may be seen as proxies for social support due to their high correlation with social support measures (Lu, 1995).

behaved predictably were compared to those who behaved in unpredicted ways (i.e., Resilient and Vulnerable adoptees).

Though these analyses are primarily exploratory, past research on the relationship between genes and environments lead to some predictions. Because antisocial personality disorder and other disorders associated with externalizing behaviors (such as conduct disorder and attention deficit hyperactivity disorder) have been found to be moderately heritable (American Psychiatric Association, 1994), once genetic factors were taken into consideration, I expected to find that adoptees' individual characteristics, more than adoptive family factors, would influence the behavioral development of individuals whose biological mothers showed varying degrees of psychopathic deviance. Also, because adoptive environments have been found to influence characteristics such as personality and intelligence (Loehlin, et al, 1981, 1982), I expected the adoptive family environmental factors, heretofore suggested as main effects variables, would interact with individuals' characteristics to influence behavioral outcomes,

METHOD

Subjects

As described in detail in previous Chapter Two, the Texas Adoption Project (TAP) is a longitudinal investigation into the lives of 300 Texas families who adopted at least one child from a particular Texas adoption agency. Data from TAP was collected at three time points covering childhood (average age 8), adolescence (average age 17), and adulthood (average age 30). The data used in this chapter includes only those from the adopted children for whom complete data was present (n=181) and included: interview data from the adoptive parents taken between the summer of 2000 and the spring of 2002; IQ and personality data from the birth mothers; and parent and self-report data from childhood, adolescence, and adulthood.

Measures

Grouping Variables

Each participant was grouped according to 1) relative risk toward developing problem behaviors and 2) whether they were considered to be higher or lower on the Index of Problem Behaviors (IPB) during each of the three life stages measured. The following section describes the grouping procedures:

Risk status. The Minnesota Multiphasic Personality Inventory (MMPI) was administered to the biological mothers by a staff clinical psychologist at the home/agency from which the participants were adopted, prior to the inception of the Texas Adoption Project. The MMPI is a highly valid and reliable measure of both personality and state of psychological functioning (Butcher, 1966). Of particular use for this measure of risk was the psychopathic deviancy (Pd) subscale, a 50-item scale primarily measuring social maladjustment and antisocial tendencies (Dahlstrom, et al., 1960). The average age of the biological mothers of the adoptees in this sample was approximately 19 years old. For adult females a T-score of 50 is average while a T-score of 70 (2 standard deviations above the mean) indicates an individual who is highly impulsive, displays severe mood swings, is generally resentful, and shows no regard for consequence or convention (Carson, 1969). However, the mean Pd T-score for females below 20 years of age is 59.52 (SD=11.07) (Swenson, 1970). A subject was considered Higher-Risk if their biological mother had an MMPI Pd T-score of 65 or higher. A T-score of 65 (1.5 standard deviations above the mean for women 20 and older and half a standard deviation above the mean for women under 20) was chosen as the cut point for the indicator of vulnerability because it is a clear indication of elevated tendencies toward deviant behavior, but is not so strict a cut-point as to limit the numbers of individuals with elevated scores.

Individuals whose birth mothers scored at or above 65 on this measure of psychopathic deviance received a "1" for this measure and were classified as "Higher-Risk", while those whose birth mothers had a Pd T-score of 64 or below this level received a "0," and were classified as "Lower-Risk." Seventy-five individuals, out of the

181 for whom complete biological mother data was available, were classified as Higher-Risk for developing problem behaviors according to this definition, the remaining 106 adoptees were classified as Lower-Risk.

Index of problem behaviors. As described in Chapter Two, typical behaviors throughout the life span were assessed during in-home interviews with the parents of the participants. Extensive notes were taken by the interviewers regarding each individual living in the home. Three independent raters then coded each participant's relevant information from the interview notebooks according to a checklist created for this investigation (see Appendix 2B), hereafter referred to as the Index of Problem Behaviors (IPB). Problem behavior scores were then computed for each of the life stages: childhood (age 4-12), adolescence (age 13-19), and adulthood (age 20 and up). The mean problem behavior scores were then computed and the mean score of the biological offspring was used as the reference point on which to judge whether individuals scored high or low (2.01 for childhood, 3.37 for adolescence, and 1.07 for adulthood). The mean IPB scores of the biological children of the adoptive parents in the Texas Adoption Project were used, rather than the mean or median score for the whole sample, because they were more representative of the national population than a sample comprised of 70% adoptive children (i.e., they are children who were born and raised by their biological parents). Therefore, the adopted children who had IPB scores that were above the biological children's mean score were considered "higher" scorers, while those who had scores below the biological children's mean score were considered "lower" scorers. Higher scorers comprised 43% of the adoptive sample in childhood, 54% in adolescence, and 35% in adulthood (compared to 24%, 30%, and 21% of the biological offspring that were considered higher scorers during the same life stages, respectively. The fact that 30% or less of the biological children scored above the mean is reflection of the highly positive skewness of the scores in the IPB measure).

A dichotomous variable was created indicating whether each individual was "higher"=1, or "lower"=0, for each of the three life stages.

Table 4.1 provides the number of adoptees that were classified into each of the groups. It should be noted that during childhood the mean biological IPB score was 2.01. In an attempt to make a clearer distinction between higher and lower scorers, anyone who scored below 1.96 was considered a lower scorer. Anyone who scored above 2.06 was considered a higher scorer. Because the range of the average score included the whole integer 2, and 2 was a common score in the childhood IPB scale, a number of subjects (60) were not included in the childhood analyses. This was not a problem during adolescence or adulthood because the biological mean scores fell in between integers.

Biological Mother Characteristics

Age. Because teen pregnancy has been found to be related to a number of factors that are also associated with problem behaviors, such as low SES, troubled family life, and academic failure (Holden et al., 1993) those birth mothers who were younger when giving their babies up for adoption may have also been more problematic. Because I wanted to control for the genetic effects of problem behavior development, in order to better isolate important environmental characteristics, I included age as a genetic control variable. The age of the birth mother was recorded upon entry into the home for unwed mothers. Among our sample of participants, the birth mothers' ages ranged from 13-38 years (mean= 19.5, SD= 3.63), among those with complete data the mean was 19.1 years (SD=3.55). This age is also within a few months of the age at which the birth mothers gave up their children for adoption and the age at which they took the tests described below, which is important to consider because teen females have higher mean scores than adult females, even in normative populations (Dahlstrom et al., 1960).

IQ. The IQ of the birth mothers was measured using the standardized Revised Beta Examination (Kellogg, et al., 1946). The Revised Beta is a valid measure of intelligence, and is correlated 0.92 with Wechsler IQ scores. This measure was also administered in the home for unwed mothers by a staff clinical psychologist. The birth mother Beta IQs were available for only 181 of our participants. IQs for these mothers

ranged from 70-124, or Defective to Superior (Kellogg et al., 1946). The mean IQ of the biological mothers in this sample was 108 (SD= 8.77), or in the Average range.

Index of psychosocial functioning. For this investigation, psychosocial functioning was assessed using the number of elevated MMPI T-scores for which an individual scored 70 or above (see Chapter Two). The number of elevated MMPI T-scores for all of the subscales, except for the masculinity/femininity subscale, was summed for a theoretical index score range of 0-8. For our sample of birth mothers, index scores on this measure of psychosocial functioning ranged from 0-6 (mean=0.507, SD= 1.12). Thus the birth mothers' scores on this measure of functioning were highly skewed in a positive direction[9], with approximately 50% showing no extreme scale scores and only 16% scoring 3 or more.

Family Characteristics

Adoptive parent's socio-economic status. SES scores were calculated in prior research from the Texas Adoption Project (Horn, et al, 1982) based on both fathers and mothers' education and fathers' occupation (see Chapter Two for a more complete description).

Adoptive mother's education. During the initial interview with TAP the highest level of education completed was reported on a six point scale (1= elementary school, 2= 1-3 years of high school, 3= 4 years of high school, 4= 1-3 years of college, 5= 4 years of college, 6= more than 4 years of college). The mean level of adoptive mother education was 3.49 (SD= 1.211), or some college.

Adoptive mother's IQ. As with the biological mothers, the adoptive mothers' IQs were assessed using the standardized Revised Beta Examination scores. The adoptive mothers' IQs ranged from 89-127, below average to superior. The mean adoptive mother IQ was 114.05 (SD= 7.07), or above average (Kellogg et al., 1946).

Adoptive mother's warmth. Maternal warmth was assessed using the Factor A scale taken from the Cattell 16 Personality Factor (16PF) self-rated questionnaire (Cattell,

[9] The skewness of the data and its implications are discussed more fully in Chapter Two.

Eber, & Tatsuoka, 1985). The adoptive mothers' responses to eight bipolar items (e.g., Cool, Aloof vs. Attentive to People; Precise, Objective vs. Softhearted, Casual; and Cold vs. Warmhearted) led to a scale score that fell between "1"(reserved) and "10" (warm) (mean= 5.64, SD= 1.832).

Adoptive mother's emotional stability. Maternal emotional stability was also assessed using a scale from the Cattell 16PF, Factor C. This scale was comprised of the adoptive mothers' responses to six bipolar items (e.g., Gets emotional when frustrated vs. Emotionally Stable; Easily perturbed vs. Calm; and Worrying vs. Unruffled) resulting in a scale score ranging from "1" (reactive) to "10" (stable). The mean scale score for maternal emotional stability was 6.34 (SD=1.732).

Adoptive mother's psychosocial functioning was measured in the same way as the psychological functioning of the birth mothers. The adoptive mothers' index scores were narrower in range than the birth mothers' score, they ranged from 0-5, and were even more dramatically skewed, with a mean of 0.197 (SD= 0.63), indicating that 80% of the birth mothers were relatively well-functioning at the time the MMPI was administered.

Number of siblings. The number of siblings residing in a household has been found to be associated with problem behavior development (Ma, 2001), with greater numbers being associated with more problem behaviors. The number of children in each household was reported by the adoptive parents at Time 2. The full sample sibship size ranged from 1-5 (mean= 2.50, SD=0.796).

Average sibling rank. Past research on problem behavior development has also found that the behavior problems of siblings are related to one another (Conger & Rueter, 1996; Rowe, Rodgers, & Meseck-Bushey, 1992). To ascertain whether the behavior of siblings influenced the development of individuals' problem behaviors among adoptive samples, each participant was ranked according to their IPB score (relative to all the other participants) during each of the three life stages. Rank order ranged from 1-100 (with 1 being the lowest percentile and 100 the highest or most deviant) and individuals with the same score during a particular life stage received the same rank for that stage. Lower rankings corresponded to less problem behaviors. For each participant with at least one

sibling, the average of all their siblings' ranks during childhood, adolescence, and adulthood were also calculated—by summing the individuals' sibling ranks and dividing by the number of siblings each participant had. For example, if a given participant had two siblings, one of whom had a childhood rank order of 54 the other 28, than that participant would have a childhood average sibling rank of 41. Then during adolescence this participant would have the average sibling rank that corresponded to the average of his/her two sibs during that life stage. Therefore, each participant that had at least one sibling had three average sibling rank values, one for each stage: childhood, adolescence, and adulthood. Participants who had no siblings were treated as having missing data for this variable. The mean average sibling rank during childhood was 48.75 (SD= 24.05), 48.30 (SD= 24.05) during adolescence, and 47.47 (SD= 26.11) during adulthood.

Individual differences

Parental reports of infant behavior were provided during an in-home interview during the third data collection phase of the Texas Adoption Project, and rated and scored on the IPB (see Chapter Two). In accordance with Thomas and Chess's (1977) conception of "easy" versus the "difficult" temperament, each participant was scored on regularity of sleep, general disposition, and level of anxiety and activity they displayed as infants and toddlers (age 0-3 years). The infant behavioral checklist was comprised of 9 items, most with 4 possible choices (1=rarely, 2=sometimes, 3=a lot of the time, 0=not indicated/missing) which were coded by three independent raters (see Chapter Two). Positive items were reverse scored. Possible scores ranged from 0-19, with higher scores indicating more problematic, or "difficult," infants (see Appendix 2B). Actual scores for the adoptive sample ranged from 0-13, with a mean score of 3.61 (SD=2.93). For some of the analyses individual item scores were used. For the logistic regression analyses, the infant scores were then transformed into z-scores to make interactions run more smoothly.

