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Contextual Influences on Associations between Impulsivity and Risk-Taking and Child Delinquency

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To the Graduate Council:

I am submitting herewith a thesis written by Michael L. Vitulano entitled "Contextual Influences on Associations between Impulsivity and Risk-Taking and Child Delinquency." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Psychology.

Paula J. Fite, Major Professor

We have read this thesis and recommend its acceptance:

Derek R. Hopko, Jenny A. Macfie

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Child Delinquency

A Thesis Presented for
the Master of Arts
Degree
The University of Tennessee, Knoxville

Michael Lawrence Vitulano
May 2010

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Acknowledgements

This thesis is dedicated to my grandmother, Anna Silvestro Vitulano. She is forever remembered for her grace, selflessness and generous spirit. I am lucky to have known her so well and to have seen her dedication to the lives of children.

Abstract

Previous literature has shown that risk factors for delinquency include individual characteristics of impulsivity and risk-taking as well as contextual influences such as neighborhoods, parenting and engagement in physical activity (e.g., exercise, sports). Theory suggests that individual characteristics interact with contextual factors to influence child development, however evidence is limited. The current study examined the interaction between these individual and contextual risks to influence childhood delinquency in a community sample of 89 children ranging from 9 to 12 years of age ($M = 10.4$, $SD = 1.1$). Questionnaire measures showed that both caregiver report of impulsivity and self-reported risk-taking were positively associated with self-reported delinquency, yet no interactions with contextual factors were found. When using computer tasks, neither impulsivity nor risk-taking were significantly associated with delinquency. However, a risk-taking by physical activity interaction was found, such that at low levels of physical activity risk-taking was positively related to delinquency, yet at high levels of physical activity, risk-taking and delinquency were unrelated. Thus, programs that involve physical activity may be useful prevention and intervention strategies for risk-taking children.

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Chapter 1

Delinquency and Temperamental Risk

Children under the age of 15 account for 29% of all juvenile (persons under age 18) arrests in the United States (Snyder, 2008) and the early onset of delinquency has critical implications. The cost to society of juvenile violent crime is estimated at \$158 billion annually, which includes both victim and government costs (Welsh et al., 2008). Delinquent youth, offending between the ages of 7 and 12 years inclusive, are also two to three times more likely to become serious, violent and chronic offenders than are adolescents whose delinquent behavior begins in their teens (Loeber & Farrington, 2000). Thus, a better understanding of factors related to early delinquency is needed for the refinement of current prevention and intervention strategies.

Defining delinquency can involve complex issues, however for the purposes of this study delinquency characterizes behavior committed by individuals under the age of 18 years which if known to official authorities could result in legal action (Miller, 1958). As one would expect with such an important topic, there is extensive research identifying risk factors for childhood delinquency, defined as offending (see Farrington, 2007). Within this literature, many temperamental styles have been found to be early predictors of delinquency in late childhood and early adolescence, defined by problem behaviors such as stealing, attacking others and vandalism (e.g., Loeber, 1990). Two common risks for conduct problems and later delinquent behavior are the temperamental characteristics of impulsivity and risk-taking (Rothbart & Bates, 1998; White et al., 1994; Wood, Pfefferbaum, & Arneklev, 1993). Both impulsivity and risk-taking may put children on a developmental pathway to delinquent behavior. However, contextual factors (e.g., family, friends, neighborhoods, activities) also play a significant influential role in preventing