Childhood IQ was assessed by the Texas Adoption Project, during the first data collection phase, using an age appropriate Wechsler intelligence test—most often the

Wechsler Intelligence Scale for Children (WISC) (Wechsler, 1949)—which has outstanding reliability (split-half reliabilities 0.92-0.94 for the full-scale IQ) and validity (correlations range from .85 with the Stanford-Binet to .95 with the Revised Beta Examination) for assessing intellectual capacity (Wechsler, 1949). The adoptees from the Texas Adoption Project had a full-scale IQ range of 76 (Borderline Defective) to 145 (Very Superior). The mean IQ score of the adoptees was 111.43 (SD= 11.32), or Bright/Above Average (Wechsler, 1946).

Childhood and adolescent personality were rated by the adoptive mothers during the first and second data collection phases of the Texas Adoption Project. The measures included 24 bipolar items on which the adoptive mother indicated her perception of each child's placement on each bipolar personality dimension (Appendix 2A). Three scales—Extraversion, Emotional Stability, and Well-Socialized—were then constructed using factor analytic techniques (Loehlin, et al., 1981). Items for the Extraversion scale included: Warm-hearted, Happy-go-lucky, Socially bold, Restrained(-), and Critical(-); for the Well-Socialized scale: Conscientious, Controlled, Careless of social rules(-), Frivolous(-), Unresponsive to threats(-), Affected by feelings; and for the scale of Emotional Stability: Emotionally stable, Tense(-), Apprehensive(-), Unfrustrated, Complacent. Items were reversed in scoring as indicated above by the (-) (see Appendix A of Loehlin et al., 1981, for more information on item and scale scoring).

Analyses

First, a series of one-way Analyses of Variance (ANOVA) were run to estimate between-group differences on biological mother characteristics, within-family environmental factors, and individual characteristics for groups of adoptees that varied according to risk status (Higher or Lower) and the relative levels of problem behaviors they displayed (above average= Higher, below average= Lower) during childhood, adolescence, and adulthood. Post hoc Bonferonni tests of multiple comparisons were also used to identify which of the groups were statistically different from one another on each of the measures for which significant group differences were indicated. ANOVAs were

run, rather than MANOVAs, because of the small group Ns and because the analyses presented here were primarily for exploratory purposes.

Next, binary logistic regressions were used in order to assess potential individual and family factors that directly influenced the development of problem behaviors throughout the life course. Because the limited numbers of subjects that qualify as members of each group, multinomial logistic regressions could not be used. Instead, two separate binary regressions were run for each of the three life stages measured in this investigation: one for the Higher-Risk group and one for the Lower-Risk group. It should be noted that even the use of binary logistic regression on samples as small as those in these analyses may render unreliable estimates. However, given the exploratory spirit of this investigation, the use of the binary models best addresses the question of who develops higher or lower problem behaviors within each of the risk groups.

Within each model, lower versus higher scorers on the IPB were compared. To control for the influence of genetic factors that may influence problem behavior development among adoptees, the birth mothers characteristics were entered in the first block. Then, to test for shared family environmental effects, factors pertaining to the adoptive family environment were entered in the second block of the regression equations. Individual characteristics were entered in block three, to test their effects above and beyond those of the birth mother and family environmental characteristics. Finally, a couple of adoptive mother-child interaction terms were entered into the last block.

The coefficients presented in the tables are Betas (or log-odds) and can be difficult to interpret. Therefore, I have also presented a table with exponentiated Betas, or odds ratios, for the significant factors to aid interpretation. I also elucidate the meaning of the odds ratios for each of the significant effects in the text in the results section.

RESULTS

Though these analyses were exploratory in nature, results from the ANOVAs supported the prediction that individual differences would differentiate individuals who displayed high levels of problem behaviors across the life span. In childhood (Table 4.2) children with higher IQs were least likely to display above average amounts of problem behaviors, regardless of which risk group they were in. Children who displayed above average levels of behavior problems also appeared to have been poorer sleepers and did not like to cuddle during infancy. In addition, children who were at lower risk of developing problem behaviors but who turned out to display above average levels of behavior problems were generally rated as more difficult during infancy than all other groups, although they were not statistically different from the Higher-Risk, Higher Problem Behavior children. By definition, the birth mothers' psychosocial index score differentiated the Higher-Risk adoptees from the Lower-Risk adoptees. However, this birth mother characteristic did not differentiate those children who developed above average amounts of problem behaviors from those who developed below average levels. Finally, none of the eight family environmental factors differentiated between risk groups or problem behavior development levels.

Adolescent comparisons paint a similar picture (Table 4.3). Again, biological mothers' psychosocial index scores differentiated the Higher-Risk from the Lower-Risk groups but none of the groups differed by adoptive family characteristics. Also the groups were found to significantly differ from one another on a couple of key individual differences. First, childhood rank order was found to differentiate both by risk status and by problem behavior development. In general the adolescent Higher-Risk groups were ranked higher in childhood problem behaviors than the Lower-Risk groups. However, the Lower-Risk, Higher problem behavior adolescents were not found to differ significantly from the Higher-Risk, Lower Problem Behavior adolescents on childhood rank order. Second, the two "off diagonal" groups (i.e., the Resilient and the Vulnerable groups) differed from one another on their adoptive mothers' ratings of emotional stability

assessed during the adoptees childhood years. In other words, the Higher-Risk adolescents who *did not* engage in excessive externalizing behaviors had been rated by their adoptive mothers, during childhood, as being more emotionally stable than the Lower-Risk adoptees that *did* manifest above average levels of externalizing, antisocial types of behaviors during adolescence. A similar difference was observed for mothers' ratings of socialization, although this difference was not statistically significant.

Table 4.4 presents the ANOVA results comparing the four groups of adoptees during their adult years. Once again, the same pattern of group differences in birth mother psychosocial adjustment emerged and similar individual characteristics were found to differentiate the groups. As during childhood, significant between group differences were found for intelligence. This time, although the overall pattern of means was similar, only the Higher-Risk, Higher Problem Behavior adults were significantly lower in IQ than the Lower-Risk, Lower Problem Behavior adults. As was found during adolescence, previous rank order predicted group membership, and the same finding for mother-rated childhood emotional stability emerged between the Higher-Risk, Lower problem behavior and Lower-Risk, Higher problem behavior adults as was found during adolescence. In addition, adolescent rank differentiated the higher problem behavior adults from the lower problem behavior adults and mother ratings of socialization during adolescence differentiated the Higher-Risk, Higher Problem Behavior Adults from the Higher-Risk, Lower problem behavior adults. These final two results, together, suggest that problematic adolescents (i.e., those who are rated as not being well socialized and those who display relatively high levels of problem behaviors) become problematic adults.

During adulthood, one new finding was the ability for adoptive family factors to differentiate between groups. Specifically, adoptive mothers' IQ and psychosocial index scores were found to significantly differ between groups. Lower-Risk, Higher problem behavior adults tended to have smarter adoptive mothers than Higher-Risk, Lower problem behavior adults. Higher-Risk, Higher Problem Behavior adults tended to have adoptive mothers with more psychosocial problems than the Lower-Risk, Lower problem behavior adults.

While informative, ANOVAs only had the ability to describe what individual, biological mother, and family characteristics differed between the groups, not what factors might have been an influence on how the Higher-Risk and Lower-Risk adoptees developed over time. To explore questions of this nature more sophisticated statistical techniques were used.

Binary Logistic Regressions

Binary logistic regressions were run to explore the influence of individual and family level factors on the amount of problem behavior during childhood, adolescence, and adulthood. Biological mother characteristics were entered as the first block to control for the influence of the mothers' genes on problem behavior development, home environment characteristics were entered as block 2, individual characteristics as block three, and interaction terms as block 4. Because of the low N in many of the group comparisons (Ns equaled 25 and 27 for the Higher-Risk, Low and Higher-Risk, High groups, respectively, during childhood), binary regression models were run separately for the Higher-Risk and Lower-Risk groups, rather than using one multinomial regression model. This method allowed the questions of causal inference to be explored. Due to the sample sizes, however, care is advised when interpreting the outcome of the model coefficients because of the possibility of type I error.

It should also be noted that the R^2s presented at the bottom of each regression table are Cox & Snell R^2s, which some argue are not the same as those found in ordinary least squares (OLS) regressions (UCLA Academic Technology Services, 2006). Others (e.g., Wuensch, 2006), however, argue that Cox & Snell R^2 s can be interpreted in the same fashion (i.e., percent of the variance accounted for by the model). I have used the R^2 values as they are used in OLS regressions. However, due to the debate regarding their use, I did not use the R^2 values to estimate effect sizes as I did in Chapter Two. Readers are cautioned that the interpretations of the models presented may be debatable.

During childhood (Table 4.5), the model predicting higher vs. lower problem behaviors among the Higher-Risk children indicated that both family and individual

characteristics influenced the development of problem behaviors. Once the interaction between adoptive mother characteristics and the children's characteristics were entered into the model, no one specific factor remained significant. Although one should note the relatively large standard errors in the final model. The size of those standard errors, combined with the inconsistencies between the models with and without the interactions, raises doubt regarding the reliability of the solution in the final model. The model itself was significant and including all the factors and interactions accounted for 60% of the difference in problem behaviors between Higher-Risk, Higher-Problem Behavior children and Higher-Risk, Lower-Problem Behavior children. Although, due to the previously mentioned sample size issue, this finding too might be questionable.

The models predicting higher and lower problem behaviors among the Lower-Risk adoptees, during childhood are presented in Table 4.6. For the Lower-Risk adoptees the only significant predictor of childhood behavior classification was the infant Index of Problem Behavior z-score. Lower-Risk children who developed a higher number of problem behaviors were more problematic as infants than Lower-Risk children who developed lower amounts of behavioral problems. Specifically, for every additional point increase on the infant IPB score the odds of falling into the Higher-Problem Behavior group (vs. the Lower-Problem Behavior group) increased by a factor of 1.246 (Table 4.7). The infant score remained a significant predictor even after the interaction between adoptive mother and adopted children's characteristics were entered into the model. While the final model (like that for the Higher-Risk children) was significant, the amount of variance captured by the model distinguishing higher and lower problem behavior children for the Lower-Risk adoptees was only 21 percent—relatively small compared to the 60% that was accounted for by the same factors for the Higher-Risk group. Regardless, this model implies that among individuals who do not have biological mothers with strong indicators of defiant tendencies, having a difficult disposition as an infant may be a risk factor for developing problem behaviors during childhood.

During adolescence (Tables 4.8 and 4.9), the models for the Higher-Risk and Lower-Risk groups also differed from one another. For the Higher-Risk adolescents,

individual differences in childhood extraversion, socialization, and behavioral rank positively and significantly predicted being in the higher problem behavior category. Looking at the odds ratios presented in Table 4.7, a single percentage point increase in childhood rank order increased the odds of a Higher-Risk adolescent being in the Higher-Problem Behavior category by a factor of 1.051. A single point increase on the mother rated extraversion scale (during childhood) increased the odds that a Higher-Risk teenager would display above average levels of behavior problems by a factor of 1.201, and a single point increase in childhood socialization increased the odds of being in the Higher-Problem behavior group by a factor of 1.198.

As in the childhood model for Higher-Risk adoptees, the final model accounted for 40 percent of variance in problem behaviors between the Higher-Risk, Higher-Problem Behavior adolescents and the Higher-Risk, Lower-Problem Behavior adolescents. None of the individual or family factors measured here were found to predict higher verses lower problem behavior development among the Lower-Risk adolescent adoptees. Results from the adolescent models suggest that, for the Higher-Risk adolescent adoptees, previous indications of problematic behavior, extraversion, and being well-socialized as a child[10] may be risk factors for developing above average levels of problem behavior during adolescence.

Finally, the adulthood models revealed yet another picture. While there were still no significant environmental influences found in either of the full models (see Table 4.10 and 4.11), there were also no significant individual predictors of problem behavior development in adulthood. The only significant predictor in both of the models was birth mothers' psychosocial functioning. However, the influence of birth mother psychosocial functioning was in opposite directions and of very different magnitude between the Higher- and Lower-Risk groups. While the Higher-Risk adults were more likely to score

[10] Although the average age of the TAP participants was around eight-years-old when the adoptive mothers first rated them on their personality and general behavioral tendencies, some of the participants were adolescents at the time. However, most of the older participants were the biological children of the adoptive parents. So while a few of the adoptees may have been adolescents, most were children when this measure was taken.

in the high range of behavior problems when their biological mothers displayed more problems with their overall psychosocial functioning, the Lower-Risk adults were more likely to display higher amounts of problem behaviors when their biological mothers exhibited *fewer* problems with overall psychosocial adjustment. Specifically, for each elevated birth mother subscale, Higher-Risk adults odds of being in the Higher-Problem Behavior category increased by a factor of 4.535, while the Lower-Risk adults odds decreased by a factor of 0.011. This result was unexpected and will be explored in further detail in the discussion section.

Also, unlike the childhood and adolescent models, the amount of variance accounted for in both the Higher-Risk model and the Lower-Risk model was nearly identical, 49 percent in the case of the Higher-Risk adults, 47 percent for the Lower-Risk adults. However, the model was only significant for the Lower-Risk adults (most likely due to the smaller N in the Higher-Risk adult model). Results from the adulthood models suggest that once individuals reach full maturity their biological mothers' general psychosocial functioning may prevail in determining whether or not they go on to display above average levels of problem behaviors, but how her functioning affects individuals may first depend on her levels of deviant behavior.

DISCUSSION

The purpose of this investigation was to explore a unique data set, looking for clues as to what factors might potentially serve as risk or protective factors for individuals who have a genetic liability toward developing problem behaviors and to see if these same factors influence problem behavior development among individuals who are not at particularly high risk, genetically. Research presented in Chapter Two of this dissertation supported the conclusion that biological mothers who give up their offspring for adoption and who have elevated scores on the psychopathic deviate scale of the Minnesota Multiphasic Personality Inventory leave these offspring at risk for developing problem behaviors during childhood, adolescence, and up into middle adulthood.

According to this definition of risk, the current investigation explored the mean differences, via ANOVAs, between Higher-Risk adoptees whose development went as predicted and those who were resilient (i.e., Higher-Risk but displayed below average levels of problem behaviors) on several individual and family level characteristics. In addition, the same factors were investigated to see if they also differentiated individuals who were classified as Lower-Risk. In other words, were the same factors related to the development of predicted (i.e., lower) or unpredicted (i.e., higher) problem behaviors.

In an attempt to uncover some potentially causal factors, rather than simply descriptive differences, binary logistic regressions were then used to test for the significant main effects and interactions. Individual and family characteristics were investigated as potential risk or protective factors for the two risk groups. Though this investigation was exploratory in nature, past findings inspired a few predictions—namely that individual characteristics, more than family factors, would influence the behavioral development of individuals whose biological mothers showed varying degrees of psychopathic deviance prior to the adoptees' birth, and that family environmental factors, heretofore suggested as main effects variables, would instead have interactive effects, once genetic factors were taken into consideration.

Mean Difference

Results from the one-way ANOVAs supported the hypothesis that individual characteristics would differ between groups of adoptees classified according to risk status and behavioral outcome. The four groups of adoptees also showed significant differences on some key biological mother characteristics. During childhood, adolescence, and adulthood biological mothers' index of psychosocial functioning scores showed the same pattern across the four groups. Based on the means, it appeared as though the biological mothers of the Higher-Risk adoptees tended to have more psychological problems than psychopathic deviancy. From the definition of risk status, I expected most birth mothers of the Higher-Risk adoptees to have at least one elevated sub-scale (the Pd sub-scale);

however, the mean number of birth mothers' sub-scale elevations was around 2 for the Higher-Risk adoptees. While the Higher-Risk, Higher-Problem Behavior group did not significantly differ from the Higher-Risk, Lower-Problem Behavior group on the birth mothers' index scores, during adolescence and adulthood those who displayed fewer problem behaviors tended to have birth mothers with slightly less psychosocial problems. During childhood, however, the opposite trend was found with the birth mothers of the High-Risk, Low-Problem Behavior Adoptees showing signs of more maladjustment. While this difference was not statistically significant, this childhood finding is similar to earlier findings from the Texas Adoption Project (Loehlin et al., 1982) which found that the adoptees of more maladjusted mothers were rated by their adoptive mothers as better functioning than adopted siblings whose birth mothers showed fewer signs of maladjustment.

In addition, the ANOVA results showed that indicators of prior difficult behavior (i.e., infant IPB score, childhood rank, and/or adolescent rank) differentiated the groups by risk status and behavioral classification across the lifespan. For example, Lower Problem Behavior children had lower scores on the infant total scale score than did the Higher Problem Behavior children—with the Lower-Risk, High-Problem Behavior children tending to be rated as the most difficult during infancy. Additionally, adolescents and adults that manifested above-average levels of problem behaviors tended to be ranked higher during earlier life stages than the adolescents and adults who developed fewer problem behaviors, regardless of risk status. These findings support past work of Moffitt (1993) and others (e. g., Bennett, Lipman, Brown, Racino, Boyle, & Offord, 1999; Jones & Forehand, 2003; Reitz, Dekovic, & Meijor, 2005), who have found externalizing, antisocial behaviors to be relatively stable over time.

Particularly interesting was the finding that adoptees indications of childhood emotional stability (as rated by the adoptive mothers') tended to differ between the off diagonal groups. During both adolescence and adulthood the Higher-Risk, Lower-Problem Behavior (i.e., Resilient) adoptees and the Lower-Risk, Higher-Problem Behavior (i.e., Vulnerable) adoptees significantly differed by how their adoptive mothers

rated them on emotional stability during the initial TAP data collection phase. During both life stages the Resilient individuals were rated as more emotionally stable than the Vulnerable adoptees. These findings suggest that emotional stability during childhood may be a protective factor against problem behavior development, in the face of genetic risk toward deviant behaviors.

A number of investigations have found a link between conduct disorders or antisocial personality disorder and internalizing symptoms, especially among females (Patterson et al., 1991; Zoccolillo, 1992). Antisocial personality disorder has often been found to be co-morbid with other psychological disorders, including depression (Foley, et al., 2001). It is possible that the adolescents and adults who are at Lower-Risk, based on birth mother's Pd scores, became more vulnerable to problem behaviors because of either genetic or environmental factors that influenced their emotional well-being during childhood. For example, perhaps Lower-Risk adoptees were more affected by adoptive mothers' hostility than the Higher-Risk adoptees which served to reduce their emotional stability during childhood and increase their problem behaviors during adolescence and adulthood.

To test such hypotheses, one could use structural equation modeling, or another more sophisticated statistical procedure and estimate separate models for each the Higher and Lower-Risk samples. In this way one could identify whether certain family characteristics (e.g., maternal hostility) have the same influence in the two groups. This was attempted in the present investigation by running a series of binary logistic regressions.

Risk/Protective Factors

Higher-Risk Adoptees

Unfortunately, results from the binary logistic regression models were not as straightforward as those from the ANOVAs. Factors were found to have a significant influence on the classification of adoptees into higher or lower problem behavior groups

among both the Higher-Risk and Lower-Risk samples of adoptees. However, no one factor stood out as being a clear risk or protective factor across time for either group.

Among the adoptees classified as Higher-Risk, it seemed that the family environment, along with the sex of the adoptees, influenced whether the adoptees, as children, developed above average amounts of problem behaviors. Specifically, the environment created by smart and caring mothers with well-behaved siblings influenced the development of lower levels of problem behaviors among adoptees whose birth mothers showed strong indications of defiant tendencies. However, these effects were no longer significant once the interactions between adoptive mother and child characteristics were added to the model. This result is contrary to my hypothesis that adoptive family characteristics would interact with the adoptees' individual characteristics to influence problem behavior development. However, the relative effect size of adding the interactions, compared to adding both the family and individual characteristics, was small. In addition, the large standard errors in the model with the interactions and the inconsistencies between the models with and without the interactions raise some doubt regarding the accuracy of the results in the final (block four) model. It is possible that with larger samples the individual and environmental effects would have remained after the addition of the interaction terms.

During adolescence, the Higher-Risk adoptees levels of behavior problem development were found to be predicted by their childhood personality and behavior. While these findings were consistent with the ANOVA results, different personality indicators were found to be associated with problem behavior development in the Higher-Risk regression model. Here it was found that adoptive mothers' ratings of extraversion and socialization, not emotional stability, were related to problem behavior development. Extraversion has been found to have two main components, sociability and impulsivity (Eysenck & Eysenck, 1963), and impulsivity has been found to be strongly related to externalizing behaviors (Eisenberg, Sadovsky, Spinrad, Fabes, Losoya, Valiente, et al., 2005) and negatively related to adjustment (Eysenck & Eysenck, 1963). Therefore, it seems likely that Higher-Risk adoptees that were also high on impulsivity would be

likely to exhibit more problem behaviors in adolescence, due to an underlying temperamental/physiological propensity that keeps these individuals from assessing the consequences of their actions and delaying gratification.

Though the direction of the effect between socialization and odds of being in the Higher-Risk, Higher-Problem Behavior group may at first seem counterintuitive, previous findings from the Texas Adoption Project may help shed some light on why this result was found. In a study mentioned earlier, adoptees whose biological mothers were *more* maladjusted were rated as *better* socialized during childhood. However, these same adoptees were later rated by their adoptive mothers, during adolescence, as the least well-socialized (Loehlin et al., 1987). The findings here may be a reflection of these same tendencies. Consistent with earlier results, it appeared here that the adoptive family environment may have had an influence on problem behavior development among Higher-Risk adoptees during childhood, but that effect seems to have disappeared by adolescence. The results from the adult Higher-Risk sample also provide little evidence to suggest that the adoptive family environment has a lasting influence on the development of behavior problems among adopted individuals.

Lower-Risk Adoptees

For the Lower-Risk adoptees, problematic infants tended to be more problematic children. This result finds a good deal of support in the developmental literature, especially that of Thomas and Chess (e.g., Chess, 1967; Thomas & Chess, 1977) and Jerome Kagen and his colleagues. For example, Thomas, Chess, and Korn (1982) found that more difficult infants—characterized by biological irregularity, inadaptability to change, and strong emotional reactivity—displayed more externalizing behaviors both in the classroom and in the home. Likewise, Rimm-Kaufman and Kagan (2005) have found a moderate association between infant measures of reactivity to novel stimuli (high-reactivity vs. low-reactivity) to adjustment and behavior problems in kindergarten. While neither of the results mentioned above identified the infants according to level of risk, the Lower-Risk adoptees measured in this analyses fall closer to the average risk value of

random individuals in the population (with birth mothers Pd T-scores averaging 57.65, compared to the normative adolescent female mean of 59.52) than did the Higher-Risk group (whose birth mothers' average Pd T-score was 74.45). Therefore, the Lower-Risk adoptees problem behaviors may have more typical indicators of childhood behavior problem development, such as infant temperament, than the Higher-Risk adoptees.

None of the factors measured here, whether individual or family environmental, predicted whether Lower-Risk adolescent adoptees developed above average or below average behavior problems. This could be due to the fact that I was not able to capture the factors that do predict externalizing behaviors for this group in the measurements or that behavior problem development, to the extent that this group did develop behavior problems, was more normative for this group. Moffitt's (1993) results on problem behavior development suggest that within more normative samples acute increases of externalizing behaviors, even severe criminal delinquency, may be normative during adolescence. Therefore, there may not be any "typical" childhood or family indicators of adolescent behavior problems among non-High-Risk groups. Instead, other environmental factors that are unique to the individual (i.e., non-shared), such as having a caring relationship with an adult outside the home (Garmezy, 1991, 1993; Werner, 1993; Werner & Smith, 1992) or experiencing a trauma, such as the death of a close friend (Werner 1993), may act as protective (in the former case) or risk (in the latter case) factors toward problem behavior development among Lower-Risk groups.