adolescent drug use and delinquent behaviors such as stealing, attacking someone with a weapon or gang fighting (e.g., Bauman & Ennett, 1996; Fauth, Roth, & Brooks-Gunn, 2007). Moreover, contextual factors have been found to serve as protective factors against temperamental risks (e.g., Wikstrom & Loeber, 2000; Valois, MacDonald, Bretous, Fischer, & Drane, 2002). Bronfenbrenner's ecological systems theory (1979) suggests that human development is influenced by several individual and contextual factors, which interact to influence child development. In contrast, Piaget's theory (1972) only focuses on the individual by suggesting cognitive developmental stages of the child. Particular ecological systems such as the family, community and activities of the child have direct effects on behavioral outcomes; however their interactions with individual factors are widely unknown. Thus, it is important to understand the impact of these contexts on individual characteristics that put children at risk for child delinquency to better inform prevention and intervention strategies. Accordingly, the goal of the current study is to examine whether impulsivity and risk-taking are uniquely associated with early child delinquency. Additionally, neighborhood safety, parental monitoring and physical activity are examined as potential moderators as these variables target community, familial, and extracurricular environments of the individual which are believed to interact with individual characteristics (Bronfenbrenner, 1979) and have been shown to be related to child delinquency (e.g., Lynam, et al., 2000).

Chapter 2

Individual and Contextual Risk Factors

Impulsivity

Impulsivity is a personality trait characterized by the tendency to act with less forethought than do most individuals of equal ability and knowledge (Dickman, 1993). Factor analytic techniques reveal a four-facet structure of impulsivity: urgency, lack of premeditation, lack of perseverance and sensation-seeking (Whiteside & Lynam, 2001). Impulsivity is a known individual risk for many child and adolescent outcomes, with research linking impulsivity to externalizing problems, substance use, unintentional injury, and delinquency (Acton, 2003; Eisenberg et al., 2004; Farrington & Loeber, 1999; Schwebel & Bounds, 2003). For example, a large longitudinal study found that high levels of impulsivity measured in kindergarten children were a robust predictor of the early onset of stable, highly delinquent behavior (e.g., vandalism, stealing, trespassing, fire-setting, fighting, etc.) at ages 11 to 13 (Tremblay, Pihl, Vitaro, & Dobkin, 1994). Further, impulsivity predicted severity of adolescent delinquency, from minor delinquency such as stealing money from mother's purse to serious delinquency such as breaking and entering, above and beyond the effects of SES and IQ (White et al., 1994). Theorists on impulsivity explain this association by highlighting neurological deficits in the prefrontal cortex, which play a role in behavior regulation (e.g., Spinella, 2004). Impulsive individuals demonstrate less ability to inhibit behavior as well as show a lack of reflection upon the consequences of their behavior (Patterson & Newman, 1993). These deficits in impulse control may be the source of poor judgment as consequences fail to become internalized. Research on impulsivity has also characterized these individuals as overly reward focused as they demonstrate difficulty in delaying gratification in laboratory tasks (Logue, 1988). These aspects may result in leading to a

more risky lifestyle including disregard for rules and the law, which may ultimately lead to delinquent behavior.

Risk-taking

Risk-taking behavior, on the other hand, involves any activity that contains some potential for danger or harm while also providing an opportunity to obtain some form of reward (Leigh, 1999). When comparing risk-taking to impulsivity, results reveal that although the two may be overlapping ($r = 0.36$), risk-taking and impulsivity are conceptually distinct constructs (e.g., Lejuez, Aklin, Zvolensky, & Pedulla, 2003; Eysenck & Eysenck, 1977). For example, risk-taking has been shown to follow a pathway to substance use, independent of impulsivity (Wills, Sandy, & Shinar, 1999). Risk-taking has been strongly linked to sensation-seeking ($r = 0.56$; Lejuez et al., 2003), which is believed to be a temperamental construct due to biological bases in the excitatory and inhibitory centers of the central nervous system (Zuckerman, 1994). This link can be explained such that in situations that entail risk, individuals high in sensation seeking find the experiences worth the risk and value the sensations of the activity more than most individuals (Zuckerman, 1994). Research on risk-taking has consistently focused on the associations with negative health and safety outcomes such as drug and alcohol dependence, reckless driving behavior, sexually transmitted diseases and delinquency (Arnett, 1990; DiClemente, Hansen, & Ponton, 1996; Leas & Mellor, 2000; Zuckerman, 1979). For example, evidence suggests that juvenile offenders engage in more rebellious, reckless, and sensation-seeking leisure activities than non-offenders (Lavery, Siegel, Cousins, & Rubovits, 1993). Converging evidence also shows a consistent relation between risk-taking behavior and delinquency, such that high levels of risk-taking are related to high levels of delinquency (Arnett, 1992; Reddon, Pope, Friel, & Sinha, 1996).