In adulthood, the same factors did significantly predict the development of above average levels of problem behaviors for both the Higher-Risk and Lower-Risk adoptees. Specifically, the birth mothers' index of psychosocial functioning predicted behavioral outcomes in adulthood, positively for the Higher-Risk adoptees but negatively for the Lower-Risk adoptees. While the former result is consistent with the theory that there is an underlying genetic basis for problem behavior development, the latter, while also suggesting some sort of genetic hypothesis, seems counterintuitive. However, this finding bears some resemblance to the results mentioned earlier (Loehlin et al., 1982) regarding the shift in maternal rating of adoptees with more maladjusted birth mothers. Although

this particular finding reversed by adolescence, when the adoptive sibling with the most maladjusted birth mother displayed more adjustment problems, perhaps for Lower-Risk group some sort of negative relationship between more biological mother maladjustment and less adoptee maladjustment has continued. In other words, perhaps the Lower-Risk adoptees who have birth mothers with more generalized psychological maladaptation continue to be among the least problematic throughout the life span. However, because most adolescents increased on the amount of problem behaviors during adolescence, the relationship between birth mothers' psychological maladjustment and the Lower-Risk adoptees problem behaviors could not be detected until after the adolescent peak subsided. In any case, it is possible that shared environmental factors not measured here, or non-shared environmental factors may also be involved. Further research using genetically informed designs that follow individuals into adulthood may help isolate other aspects of the environment which may be influencing the development of problem behaviors. Twin methods may be helpful in investigating the effects of the non-shared environment on problem behavior outcomes. Specifically, by looking at the differences in behaviors between MZ twins the influence of non-shared environmental factors can be assessed.

The finding that birth mothers' general psychosocial functioning had opposite effects on the adoptees with Higher and Lower-risk might conceivably reflect the method used to split the sample. Any time samples are chosen by an extreme score on a measure—such as the Higher-Risk sample being selected based on a Pd T-score of 65 or higher—the sample is susceptible to restriction of range on other, correlated factors. A post-hoc set of correlations between birth mothers' Pd T-scores and their scores on the general index of psychosocial functioning (i.e., summation of elevated MMPI subscales) revealed that the two measures were moderately strongly correlated ($r= 0.48$, $p< .001$) for the Higher-Risk adoptees, but less correlated for the Lower-Risk adoptees ($r= 0.29$, $p< .05$). This might result in more restriction of range for mothers' psychopathology in the Higher-Risk group, but seems unlikely to have reversed the direction of the relationship altogether.

Because of the nature of the sample used to investigate the question of problem behavior development among two groups of adoptees who differed in the amount of relative risk they possessed, this investigation was done in an exploratory spirit. Cutting an already small sample into smaller groups did not enable me to fully test the models presented here. In addition, small samples can present problems with the reliability of the estimation of effects when using logistic regression, therefore, making the conclusion tenuous that shared environmental factors have no effect. I have appended a correlation matrix (Appendix 4A) for anyone interested in pursuing alternative interpretations of the models presented in this chapter.

Some readers may also wonder if the insignificant family influences were the result of adding genetic controls into the model first and not just a sample artifact. Therefore, I have conducted a series of supplemental analyses where I do not include the birth mothers' characteristics into the models first. Specifically, the family factors were entered in the first block, the adoptees' characteristics in block two, and the adoptive mother, adoptive child interactions were entered into the third block. No birth mother characteristics were specified in the model. Comparing the outcomes of the two sets of models, those with and without the birth mothers' characteristics, allowed me to test whether the shared-family factors have emerge as significant predictors of behavior problem development in the absence of genetic controls. In addition, if significant family factors were to emerge, I would be more able to draw conclusions about the interaction between genes and the environment.

The results of these models are presented in the Appendix 4B through 4G, and only partially support the idea that without genetic controls common family factors would be significant indicators. For Higher-Risk children (Appendix 4B) and Lower-Risk adults (Appendix 4G) some of the shared family characteristics emerged as significant predictors of Higher-Problem Behaviors versus Lower-Problem Behaviors. For the other four models (Lower-Risk children, Higher-and Lower-Risk adolescents, and Higher-Risk adults) the results were very similar with and without the birth mothers characteristics.

The major conclusion regarding the limited ability of the shared family factors measured here to influence problem behavior development among adoptees remains supported.

Further investigation into the development of problem behaviors, across the lifespan, using large genetically informed samples is needed in order to tease apart the influence of shared and non-shared environmental factors on groups who differ in the amount of genetic risk they face. The findings presented here may help to guide future research by providing potential within-family characteristics to investigate, such as maternal intelligence and sibling behaviors, as well as an alternate method of identifying resilient and vulnerable individuals who vary in the amount of genetic risk for problem behaviors.

Figure 4.1. Illustration of groups being compared in Chapter 4 analyses.

Adoptees' Classification according to BM MMPI Pd T-score	Index of Problem Behavior Scores	
	Above Average	Below Average
Higher-Risk (>65)	predicted	**Resilient**
Lower-Risk (<65)	**Vulnerable**	Predicted

Table 4.1

Frequency distribution of individuals in the four groups, classified according to risk status and behavioral category during childhood, adolescence, and adulthood.

	Higher-Risk Adoptees (N=75)		**Lower-Risk Adoptees (N=106)**	
	Higher problem behavior	**Lower problem behavior**	**Higher problem behavior**	**Lower problem behavior**
Childhood	**27**	**25**	**29**	**48**
Adolescence	**46**	**29**	**45**	**57**
Adulthood	**33**	**42**	**29**	**75**

Note: Numbers do not add up to totals, particularly during childhood, because some adoptees scored at the biological sample mean for that age group.

Table 4.2

Mean Differences in Biological Mother Characteristics, Family Environment, and Individual Characteristics by Risk Status and Behavioral Category, ***during Childhood****.*

	Group Means (Std. Error)				
	Higher-Risk, Hi PB (N=27)	**Higher-Risk, Lo PB (N=25)**	**Lower-Risk, Hi PB (N=29)**	**Lower-Risk, Lo PB (N=48)**	**F Statistics**
Biological Mother Characteristics					
Age at birth of Ss	19.67 (1.00)	18.76 (.487)	18.79 (.477)	19.60 (.331)	0.740
Beta IQ	105.52 (1.78)	110.13 (1.57)	109.46 (1.47)	106.37 (1.64)	1.657
Psychosocial index Score	**1.96 (.28)**[a,c]	**2.28 (1.7)**[b,d]	**0.42 (.14)**[a,b]	**0.41 (.12)**[c,d]	**21.951*** **
Family Environment					
SES	168.44 (4.74)	169.16 (4.86)	165.03 (4.20)	167.04 (3.50)	0.159
AM Beta IQ	111.38 (1.76)	114.32 (1.10)	115.21 (1.51)	114.62 (1.05)	1.424
AM Education	5.44 (.229)	5.32 (0.25)	5.48 (.208)	5.33 (.177)	0.140
AM warmth	5.50 (.401)	6.12 (.452)	5.55 (.342)	5.39 (1.41)	0.899
AM emotional stb.	5.62 (.364)	6.08 (.364)	6.48 (.320)	6.57 (1.85)	1.787
AM Psychosocial Index score	0.630 (.245)	0.20 (0.10)	0.10 (.076)	0.23 (.116)	2.241
# of siblings	2.30 (.158)	2.32 (.802)	2.28 (.156)	2.31 (.108)	0.018
Siblings' ave. child IPB rank	41.81 (4.13)	46.70 (5.75)	47.73 (4.99)	45.63 (3.91)	0.260
Individual Characteristics					
Sex	0.30 (.090)	0.64 (.098)	0.41 (.044)	0.50 (.073)	2.286
Wechsler IQ	**106.6 (2.4)**[a,d]	**115.5 (2.3)**[a,b]	**109.4 (2.1)**[b,c]	**114.3 (1.8)**[c,d]	**3.666***
Type of sleeper	0.78 (.202)	0.32 (.095)	0.79 (.201)	0.29 (.084)	**3.750***
Freq. of crying	0.19 (.120)	0.16 (.125)	0.59 (.202)	0.23 (.091)	2.020
Liked to be cuddled (r)	1.26 (.217)	0.80 (.191)	1.55 (.190)	0.92 (.151)	**3.203***
Generally happy (r)	0.41 (.162)	0.24 (.133)	0.55 (.145)	0.35 (.105)	0.813
Shy w/ strangers	0.26 (.147)	0.24 (.133)	0.17 (.087)	0.38 (.128)	0.494
Anxious/nervous	0.07 (.074)	0.04 (.040	0.00 (.000)	0.15 (.079)	0.962
Freq. of tantrums	0.22 (.154)	0.12 (.120)	0.17 (.122)	0.00 (.000)	1.153
Activity level	1.44 (.347)	0.84 (.293)	1.21 (.303)	0.73 (.192)	1.519
Total infant scale score	4.63 (.706)	**2.76 (.494)**[a]	**5.03 (.502)**[a, b]	**3.04 (.367)**[b]	**4.859****

Note: Groups that share superscripts on an item/measure are statistically different from one another at the p< .05 level. AM= adoptive mother, IPB= Index of Problem Behavior. Ns do not add up to the total adoptive sample size of 181 because of 60 of the adoptees childhood IPB scores were equal to the biological children's average score.

Table 4.3

Mean Differences in Biological Mother Characteristics, Family Environment, and Individual Characteristics by Risk Status and Behavioral Category, ***during Adolescence****.*

	Group Means (Std. Error)				
	Higher-Risk, Hi PB (N=46)	**Higher-Risk, Lo PB (N=29)**	**Lower-Risk, Hi PB (N=48)**	**Lower-Risk, Lo PB (N=57)**	**F Statistics**
Biological Mother Characteristics					
Age at birth of Ss	19.57 (.643)	19.24 (.739)	18.79 (.446)	19.81 (.382)	0.773
Beta IQ	108.33 (1.32)	108.62 (1.20)	108.62 (1.48)	107.94 (1.29)	0.059
Psychosocial index Score	**2.09 (.232)[a,c]**	**1.86 (.316)[b,d]**	**0.35 (.091)[a,b]**	**0.49 (.120)[c,d]**	**24.851*** **
Family Environment					
SES	164.85 (3.52)	172.90 (4.66)	173.33 (2.76)	165.72 (3.29)	1.686
AM Beta IQ	112.02(1.25)	113.52 (1.18)	115.88 (1.45)	113.69 (.973)	2.034
AM Education	5.33 (.189)	5.52 (.236)	5.69 (.171)	5.42 (.162)	0.738
AM warmth	5.49 (.303)	5.82 (.443)	5.29 (.238)	5.47 (.199)	0.496
AM emotional stb.	5.89 (.264)	6.64 (.338)	6.48 (.236)	6.45 (.236)	1.484
AM Psychosocial Index score	0.43 (.154)	0.17 (.100)	0.08 (.050)	0.19 (.098)	1.993
# of siblings	2.43 (.119)	2.34 (.151)	2.46 (.849)	2.26 (.095)	0.654
Siblings' ave. child IPB rank	50.48 (3.37)	43.42 (5.01)	47.90 (3.93)	47.75 (3.49)	0.442
Siblings' ave. teen IPB rank	47.03 (3.81)	45.53 (4.91)	43.30 (4.05)	47.99 (3.17)	0.310
Individual Characteristics					
Sex	0.41 (.073)	0.52 (.094)	0.44 (.072)	.49 (.067)	0.364
Wechsler IQ	108.69 (1.78)	112.43 (2.25)	111.43 (1.59)	113.76 (1.52)	1.683
Total infant scale score	3.93 (.479)	3.79 (.598)	4.02 (.372)	3.49 (.390)	0.323
Extraversion (T1)	50.25 (1.01)	48.04 (1.65)	48.11 (1.24)	47.65 (1.01)	1.055
Well-Socialized (T1)	32.61 (1.19)	33.58 (1.54)	30.25 (.882)	32.83 (.833)	1.754
Emotional Stability (T1)	47.43 (.936)	**50.41 (1.10)[a]**	**46.61 (.877)[a]**	48.05 (.647)	**2.697***
Childhood Rank	**50.25 (1.01)[a]**	48.04 (1.65)	**48.11 (1.24)[b]**	**47.65 (1.0)[a,b]**	**4.917****

Note: Groups that share superscripts on an item/measure are statistically different from one another at the p< .05 level. AM= adoptive mother, IPB= Index of Problem Behavior.

Table 4.4

Mean Differences in Biological Mother Characteristics, Family Environment, and Individual Characteristics by Risk Status and Behavioral Category, ***during Adulthood****.*

	Group Means (Std. Error)				
	Higher-Risk, Hi PB (N=33)	**Higher-Risk, Lo PB (N=42)**	**Lower-Risk, Hi PB (N=29)**	**Lower-Risk, Lo PB (N=75)**	**F Statistics**
Biological Mother Characteristics					
Age at birth of Ss	19.76 (.897)	19.19 (.508)	18.62 (.582)	19.61 (.341)	0.712
Beta IQ	108.50 (1.22)	108.40 (1.35)	106.00 (2.11)	109.12 (1.08)	0.811
Psychosocial index Score	**2.39 (.271)[a,c]**	**1.69 (.249)[b,d]**	**0.28 (.121)[a,b]**	**0.49 (.844)[c,d]**	**27.407*** **
Family Environment					
SES	166.79 (4.35)	168.88 (3.78)	170.97(3.88)	168.84 (2.70)	0.921
AM Beta IQ	113.03(1.38)	**112.2 (1.18)[a]**	113.6 (.904)	**117.3 (1.26)[a]**	**2.769***
AM Education	5.33 (.233)	5.45 (.190)	5.76 (.231)	5.47 (.139)	0.649
AM warmth	5.42 (.337)	5.78 (.366)	4.97 (.312)	5.58 (.173)	1.199
AM emotional stb.	5.94 (.325)	6.38 (.277)	6.69 (.314)	6.36 (.198)	0.980
AM Psychosocial Index score	**0.58 (.209)[a]**	0.14 (.064)	0.21 (.104)	**0.12 (.071)[a]**	**3.361***
# of siblings	2.42 (.151)	2.38 (.118)	2.38 (.144)	2.35 (.092)	0.074
Siblings' ave. child IPB rank	48.65 (4.12)	46.91 (3.98)	42.23 (4.89)	49.92 (3.09)	0.650
Siblings' ave. teen IPB rank	46.35 (4.89)	46.50 (3.76)	42.99 (5.41)	47.22 (2.85)	0.186
Siblings' ave. adult IPB rank	52.09 (4.96)	45.30 (3.90)	43.71 (5.45)	45.39 (3.30)	0.602
Individual Characteristics					
Sex	0.36 (.085)	0.52 (.078)	0.55 (.094)	.43 (.057)	1.075
Wechsler IQ	**107.0 (2.28)[a]**	112.54 (1.68)	108.41(2.06)	**114.3 (1.27)[a]**	**4.014****
Total infant scale score	4.09 (.655)	3.71 (.425)	4.24 (.522)	3.53 (.321)	0.527
Extraversion (T1)	50.56 (1.08)	48.46 (1.34)	46.41 (1.87)	48.32 (.827)	1.458
Well-Socialized (T1)	30.91 (1.54)	34.62 (1.10)	30.04 (1.25)	32.21 (.708)	**2.910***
Emotional Stability (T1)	47.03 (1.21)	**49.82 (.850)[a]**	**45.22 (1.00)[a]**	48.24 (.613)	**4.000****
Extraversion (T2)	43.43 (1.73)	43.37 (2.00)	43.33 (1.87)	45.44 (.908)	0.659
Well-Socialized (T2)	**26.78 (1.99)[a]**	**33.71 (1.79)[a]**	30.88 (1.92)	32.00 (.942)	**3.250***
Emotional Stability (T2)	45.17 (1.35)	46.96 (1.34)	44.65 (1.58)	47.33 (.732)	1.245
Childhood Rank	**68.47(4.35)[a,b]**	**44.09 (4.47)[a]**	60.23 (5.53)	**48.71 (2.88)[b]**	**6.571*****
Adolescent Rank	**70.5 (4.97)[a,b]**	**52.1 (3.96)[b,c]**	**70.6 (4.78)[c,d]**	**45.9 (3.15)[a,d]**	**9.856*****

Note: Groups that share subscripts on an item/measure are statistically different from one another at the p< .05 level. AM= adoptive mother, IPB= Index of Problem Behavior.

Table 4.5

Childhood *Binary Logistic Regression Model predicting High or Low Index of problem Behavior Scores among individuals who were at* ***Higher-Risk*** *toward developing behavior problems.*

	Block 1 ***B (S.E.)***	***Block 2*** ***B (S.E.)***	***Block 3*** ***B (S.E.)***	***Block 4*** ***B (S.E.)***
Biological Mother Characteristics				
IQ	-0.07 (.041)	-0.09 (.050)	-0.16 (.085)	-0.58 (.383)
Age at birth of child	0.05 (.078)	0.02 (.121)	-0.03 (.169)	-0.51 (.471)
Psychosocial Profile Score	-0.07 (.194)	-0.16 (.281)	0.02 (.486)	-0.53 (.787)
Adoptive Family Characteristics				
SES		-0.01 (.038)	-0.10 (.071)	-0.48 (0.321)
AM education		0.76 (.755)	2.88 (1.59)	13.02 (8.66)
AM IQ		-0.14 (.081)	**-0.25* (.125)**	-0.72 (.470)
AM warmth		-0.41 (.257)	**-0.93* (.465)**	-3.48 (2.15)
AM emotional stability		-0.22 (.288)	-0.27 (.460)	-1.23 (1.09)
AM psychosocial profile score		1.19 (.866)	-0.03 (1.40)	-2.57 (2.25)
# of sibs		**1.16* (.590)**	**2.77* (1.32)**	10.59 (6.99)
Mean sib IPB rank		-0.03 (.020)	**-0.12* (.053)**	-0.58 (.386)
Individual Characteristics				
Sex			**-5.23* (2.381)**	-21.23 (13.5)
IQ score			-0.15 (.079)	-0.54 (.366)
Infant IPB score			0.23 (.712)	-0.43 (.472)
Interactions				
AM warmth X Infant IPB score				-3.36 (2.40)
AM IQ X Child IQ				3.45 (3.39)
Constant	6.96 (4.64)	25.24* (12.22)	75.30* (30.89)	284.40 (177.2)
Chi-square	4.348	18.569	**36.35****	**42.37*****
R^2	0.09	0.33	0.55	0.60

Note: AM= adoptive mother, IPB= Index of Problem Behavior ratings.

***p< .05, **p< .01,**

N=46

Table 4.6

Childhood *Binary Logistic Regression Model prediction High or Low Index of problem Behavior Scores among individuals who were at* ***Lower-Risk*** *toward developing behavior problems.*

	Block 1 ***B (S.E.)***	***Block 2*** ***B (S.E.)***	***Block 3*** ***B (S.E.)***	***Block 4*** ***B (S.E.)***
Biological Mother Characteristics				
IQ	-0.02 (.021)	-0.02 (.023)	-0.01 (.027)	0.00 (.028)
Age at birth of child	0.02 (.055)	-0.02 (.057)	0.03 (.062)	0.03 (.062)
Psychosocial Profile Score	0.02 (.131)	-0.04 (.143)	-0.04 (.160)	-0.09 (.167)
Adoptive Family Characteristics				
SES		-0.02 (.016)	-0.01 (.017)	-0.01 (.017)
AM education		0.52 (.320)	0.30 (.349)	0.31 (.351)
AM IQ		-0.02 (.029)	-0.02 (.031)	-0.01 (.032)
AM warmth		-0.05 (.123)	0.06 (.133)	0.10 (.139)
AM emotional stability		-0.09 (.115)	-0.04 (.125)	-0.04 (.126)
AM psychosocial		0.17 (.242)	0.10 (.268)	0.13 (.269)
profile score		0.18 (.270)	0.25 (.308)	0.17 (310)
# of sibs				
Mean sib IPB rank		-0.01 (.008)	-0.01 (.009)	-0.01 (.009)
Individual Characteristics				
Sex			-0.80 (.442)	-0.76 (.449)
IQ score			-0.05 (.020)	-0.05 (.021)
Infant IPB score			**0.23** (.083)**	**0.22* (.086)**
Interactions				
AM warmth X Infant Score				-0.31 (240)
AM IQ X Childhood IQ				0.12 (.227)
Constant	1.31 (2.575)	6.14 (4.365)	6.40 (5.304)	5.97 (5.362)
Chi-square	0.980	7.010	**24.86***	**26.987***
R^2	0.01	0.06	0.19	0.21

Note: AM= adoptive mother, IPB= Index of Problem Behavior ratings. N= 105.

***p< .05, **p< .01**

Table 4.7

Odds ratios for significant effects from models 4.5-4.6 and 4.8-4.11 (Block 4 full models only).

	Higher-Risk Adoptees	*Lower-Risk Adoptees*
Childhood		
Infant IPB score	.650	1.246*
Adolescence		
Childhood rank order	1.051*	1.018
Childhood Extraversion	1.201*	0.994
Childhood Socialization	1.198*	0.972
Adulthood		
BM general psychosocial functioning	4.535*	0.011*

Note: IPB= Index of Problem Behavior, BM= biological mother.
Group Ns range from 42-62 for the Higher-Risk group and 60-105 for the Lower-Risk group.
*p<.05.

Table 4.8

Adolescent *binary logistic regression model predicting High or Low Index of problem Behavior Scores among individuals who were* ***Higher-Risk*** *toward developing behavior problems.*

	Block 1 ***B (S.E.)***	***Block 2*** ***B (S.E.)***	***Block 3*** ***B (S.E.)***	***Block 4*** ***B (S.E.)***
Biological Mother Characteristics				
IQ	0.00 (.033)	0.02 (.039)	0.04 (.069)	0.05 (.075)
Age at birth of child	0.01 (.060)	0.02 (.069)	-0.05 (.101)	-0.03 (.109)
Psychosocial Profile Score	0.12 (.165)	0.02 (.198)	0.33 (.285)	0.33 (.328)
Adoptive Family Characteristics				
SES		-0.02 (.027)	0.01 (.039)	0.03 (.044)
AM education		0.27 (.502)	-0.41 (.701)	-0.86 (.812)
AM IQ		-0.01 (.050)	-0.01 (.084)	-0.05 (.102)
AM warmth		-0.06 (.149)	-0.07 (.199)	-2.67 (.258)
AM emotional stability		-0.34 (.190)	-0.45 (.267)	-0.50 (.291)
AM psychosocial		0.50 (.466)	0.30 (.580)	0.04 (.668)
profile score		0.41 (.392)	0.73 (.547)	0.86 (.608)
# of sibs				
Mean sib IPB rank		0.01 (.013)	0.02 (.018)	0.02 (.019)
Individual Characteristics				
Sex			-0.51 (.959)	-0.61 (1.09)
IQ score			0.02 (.039)	0.04 (.047)
Infant z-score			-0.09 (.159)	-0.12 (.169)
Child rank			**0.04* (.018)**	**0.05* (.021)**
Extraversion (1)			**0.16* (.075)**	**0.18* (.082)**
Well-socialized (1)			0.15 (.081)	**0.18* (.084)**
Emotional Stability (1)			-0.21 (.127)	-0.51 (.332)
Interactions				
AM IQ X Child IQ				1.11 (.852)
AM ES X Child ES				0.05 (.050)
Constant	0.10 (3.76)	1.66 (4.78)	-7.78 (13.23)	5.89 (18.98)
Chi-square	0.59	9.96	28.38	**32.36***
R^2	0.01	0.15	0.37	0.41

Note: AM= adoptive mother, Ss=participant, IPB= Index of Problem Behavior ratings, ES= emotional stability. N=62

***p< .05, **p< .01**

Table 4.9

Adolescent *binary logistic regression model predicting High or Low Index of problem Behavior Scores among individuals who were at* ***Lower-Risk*** *toward developing behavior problems.*