Self-control theory posits that risk-taking is the product of people who lack self-control and in effect are also impulsive, insensitive, physical and short-sighted (Gottfredson & Hirschi, 1990). Steinberg (2007) argues that normal neuropsychological development during adolescence allows for increased vulnerability to risk-taking. That is, while logical reasoning abilities fully develop during puberty, psychosocial maturity (i.e., impulse control, delay of gratification, resistance to peer influence) remains underdeveloped. As a result there is an increased susceptibility to psychosocial influences of risky behavior during this stage of development. Similarly, Zuckerman (1979) suggests that humans have a natural tendency to either approach or withdraw from novel stimuli and the need for these sensations and experiences is labeled as the physiological trait of sensation-seeking. Possessing a higher level of sensation-seeking than the level of cognitive inhibitory reaction, or anxiety, tends to lead individuals to engage in risk-taking behavior. Other explanations for risk-taking behavior see risk-taking as a normal developmental process where children and adolescents seek autonomy to develop a sense of identity (Allen, Aber, & Leadbeater, 1990; Jessor & Jessor, 1977). Jessor and Jessor (1977) believe risk-taking in late childhood/adolescence is functional and goal-directed as children attempt to fit in with social roles by trying to achieve adult status. Thus, risk-taking behavior may be a normal, rebellious, adolescent stage characterized by breaking parents' rules and experimenting with alcohol, cigarettes and sexual behavior. The current study's age group of 9-12 year old children is ideal, as it utilizes a sample of children transitioning into adolescence and may capture early indications of risk-taking propensity and its links to an early onset of delinquency. This population is unique to that of previous studies in this area, which focus almost solely on influences of adolescent risk behaviors.

Interactive Effects between Contextual Influences and Individual Characteristics

Many factors have also been shown to have interaction effects with impulsivity and risk-taking and their association with delinquency. For example, previous studies show that neighborhood risk interacts with impulsivity to predict delinquency, such that children living in economically disadvantaged neighborhoods were at increased risk for the effects of impulsivity on delinquency, measured in subtypes of status offenses (e.g., truancy), vice and drug offenses, theft, violence and total number of delinquent acts (Lynam et al., 2000; Meier, Slutske, Arndt, & Cadoret, 2008). Impulsivity has also been found to have interactive effects on the positive relationship between drug use and sexual risk behavior, suggesting that impulsivity increases the likelihood of risky sexual behavior for drug users (Semple, Zians, Grant, & Patterson, 2005). Furthermore, the relationship between anger and problem behavior in adolescence has also been found to be stronger among those with high compared to low levels of impulsivity (Colder & Stice, 1998). In addition, peer delinquency and impulsivity interact to predict child delinquency suggesting that peer influences vary depending on the level of impulsivity of the child (Vitulano, Fite, & Rathert, in press). With regards to risk-taking behavior, social and personal resources have been found to interact with risk-taking behavior to predict both young adult drug use and antisocial behavior such as damaging property or stealing (Maggs, Frome, Eccles, & Barber, 1997). That is, adolescents' higher status socio-economic backgrounds, parental support, and GPAs predicted lower levels of drug use and antisocial behavior, but only for those who previously engaged in higher levels of risk-taking behavior. Thus, impulsivity and risk-taking seem to be significant individual characteristics that are influenced by children's environment and lifestyle.