	Block 1 ***B (S.E.)***	***Block 2*** ***B (S.E.)***	***Block 3*** ***B (S.E.)***	***Block 4*** ***B (S.E.)***
Biological Mother Characteristics				
IQ	0.00 (.027)	-0.01 (.029)	-0.01 (.034)	-0.01 (.035)
Age at birth of child	-0.09 (.078)	-0.12 (.085)	-0.15 (.096)	-0.16 (.097)
Psychosocial Profile Score	-0.14 (.288)	0.03 (.317)	0.00 (.386)	0.04 (.396)
Adoptive Family Characteristics				
SES		0.01 (.017)	0.04 (.021)	0.03 (.022)
AM education		-0.11 (.311)	-0.45 (.363)	-0.41 (.376)
AM IQ		0.02 (.032)	0.02 (.035)	0.02 (.036)
AM warmth		-0.12 (.159)	-0.11 (.175)	-1.62 (1.799)
AM emotional stability		-0.09 (.151)	-0.03(.170)	-0.02 (.172)
AM psychosocial		-0.35 (.507)	-0.19 (.595)	-0.13 (.642)
profile score		0.35 (.326)	0.34 (.352)	0.34 (.358)
# of sibs				
Mean sib IPB rank		-0.01 (.010)	-0.01 (.011)	-0.02 (.013)
Individual Characteristics				
Sex			-0.32 (.564)	-0.34 (.569)
IQ score			-0.03 (.027)	-0.04 (.030)
Infant z-score			0.14 (.115)	0.12 (.115)
Child rank			0.02 (.011)	0.02 (.011)
Extraversion (1)			0.01 (.038)	-0.01 (.040)
Well-socialized (1)			-0.03 (.049)	-0.03 (.051)
Emotional Stability (1)			0.00 (.063)	-0.18 (.227)
Interactions				
AM IQ X Child IQ				0.23 (.298)
AM ES X Child ES				0.03 (.039)
Constant	1.89 (3.397)	-0.53 (4.78)	-1.56 (6.772)	11.26 (13.222)
Chi-square	1.653	7.994	19.743	21.083
R^2	0.02	0.09	0.21	0.22

Note: AM= adoptive mother, IPB= Index of Problem Behavior ratings, ES= emotional stability

***p< .05, **p< .01**

N=83

Table 4.10

Adulthood *Binary Logistic Regression Model prediction High or Low Index of problem Behavior Scores among individuals who were* ***Higher-Risk*** *toward developing behavior problems.*

	Block 1 ***B (S.E.)***	***Block 2*** ***B (S.E.)***	***Block 3*** ***B (S.E.)***	***Block 4*** ***B (S.E.)***
Biological Mother Characteristics				
IQ	0.07 (.042)	0.07 (.050)	-0.12 (.070)	0.18 (.104)
Age at birth of child	0.05 (.147)	0.09 (.167)	-0.09 (.262)	-0.52 (.493)
Psychosocial Profile Score	0.41 (.217)	0.48 (.280)	0.99 (.539)	**1.51* (.745)**
Adoptive Family Characteristics				
SES		0.03 (.037)	0.05 (.053)	0.06 (.056)
AM education		-0.30 (.665)	-1.13 (1.01)	-1.02 (1.11)
AM IQ		0.06 (.069)	0.14 (.115)	0.20 (.168)
AM warmth		-0.15 (.225)	0.01 (.319)	-2.16 (4.01)
AM emotional stability		-0.13 (.240)	-0.32 (.441)	-0.83 (.637)
AM psychosocial		1.25 (.807)	0.48 (.884)	1.70 (1.82)
profile score		0.46 (.540)	0.50 (.900)	0.31 (.855)
# of sibs				
Mean sib IPB rank		0.01 (.017)	0.02 (.026)	0.04 (.032)
Individual Characteristics				
Sex			-0.06 (1.35)	-0.21 (2.03)
IQ score			0.03 (.048)	-0.01 (.063)
Child rank			0.05 (.030)	0.06 (.035)
Adolescent rank			0.03 (.026)	0.01 (.031)
Extraversion (2)			-0.04 (.070)	-0.07 (.084)
Well-socialized (2)			-0.08 (.055)	-0.14 (.098)
Emotional Stability (2)			0.06 (.103)	-0.31 (.449)
Interactions				
AM IQ X Child IQ				-2.12 (1.51)
AM ES X Teen ES				0.06 (.089)
Constant	-8.99 (5.22)	-20.05 (10.69)	-37.50 (18.47)	-21.30 (30.47)
Chi-square	5.99	11.85	24.65	28.60
R^2	0.13	0.25	0.44	0.49

Note: AM= adoptive mother, IPB= Index of Problem Behavior ratings, ES=emotional stability.
***p< .05, **p< .01**
N=42

Table 4.11

Adulthood *Binary Logistic Regression Model prediction High or Low Index of problem Behavior Scores among individuals who were at* ***Lower-Risk*** *toward developing behavior problems.*

	Block 1 ***B (S.E.)***	***Block 2*** ***B (S.E.)***	***Block 3*** ***B (S.E.)***	***Block 4*** ***B (S.E.)***
Biological Mother Characteristics				
IQ	-0.02 (.044)	-0.03 (.058)	-0.08 (.090)	-0.14 (.151)
Age at birth of child	-0.17 (.136)	-0.05 (.160)	-0.11 (.303)	-0.19 (.607)
Psychosocial Profile Score	-0.98 (.734)	-1.54 (.1.071)	**-2.69* (1.32)**	**-4.49* (2.24)**
Adoptive Family Characteristics				
SES		-0.01 (.033)	-0.03 (.044)	0.00 (.070)
AM education		0.80 (.568)	1.09 (.841)	0.91 (1.367)
AM IQ		0.02 (.060)	0.10(.094)	0.11 (.178)
AM warmth		-0.54 (.309)	-0.20 (.356)	18.35 (10.4)
AM emotional stability		0.26 (.264)	-0.61 (.442)	0.38 (.847)
AM psychosocial		0.69 (1.77)	3.28 (3.46)	7.22 (7.27)
profile score		-0.85 (.603)	-1.60 (.934)	-2.65 (1.56)
# of sibs				
Mean sib IPB rank		0.01 (.014)	0.02 (.027)	0.06 (.056)
Individual Characteristics				
Sex			-0.78 (1.121)	-1.66 (2.030)
IQ score			-0.05 (.063)	-0.21 (.169)
Child rank			0.03 (.027)	0.04 (.045)
Adolescent rank			0.05 (.034)	0.08 (.055)
Extraversion (2)			-0.09 (.092)	-0.23 (.142)
Well-socialized (2)			0.12 (.096)	0.26 (.156)
Emotional Stability (2)			-0.10 (.112)	1.81 (1.028)
Interactions				
AM IQ X Child IQ				0.55 (1.258)
AM ES X Teen ES				-0.40 (.223)
Constant	3.86 (5.807)	-0.71 (10.243)	2.629 (17.923)	-62.528 (49.85)
Chi-square	4.466	14.749	**28.85***	**38.01****
R^2	0.07	0.22	0.38	0.47

Note: AM= adoptive mother, IPB= Index of Problem Behavior ratings, ES= emotional stability

***p< .05, **p< .01**

N=60

Appendix 4A

Correlation Matrix for Individual, Family, and Birth Mothers' Characteristics used in Chapter Four Binary Regression Models.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1 Sex		0.05	0.17	0.09	0.12	0.02	0.09	0.08	**-0.29**	-0.14	-0.03	-0.13	0.08	0.01	-0.05	-0.02	-0.04	0.15	-0.13	**0.35**	0.05	0.04
2 Ss IQ	-0.03		-0.17	0.22	0.08	-0.04	0.10	0.06	**-0.35**	-0.09	0.01	-0.05	-0.17	**0.28**	0.25	-0.04	0.01	0.12	-0.14	-0.09	-0.16	0.29
3 Ext1	-0.01	0.01		**-0.25**	0.12	**0.49**	-0.20	-0.22	-0.03	0.10	0.03	-0.03	0.02	-0.13	-0.05	0.07	-0.03	0.05	0.00	0.04	-0.12	0.11
4 Soc1	-0.10	0.05	**-0.24**		**0.33**	-0.22	0.26	0.24	-0.22	-0.08	-0.11	0.07	0.03	0.10	0.13	-0.20	0.01	0.00	-0.08	-0.10	0.15	0.19
5 ES1	-0.13	0.10	**0.34**	**0.25**		0.02	0.12	**0.33**	**-0.24**	**-0.28**	-0.16	0.06	0.23	0.12	0.26	0.01	-0.13	-0.07	-0.09	-0.03	0.04	0.24
6 Ext2	-0.11	-0.05	**0.58**	-0.11	0.19		-0.14	0.23	0.11	0.20	0.02	-0.09	-0.15	-0.02	0.04	0.11	-0.16	-0.08	0.06	0.12	-0.19	0.06
7 Soc2	0.00	0.07	-0.04	**0.56**	**0.31**	-0.01		**0.31**	-0.22	-0.29	-0.20	0.12	0.00	-0.10	-0.04	-0.01	0.04	0.05	0.06	0.07	-0.07	0.16
8 ES2	-0.03	0.02	0.20	0.18	**0.33**	0.22	**0.36**		0.09	-0.18	-0.19	0.07	0.02	0.14	0.14	0.12	-0.22	0.04	0.06	0.04	0.00	0.10
9 Crank	-0.05	-0.15	0.06	**-0.27**	**-0.30**	0.13	**-0.33**	-0.16		**0.24**	-0.15	-0.14	-0.08	0.04	-0.05	-0.02	0.00	0.08	0.17	-0.11	0.10	**-0.23**
10TRank	-0.08	-0.17	0.06	**-0.27**	-0.12	0.07	**-0.34**	**-0.36**	**0.36**		0.05	-0.18	-0.21	0.05	-0.04	-0.03	0.17	0.06	0.18	0.06	-0.04	0.07
11 AMIQ	0.05	0.04	0.06	0.05	0.01	-0.22	-0.09	-0.11	0.03	0.18		-0.04	**0.28**	**0.33**	**0.28**	0.18	-0.02	0.13	-0.21	-0.09	0.09	0.21
12AMwm	0.19	0.03	0.00	-0.06	0.06	0.15	-0.11	-0.05	0.02	-0.07	-0.06		0.12	0.06	**0.23**	0.16	**-0.28**	**-0.27**	-0.01	-0.08	0.11	0.03
13 AMes	0.09	0.05	-0.05	0.00	-0.02	0.02	0.03	-0.12	-0.01	0.09	0.09	0.01		0.12	0.19	**0.25**	0.05	0.02	**-0.23**	-0.21	**0.26**	0.11
14 AMed	0.07	0.05	-0.01	-0.08	-0.14	0.08	0.00	-0.16	0.08	0.15	0.13	**0.24**	0.03		**0.82**	0.00	-0.12	0.15	-0.06	-0.05	0.08	**0.30**
15 SES	0.05	0.16	-0.19	0.03	**-0.22**	-0.04	-0.02	-0.19	-0.01	**0.20**	0.17	0.16	-0.04	**0.73**		0.04	-0.16	0.08	-0.04	-0.22	0.11	**0.31**
16 # Kids	0.05	-0.06	-0.11	-0.04	-0.12	-0.07	-0.05	**-0.24**	0.01	0.17	**0.23**	0.06	0.18	**0.21**	**0.19**		0.18	0.18	**-0.23**	-0.07	0.20	0.14
17 Sib1	0.08	0.05	**-0.23**	-0.03	-0.13	-0.26	0.04	-0.01	0.08	-0.03	-0.09	0.09	-0.06	0.01	0.02	0.13		**0.57**	**-0.29**	-0.12	-0.06	0.00
18 sib2	-0.14	0.10	**-0.28**	0.10	-0.13	-0.15	0.09	-0.07	-0.07	-0.11	0.11	-0.01	-0.01	0.06	0.05	0.16	**0.51**		**-0.28**	-0.14	0.00	0.10
19 AM prf	0.07	0.00	-0.05	0.00	-0.01	0.06	0.17	0.17	-0.11	-0.17	-0.14	0.08	**-0.29**	-0.06	-0.02	-0.03	0.04	0.06		0.12	0.06	-0.18
20 BM prf	-0.04	-0.01	0.16	0.07	**0.32**	0.05	0.00	0.03	-0.02	-0.05	-0.04	-0.09	-0.11	-0.12	**-0.26**	-0.15	-0.03	0.16	0.07		-0.11	-0.09
21 BM age	-0.13	-0.17	-0.03	0.01	-0.01	0.02	-0.05	-0.15	-0.09	-0.13	**-0.22**	-0.08	**-0.19**	-0.13	-0.08	0.08	-0.07	-0.05	0.05	0.04		0.07
22 BM IQ	0.08	**0.30**	0.05	-0.05	0.00	-0.01	-0.14	0.06	**0.20**	0.05	0.09	0.17	-0.05	**0.24**	**0.31**	0.00	0.01	-0.05	0.07	**-0.24**	-0.13	

Note: Figures above the diagonal are for the Higher-Risk adoptees, those below are for the Lower-Risk adoptees. Bold faced coefficients are significant at the p< .05 level or better. Ns range from 48-106.

Appendix 4B

Binary Models without Birth Mother Characteristics, Higher-Risk Children

	Block 1 *B (S.E.)*	*Block 2* *B (S.E.)*	*Block 3* *B (S.E.)*
Adoptive Family Characteristics			
SES	-0.01 (.030)	-0.06 (.055)	-0.09 (.067)
AM education	0.56 (.593)	2.07 (1.08)	2.62 (1.39)
AM IQ	-0.13* (.066)	-0.21* (.090)	-0.25* (.118)
AM warmth	-0.37 (.219)	-0.69* (.340)	-0.90* (.384)
AM emotional stability	-0.13 (.233)	-0.14 (.375)	-0.24 (.446)
AM psychosocial profile score	1.24 (.765)	-0.02 (.891)	-0.23 (.730)
# of sibs	0.84 (.521)	2.04* (1.03)	2.29* (1.16)
Mean sib IPB rank	-0.02 (.018)	-0.09* (.039)	-0.12* (.051)
Individual Characteristics			
Sex		-3.57* (1.47)	-4.86* (2.11)
IQ score		-0.15* (.066)	-0.17* (.074)
Infant IPB score		0.20 (.196)	0.05 (.220)
Interactions			
AM warmth X Infant IPB score			-0.62 (.486)
AM IQ X Child IQ			0.42 (.946)
Constant	14.57* (12.22)	44.60** (16.42)	55.60** (21.40)
Chi-square	14.89	34.39***	36.50***
R^2	0.27	0.51	0.53

Note: AM= adoptive mother, IPB= Index of Problem Behavior.
N=48.
*p<.05.

Appendix 4C

Binary Models without Birth Mother Characteristics, Lower-Risk Children

	Block 1 *B (S.E.)*	*Block 2* *B (S.E.)*	*Block 3* *B (S.E.)*
Adoptive Family Characteristics			
SES	-0.02 (.017)	0.00 (.018)	0.00 (.019)
AM education	0.39 (.366)	0.14 (.390)	0.09 (.395)
AM IQ	0.10 (.037)	0.02 (.041)	0.02 (.040)
AM warmth	-0.01 (.181)	0.64 (.340)	0.18 (.235)
AM emotional stability	-0.03 (.155)	-0.02 (.171)	-0.02 (.176)
AM psychosocial profile score	-0.57 (.640)	-0.72 (.723)	-0.54 (.713)
# of sibs	-0.18 (.388)	-0.18 (.414)	-0.21 (.413)
Mean sib IPB rank	0.00 (.011)	0.00 (.011)	0.00 (.012)
Individual Characteristics			
Sex		0.00 (.602)	-0.01 (.612)
IQ score		-0.03 (.025)	-0.03 (.027)
Infant IPB score		0.26* (.108)	0.25* (.111)
Interactions			
AM warmth X Infant IPB score			-0.39 (.459)
AM IQ X Child IQ			0.13 (.308)
Constant	-0.09 (4.59)	-1.35 (5.55)	-2.09 (5.57)
Chi-square	3.01	10.79	11.64
R^2	0.04	0.15	0.16

Note: AM= adoptive mother, IPB= Index of Problem Behavior.
*p<.05, N=56.

Appendix 4D

Binary Models without Birth Mother Characteristics, Higher-Risk Adolescents

	Block 1 *B (S.E.)*	*Block 2* *B (S.E.)*	*Block 3* *B (S.E.)*
Adoptive Family Characteristics			
SES	-0.02 (.023)	-0.01 (.029)	0.02 (.035)
AM education	0.34 (.421)	0.13 (.508)	-0.61 (.671)
AM IQ	-0.02 (.046)	-0.03 (.067)	-0.05 (.086)
AM warmth	-0.09 (.146)	-0.10 (.191)	-2.20 (2.29)
AM emotional stability	-0.30 (.178)	-0.41 (.242)	-0.50 (.270)
AM psychosocial profile score	0.44 (.435)	0.11 (.470)	-0.09 (.560)
# of sibs	0.41 (.381)	0.66 (.511)	0.83 (.581)
Mean sib IPB rank	0.01 (.012)	0.01 (.015)	0.02 (.017)
Individual Characteristics			
Sex		-0.04 (.843)	-0.14 (.989)
IQ score		0.02 (.035)	0.05 (.044)
Infant IPB score		-0.12 (.145)	-0.13 (.164)
Child rank		0.04* (.017)	0.05* (.020)
Extraversion (T1)		0.14* (.067)	0.17* (.079)
Well-Socialized (T1)		0.10 (.064)	0.16* (.074)
Emotional Stability (T1)		-0.16 (.100)	-0.42 (.289)
Interactions			
AM warmth X Infant IPB score			0.04 (.044)
AM IQ X Child IQ			1.37 (.786)
Constant	5.06 (5.49)	0.53 (10.22)	7.60 (17.02)
Chi-square	8.81	26.26*	32.01*
R^2	0.13	0.34	0.39

Note: AM= adoptive mother, IPB= Index of Problem Behavior, T1= Time 1 (i.e., childhood)

*p<.05, N=64

Appendix 4E

Binary Models without Birth Mother Characteristics, Lower-Risk Adolescents

	Block 1 *B (S.E.)*	*Block 2* *B (S.E.)*	*Block 3* *B (S.E.)*
Adoptive Family Characteristics			
SES	0.01 (.014)	0.03 (.018)	0.03 (.019)
AM education	-0.06 (.274)	-0.27 (.311)	-0.25 (.329)
AM IQ	0.03 (.031)	0.04 (.034)	0.03 (.034)
AM warmth	-0.08 (.148)	-0.08 (.160)	-1.76 (1.53)
AM emotional stability	-0.06 (.137)	-0.03 (.150)	-0.03 (.153)
AM psychosocial profile score	-0.32 (.497)	-0.17 (533)	-0.06 (.558)
# of sibs	0.34 (.306)	0.30 (.325)	0.29 (.327)
Mean sib IPB rank	-0.01 (.009)	-0.01 (.010)	-0.02 (.011)
Individual Characteristics			
Sex		-0.27 (.508)	-0.21 (.510)
IQ score		-0.02 (.024)	-0.03 (.027)
Infant IPB score		0.08 (.098)	0.09 (.098)
Child rank		0.02 (.010)	0.02 (.010)
Extraversion (T1)		-0.01 (.035)	-0.02 (.036)
Well-Socialized (T1)		-0.05 (.045)	-0.03 (.047)
Emotional Stability (T1)		0.02 (.054)	-0.18 (.192)
Interactions			
AM warmth X Infant IPB score			0.04 (.032)
AM IQ X Child IQ			0.29 (.284)
Constant	-4.77(3.88)	-4.90 (5.79)	5.39 (10.49)
Chi-square	7.56	17.58	19.91
R^2	0.08	0.17	0.20

Note: AM= adoptive mother, IPB= Index of Problem Behavior, T1= Time 1 (i.e., childhood). N=92

Appendix 4F

Binary Models without Birth Mother Characteristics, Higher-Risk Adults

	Block 1 *B (S.E.)*	*Block 2* *B (S.E.)*	*Block 3* *B (S.E.)*
Adoptive Family Characteristics			
SES	0.02 (.032)	0.03 (.040)	0.03 (.045)
AM education	-0.14 (.568)	-0.31 (.710)	-0.14 (.770)
AM IQ	0.04 (.052)	0.07 (.075)	0.06 (.084)
AM warmth	-0.18 (.200)	-0.05 (.027)	0.30 (1.99)
AM emotional stability	-0.17 (.214)	-0.23 (.307)	-0.34 (.340)
AM psychosocial profile score	0.96 (.624)	0.69 (.673)	1.22 (.876)
# of sibs	0.55 (.457)	0.90 (.723)	0.98 (.767)
Mean sib IPB rank	0.00 (.014)	0.00 (.018)	0.00 (.019)
Individual Characteristics			
Sex		1.13 (1.06)	1.03 (1.07)
IQ score		0.02 (.040)	0.00 (.043)
Child rank		0.05 (.024)	0.04 (.025)
Adolescent rank		0.03 (.018)	0.02 (.020)
Extraversion (T2)		-0.02 (.052)	-0.01 (.054)
Well-socialized (T2)		-0.04 (.044)	-0.05 (.049)
Emotional Stability (T2)		0.00 (.079)	0.01 (.284)
Interactions			
AM IQ X Ss IQ			-0.01 (.046)
AM ES X Ss ES			-0.62 (.652)
Constant	-20.05 (10.69)	-15.88 (12.18)	-13.82 (21.91)
Chi-square	5.81	17.63	18.70
R^2	0.13	0.34	0.35

Note: AM= adoptive mother, IPB= Index of Problem Behavior, T2= Time 2 (i.e., adolescence)
N=43.

Appendix 4G

Binary Models without Birth Mother Characteristics, Lower-Risk Adults

	Block 1 *B (S.E.)*	*Block 2* *B (S.E.)*	*Block 3* *B (S.E.)*
Adoptive Family Characteristics			
SES	0.00 (.026)	0.00 (.034)	0.00 (.034)
AM education	0.57 (.424)	0.38 (.535)	0.33 (.594)
AM IQ	0.01 (.052)	0.03 (.066)	11.32* (4.94)
AM warmth	-0.65* (.301)	-0.50 (.365)	0.53 (.419)
AM emotional stability	0.37 (.225)	0.51 (.304)	-0.34 (.340)
AM psychosocial profile score	0.33 (1.56)	2.01 (2.07)	4.32 (4.05)
# of sibs	-0.48 (.492)	-0.71 (.559)	-1.23 (.785)
Mean sib IPB rank	0.01 (.013)	0.02 (.018)	0.04 (.023)
Individual Characteristics			
Sex		-0.15 (.874)	-0.16 (1.02)
IQ score		-0.06 (.044)	-0.14* (.074)
Child rank		0.01 (.018)	0.02 (.024)
Adolescent rank		0.03 (.021)	0.05 (.028)
Extraversion (T2)		-0.03 (.067)	-0.13 (.086)
Well-socialized (T2)		0.04 (.071)	0.09 (.094)
Emotional Stability (T2)		-0.09 (.082)	1.17* (.511)
Interactions			
AM IQ X Ss IQ			-0.26* (.108)
AM ES X Ss ES			-0.07 (.748)
Constant	-3.43 (6.47)	0.97 (10.58)	-46.47 (23.62)
Chi-square	12.08	24.05	33.39*
R^2	0.17	0.31	0.41

Note: AM= adoptive mother, IPB= Index of Problem Behavior, T2= Time 2 (i.e., adolescence)
*p<.05, N=64.

Chapter Five: General Conclusions

In the introduction of this dissertation, I outlined the three main questions for this project. I will briefly provide answers to those questions based on the results of my investigation. Then I will discuss the implications of these results as they pertain to a) future research on problem behavior development, b) the treatment of antisocial behaviors and conduct disorders, and c) individuals involved in various aspects of the adoption process.

1) Do biological mothers with psychopathic tendencies leave their adopted away offspring at risk for developing antisocial, problem behaviors during their lifetime?

Results from both the linear regression analyses and the biological parent-child correlations yielded statistically significant, positive effects between birth mothers' scores on the psychopathic deviate scale of the MMPI. Although the effects sizes were small, leaving a lot of room for other factors to influence their development, these results support the conclusion that there are maternal genetic influences on problem behavior development, although the effect may only be substantial for males.