Neighborhood Safety

The influence of neighborhoods on healthy child development has been thought to affect many domains. Children living in disadvantaged neighborhoods are at risk for school-dropout, teenage births, internalized symptoms, and behavioral disorders (Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993; O'Neil, Parke, & McDowell, 2001; Wandersman & Nation, 1998). One of the key components of neighborhood disadvantage is crime/safety, which is believed to impact mental health (Wandersman & Nation, 1998). Aneshensel and Sucoff (1996) found that in a large sample of adolescents, the perception of neighborhood safety influenced their behavior such that more threatening neighborhoods were associated with increased symptoms of oppositional defiant and conduct disorders. Furthermore, low neighborhood attachment and community disorganization are risk factors for child delinquency (Arthur, Hawkins, Pollard, Catalano, & Baglioni, 2002). That is, youth who report less bonding to their neighborhoods as well as those who live in communities with high population density, physical deterioration and high rates of crime are at risk for juvenile crime and drug use.

The neighborhood disorder model posits that neighborhood incivilities, such as vandalism, street harassment and gang presence, impact residents' fear of crime, which in turn is associated with subsequent increases in crime and juvenile delinquency (Wandersman & Nation, 1998). Furthermore, theorists on crime suggest that perception of neighborhood safety is a contributing factor to neighborhood disadvantage. When the safety of residents in a community is in danger, businesses and residents tend to move away from these areas, leaving neighborhoods with a lack of many major resources (Felson, 2002). Neighborhood disadvantage then tends to further impair safety with the prevalence of violence, drug use, and other antisocial

behaviors associated with disadvantaged communities (Lambert, Brown, Phillips, & Ialongo, 2004; Markowitz, 2003).

Perceived level of neighborhood safety is an important contributing factor to child delinquency because fear of crime can decrease residents' willingness to intervene if they see a problem in their community (Cantillona, Davidson, & Schweitzer, 2003). For example, Korbin and Coulton (1997) found that the primary reason residents failed to intervene in their neighborhoods was fear of retaliation. Perceived neighborhood safety has been shown to interact with factors associated with childhood problem behavior. The effect of unsupervised peer contact on externalizing behavior was strongest for children living in unsafe neighborhoods (Pettit, Bates, Dodge, & Meece, 1999). Moreover, perceived neighborhood quality and child temperament have been found to interact to predict behavior problems, such that poor neighborhoods have been positively associated with problem behavior for children characterized by low fear and high positive affect (Colder, Lengua, Fite, Mott, & Bush, 2006). Thus, it was expected that neighborhood safety would attenuate the effects of risk-taking and impulsivity on child delinquency.

Parental Monitoring

Monitoring of children's behavior is an essential quality of parenting and has been known to affect many areas of child development. Parental monitoring is defined as "active surveillance or tracking of children's behavior" (Stattin & Kerr, 2000). Among the areas that parental monitoring has proven to influence are the safety of children, academic achievement and delinquent behavior (Crouter, MacDermid, McHale, & Perry-Jenkins, 1990; Weintraub & Gold, 1991). For example, research shows that poor parental monitoring predicts substance use in adolescents (Steinberg, Fletcher, & Darling, 1994) and affiliation with a drug-using peer group

(Chassin, Pillow, Curran, Molina & Barrera, 1993). Low parental monitoring also predicts engagement in more risky sexual activity (Metzler, Noell, Biglan, Ary, & Smolkowski, 1994). Most notably, lack of parental monitoring is a strong predictor of delinquent behavior (Patterson & Dishion, 1985). This may be due to the fact that poorly monitored youth are also more likely to have deviant friends (Dishion, Capaldi, Spracklen, & Li, 1995) and may be influenced by peer pressure. Thus, adequate monitoring of children's whereabouts and behaviors may be preventative against numerous negative outcomes.

Theorists believe that deficits in parental discipline and monitoring jumpstart the developmental process of child antisocial behavior (Patterson, DeBaryshe, & Ramsey, 1989; Reid & Patterson, 1989). Harsh, inconsistent discipline and poor supervision in early childhood can contribute to the development of conduct problems putting children at risk for peer rejection and academic failure, which then lead to associating with deviant peers and ultimately results in delinquency (Patterson et al., 1989). Baumrind (1991) demonstrates that authoritative parenting style, which consists of monitoring, setting clear standards for behavior and non-punitive discipline, predicted less drug use and more competence in adolescents compared to other parenting styles. To deter children from this path, effective communication that increases parents' knowledge and monitoring of their children seems necessary. Further, increased parental monitoring may serve to protect children from some of the risks associated with delinquency and risky behavior. Monitoring has been consistently found to moderate delinquent peer influences on children's subsequent delinquent behaviors by buffering the effects (Pettit et al., 1999; Vitaro, Brendgen, & Tremblay, 2000; Wood, Read, Mitchell, & Brand, 2004). Maternal monitoring has been shown to moderate the association between temperament and externalizing behavior such that more maternal monitoring weakens the link between difficult temperament on externalizing

behavior (Brody, 2003). In regards to other risky behavior, greater parental monitoring was associated with reduced sexual activity in children, even after controlling for age and gender (Romer, Black, Ricardo, Feigelman, et al., 1994). Parental supervision plays such a critical role in establishing internalized self-control that family factors may be the strongest predictor of criminal behavior when compared to school and peer influences (Gottfredson & Hirschi, 1990). Thus, parental monitoring may have potential moderating effects on other individual risk factors for delinquency, such as impulsivity and risk-taking.

Physical Activity

Physical activity, defined as “any bodily movement produced by skeletal muscles that results in energy expenditure” (Casperson, Powell, & Christensen, 1985), has many public health benefits (e.g., Pate, Heath, Dowda, & Trost, 1996). It has been shown to reduce the risks associated with numerous serious health problems, such as coronary heart disease, stroke, diabetes, osteoporosis, colon cancer and obesity (U.S. Department of Health and Human Services, 1996). In addition, exercise and physical activity have been shown to promote mental health and academic adjustment (e.g., Fredricks & Eccles, 2005). However, recent nationwide surveys revealed that only about half (49%) of the U.S. population reports participating in the recommended amount of physical activity and almost a quarter (24%) report no leisure-time physical activity as according to the Centers for Disease Control and Prevention (CDC, 2007).

Along with the clear physiological benefits, physical activity has been consistently linked to positive adjustment outcomes in children and adolescents. Specifically, physically active teens had higher grades in school, more self-esteem, less truancy and engaged in less risky behaviors (Hunt & Hopko, 2009; Nelson & Gordon-Larsen, 2006). Children and adolescents involved in physical and extracurricular activities demonstrate low levels of depression and antisocial

behavior (e.g., Duncan, Duncan, Strycker, & Chaumeton, 2002; Fleming et al., 2008; Fredricks & Eccles, 2005). There is also evidence suggesting physical activity is related to reduced risk for substance use (e.g., Kulig, Brener, & McManus, 2003; Werch, Moore, DiClemente, Bledsoe, & Jobli, 2005). Further, participation in physical activity, through team sports, predicted having more prosocial, academically-oriented peers (Eccles, Barber, Stone, & Hunt, 2003; Fredricks & Eccles, 2005). Thus, it seems that physical activity improves cognitive and emotional skills while also reducing the risk for antisocial behavior.

In addition to direct influences on delinquency, physical activity may also moderate certain risks for these outcomes as well. However, few studies examine physical activity as a moderator of adjustment outcomes. In a sample of college students, Carmack et al. (1999) found a stress-buffering effect of physical activity, such that physical activity mitigated the relation between stress and both physical symptoms and anxiety. Similarly, high intensity of physical activity weakened the association between stress and psychological well-being in adolescents, including anxiety, depression and hostility (Norris, Carroll, & Cochrane, 1992). Other findings demonstrate that high levels of anger and impulsivity interact to predict increased adolescent problem behavior (Colder & Stice, 1998), and those who are more physically active experience less anger (Hassmen, Koivula, & Uutela, 2000). It may be that physical activity improves psychological well-being and in effect attenuates the influence of temperamental risk on delinquency and other negative outcomes.