Moffitt (2005) suggests that we should only expect to find small effect sizes when investigating the relationship between risk factors and behavioral outcomes. This will especially be the case when main effects, rather than gene-environment interactions are tested (Daniels & Plomin, 1985) because a large number of risk factors are thought to be responsible for the development of antisocial problems—each of which has a small but cumulative effect (Rutter, Giller, & Hagell, 1998). In addition, other studies that have used genetically informed samples to investigate the link between parental antisocial behaviors have found relationships of similar size (Mednick, et al, 1983).

The results from the parent-child correlations, that male but not females were moderately similar to their biological mothers during adolescence and very similar to them in adulthood, was unexpected. The supplemental regressions on males told largely

the same story as the regressions on the full adoptee sample. When specific indicators of maternal maladjustment were used, a different picture emerged when mothers' general psychosocial indicators were investigated. In the latter set of male-only analyses, it appeared that maternal environmental influences were predictive of male adoptees problem behaviors during adolescence and adulthood, while maternal genetic effects only emerged during adulthood and had smaller effects than maternal environmental factors. These findings suggest that both genetic and environmental factors contribute to the development of antisocial behaviors and that each source may affect males and females differently. However, it should be noted that for males the number of adoptive mothers with any subscale scores above 70 was only 17. Therefore, the stability of the male-only models may be questionable. In other words, estimates from the male only models may be undependable because of the limited number of individuals in each of the cells.

As noted in Chapter Two, one possible limitation to this study was that the measure used to assess problem behaviors may not have captured all the potential forms of antisocial behavior that could be displayed by females. Given the results on sex differences in aggressive behaviors (Coyne, et al, 2006), other researchers interested in investigating the link between maternal antisocial behaviors and problem behavior development in their offspring are strongly advised to include items that assess malicious gossip and other forms of relational aggression. This may also help determine whether my finding, that mothers only pass the genetic liability for antisocial behavior on to their sons, is true.

Additionally, information regarding the biological fathers would likely shed some light on the transmission of antisocial behaviors from one generation to the next. As shown in previous studies (e.g., Mednick et. al., 1983) antisocial behaviors are clearly passed down from biological fathers to their sons. Though antisocial behavior in general has been studied less among females (Rhule, et al., 2004), Mason and Frick (1994) found that biological fathers also pass antisocial tendencies on to their daughters, but to a lesser degree. Adding biological fathers' antisocial tendencies, though practically difficult in the

US, would be illuminating to the question of genetic risk toward behavior problems among adoptees.

2) Do group differences in stability and continuity of problem behaviors emerge as a function of sex, adoption status, and genetic risk?

By breaking the sample up into groups according to gender, adoptive status, and relative risk status, I was able to uncover a more detailed account of how problem behaviors develop across time for different groups. When just looking at mean behavioral trends for the males and females in the sample, it appeared that both groups followed the predicted pattern—peaking in adolescence (Moffitt, 1993).However, the biological sample and the Higher-Risk females did not follow this trend. Rather those groups tended to remain relatively stable between childhood and adolescence, before declining even further between adolescence and adulthood. This was a unique finding that merits further exploration comparing the behavioral patterns biological and adopted offspring. However, it suggests the possibility that individuals at both ends of the behavioral spectrum, not just the excessively antisocial as suggested by Moffitt (1993), may remain the most stable throughout the life span.

Similar to mean level problem behavior stability, intra-individual continuity tended to differ depending on sex, adoption status, and risk status. Higher-Risk male adoptees showed the most behavioral continuity from childhood through middle adulthood, while Higher-Risk female adoptees showed the least. These results highlight the importance of considering the characteristics of the group being investigated when developmental stability and continuity are being investigated. If we simply looked at the intra-individual continuity of the sample as a whole we would have concluded that behavior problems are modestly stable across time. However, a division of the sample revealed that was the case for adopted males, but was not the case for either adopted females or biological males and females. Further, it was found that while genetic factors

are partially responsible for the development of problem behaviors they were not found to influence the continuity of behaviors over time.

As with the results from Chapter Two, these findings might have differed had the measure of problem behavior included more female-typical antisocial behaviors. Perhaps had such measures been included in the IPB I would have found more behavioral stability among the Higher-Risk females. Therefore, in addition to breaking up samples into groups according to gender and risk status, future research on trends and trajectories of problem behavior should also be sure to include appropriate measures to accurately map behavioral patterns among females, as well as males.

3) What individual and stable family characteristics serve as risk and/or protective factors for Higher-Risk and Lower-Risk adoptees, once genetic factors for maternal psychosocial functioning are controlled?

Though the analyses used to address this question were primarily exploratory, the results from the two methods—independent ANOVAs with Bonferroni post-hoc comparisons and binary regressions—comparing two groups of adoptees that varied in risk status yielded two main conclusions. The first major conclusion was that stable family factors, such as parental SES, maternal warmth, number of siblings in the home, and maternal psychological well-being had no significant influence on the development of problem behaviors across the lifespan among adopted individuals. Although two significant within-family findings presented themselves in the adulthood ANOVAs, because these same factors were not found to predict which behavior problem group the adoptees were in using binary regressions, I cannot be certain that these results would replicate in future studies. Furthermore, results from the parent-child correlations, as well as the sibling correlations from Chapter Three support the conclusion that the stable family characteristics measured here had no direct influence on problem behavior development among the adoptees.

The second major conclusion reached was that prior behavior is the best predictor of future behavior among the adoptees in the Texas Adoption Project. The ANOVAs showed that difficult infants were more problematic children and higher ranking children and adolescents tended to score above average on the IPB during adolescence and adulthood, whether they belonged to the Higher-Risk or Lower-Risk group. While results from the binary regression models (both with and without genetic controls) were much less consistent and their reliability is questionable, infant IPB scores also predicted above-average levels of behavior during childhood for the Lower-Risk adoptees, and childhood rank predicted behavioral classification during adolescence for the Higher-Risk adoptees. This result fits in with Moffitt's (1993) conclusion regarding the prediction of offending from past behavior.

This study was limited in its power to detect relationships between variables due to the small sample sizes within each of the groups. Had the samples been larger it would have been ideal, given the sex differences found in both Chapters Two and Three, to have also examined males and females within each risk group separately. That was not feasible, however. A post-hoc attempt to add a sex by birth mother interaction term to each of the binary regression models in Chapter Four rendered four out of the six models uninterpretable. Unfortunately, the limited number of participants simply limits the ability to address whether the results differ as a function of gender.

Implications for Future Research

The use of a genetically informative longitudinal research design further supports the work of many who have looked into the developmental antecedents and pathways of transmission of antisocial behavior problems (e.g., Mednick, et al., 1983; Moffit, 2005; Moffitt & Caspi, 2001; Rhule et al., 2004; van den Valk et al., 1998, 2003); adding that genetic factors continue to be an important influence on behavior as individuals reach middle adulthood. When looking for factors that influence resilience or vulnerability toward problem behavior development, future researchers should investigate aspects of

the environment that differ between siblings within the same home (such as major life events or the presence of a caring adult outside the family) and to conduct analyses on males and females and Higher-Risk and Lower-Risk groups separately. Terrie Moffitt (2005) outlines a number of particularly strong methods for doing such investigations, including the study of differences in environmental exposure between identical twins and whether these differences in exposure help explain differences observed in their behavior.

The gender differences found throughout this dissertation warrant a closer look at how female aggression and problem behaviors differ from males, as well as an overall study of the transmission of antisocial behavior between mothers and their offspring. To date, very little research exists on antisocial behavior among females (Moffitt & Caspi, 2001). This may be in part due to the limited number of women who manifest the disorder—0.05-2.0% of the U.S. female population (American Psychiatric Association, 1994). However, when researchers have a better understanding of antisocial behaviors manifested among females this figure may change. As mentioned previously, investigating the role of relational, indirect aggression in antisocial women may prove a fruitful endeavor and could change the definition as well as the estimates of the prevalence of antisocial personality disorder for females.

Two factors often overlooked in studies that use adoption designs are the effects of prenatal environment and problems during the birth of the child. It is possible that each of these may have an influence on the development of problem behaviors—or any other behavior or trait—among children who were adopted away shortly after birth. For example, was the mother depressed during pregnancy? Were there any birth complications? Was the infant premature? Studies into the effects of the prenatal environment have found that maternal depression during pregnancy (Field, Diego, & Hernandez-Reif, 2006) and abnormal birth (i.e., birth complications or prematurity) (De Sousa, 1974) can affect the developing fetus and disrupt the mother-child bond during infancy, when studied among women who raise their own children. In addition, women who had their first depressive episode while pregnant (versus before pregnancy) had children that experienced some language delays, but not to the same extent as the

children of women who experience depression prior to becoming pregnant (Sohr-Preston, & Scaramella, 2006). To my knowledge, the effects of these same pre- and perinatal experiences have not been studied among individuals adopted away at birth.

Given that the majority of adopted individuals from the Texas Adoption Project were adopted from a home for unwed mothers some of these questions may be investigated in future research. Many of the biological mothers lived at the home for the last half of their pregnancy—usually after they began to show. Therefore, data regarding their health and pregnancy, as well as the hospital records from when the young women gave birth, are included in the adoption records. Adding information about the prenatal mental health of the birth mother, as well as information regarding the normality of the adoptees birth, into the regression models may help to uncover some previously unstudied environmental effects on the development of problem behaviors among adopted individuals.

Implications for the Treatment of Antisocial and Conduct Disorders

Many individuals unfamiliar with the interpretation of research using behavior genetic methods may incorrectly conclude that nothing can be done to curtail problem behaviors among individuals who are genetically prone to developing them. A look back at the data presented in Chapter Four of this dissertation indicates that this was not the case. Of the 75 individuals who were classified as Higher-Risk, based on the definition that their birth mother had a psychopathic deviate score 0.5 standard deviations above the mean for their age group, between 39 and 64 percent (depending on the age range) did NOT show above average levels of problem behaviors. This indicates that there was something about these resilient individuals and/or their environments that kept them from manifesting problem behaviors.

Though the research presented here did not identify potential protective environmental factors, past research on risk and resilience has consistently identified one environmental factor that ameliorates the effect of multiple sources of adversity. That one

factor is the presence of warm caring relationships with adults, whether inside or outside the home (Debold, Brown & Weseen, 1999; Laursen & Birmingham, 2003; Werner, 1993; Werner & Johnson, 2004; Werner & Smith, 1992). The presence of a caring adult has been found to moderate the influence of parental alcoholism (Werner & Johnson, 2004), child abuse (Bysom, 2001), poverty (Garmezy, 1991, 1993; Werner, 1993; Werner & Smith, 1992), and the experience of severe trauma, such as the death of a parent (Werner, 1993) or an act of war (Garmezy, 1988).

Many treatment interventions have been devised based on the robustness of this effect which include mentorship programs (Beltman & MacCallum, 2006; Everhart, 2001; Osterling & Hines, 2006) and early parent-child relationship intervention (Sameroff, McDonoug, & Rosenblum, 2004). Osterling and Hines (2006), for example, found that adolescents in the foster care system who took part in a mentorship program adjusted better once they were out of the foster care system than those who did not take part in the program. In addition, Everhart found that, among 3rd and 4th grade children with externalizing problems who were randomly assigned into groups that underwent a character education curriculum with or without a mentor, those who received mentor had a greater decrease in teacher reported externalizing behaviors than those who did not. Therefore, it should not be concluded that genetic risk equates to phenotypic inevitability. Based on these prior findings, children at higher risk for problem behaviors may benefit from treatments that include mentorship as part of the program.

Implications for Individuals Involved in the Adoption Process

At this juncture our understanding of what factors influence the development of behavior problems is too limited to have any solid recommendations for either adoption agencies or parents seeking to adopt a child. While it has been found that adopted children have a higher prevalence of behavior problems than the children born into their adoptive families, the majority of cases of adoptions turn out well—even among those with highly deviant biological mothers. While it may be prudent for prospective adoptive

parents to get a detailed history with regard to any mental or physical health problems of the biological parents (and their immediate families), indications of externalizing should not be taken as a definitive sign that the child too will develop serious behavior problems. In light of the research on risk and resilience and the ameliorating effects of caring adult relationships, the adoption of a child at risk for behavior problems into the home of caring and supportive parents may be enough to deflect the developmental path. Should behavior issues arise, early interventions that increase the problem child's social support network may be of help.

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VITA

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