Impulsivity and risk-taking may be associated with a lack physical activity, and in addition, delinquent behavior may be the product of excess energy due to frustration or boredom. Following this viewpoint, sports and other forms of exercise may help to exert energy that would otherwise be used in delinquent ways. Through organized physical activities, coaches and adult

spectators provide parental supervision and monitoring which may limit opportunities for antisocial behavior (Stattin & Kerr, 2000). It seems that physical activity may benefit impulsive and risk-taking children indirectly by promoting associations with prosocial peers as well as by directly providing an outlet for excess energy.

Chapter 3

Current Study

The goal of the current study was to examine the relations between risk-taking and impulsivity and child delinquency in children age 9 to 12 years. This study also examined how impulsivity and risk-taking interact with neighborhood safety, parental monitoring and physical activity in predicting delinquency. Consistent with previous research, risk-taking and impulsivity were expected to be positively related to delinquency. Further, high levels of neighborhood safety, parental monitoring and physical activity were all expected to attenuate the effects of risk-taking and impulsivity on child delinquency. The present study was a potential replication of previous findings examining neighborhood safety as a moderator of impulsivity and delinquency (e.g., Lynam et al., 2000); however, it is also a potential expansion on prior literature by examining the risk-taking by neighborhood interaction as well as novel moderators (monitoring and physical activity) of the impulsivity/risk-taking and delinquency association.

The current study also attempted to extend previous research by examining interactive effects of risk-taking and impulsivity in a pre-adolescent age group, which may capture early risks and protective factors of childhood problem behavior. Identifying contextual factors that moderate individual risks may serve to inform preventive intervention on multiple ecological levels (i.e., community, family, extracurricular activities). This study utilized computer-based tasks in addition to questionnaires designed to measure impulsivity and risk-taking, providing a major methodological strength.

Chapter 4

Method

Participants

The current study included a community sample of 89 children (56% male) ranging from 9-12 years of age ($M = 10.4$, $SD = 1.1$). The sample was racially representative of the medium-sized, Southeastern city in which the data were collected, as the majority of children (74%) were Caucasian, 20.5% were African American, 1% Asian/Pacific Islander, 0% Hispanic and 4.5% were of another racial/ethnic group or biracial. Race was dichotomized for analyses due to low rates of children identifying with the specific racial/ethnic minority groups (i.e. 1 = Caucasian, 2 = minority). The sample included a variety of socioeconomic backgrounds with annual household income ranging from \$5,600 to \$240,000 (median = \$50,000) with approximately 27% of the sample receiving public assistance. The majority of caregiver respondents were mothers (85%), while fathers (11%) and other relatives also participated (3%). Participants were recruited by flyers, which were distributed throughout the community. Families' completed a phone screen to ensure the child was the appropriate age and did not meet any of the exclusionary criteria. Exclusionary criteria included unwillingness to not take medication that would interfere with reaction time tasks (i.e., stimulants, anti-psychotics), developmental delays, and non-English speaking families. Note, however, that all exclusions were due to age (N=3).

Procedure

Children and caregivers were invited to participate in a study that required families to come to the laboratory for interviews that lasted approximately one and a half hours. Caregiver consent and child assent was obtained on the day of the study prior to participation. After

consent forms were signed, caregivers and children were interviewed simultaneously in separate rooms to ensure confidentiality. All survey questions were read aloud by the interviewers and responses were entered directly into the computer by the interviewer using Medialab software. Children also completed two computer tasks assessing risk-taking propensity (Balloon Analogue Risk Task) and impulsivity (Point Scoring Reaction Time Task). During each computer task, interviewers read aloud the instructions and monitored the children to make sure they understood the objective of each task. Families as a whole were compensated with \$45 and children received a prize for participation. Interviewers were graduate and undergraduate psychology students who underwent extensive training in the study protocol. The university's institutional review board approved this study's protocol.

Measures

Risk-Taking

Risk-taking was assessed in two ways to validate our methods of measurement and to capture multiple aspects of the construct. Participants completed questionnaire measures as well as engaged in laboratory computer tasks.

Balloon Analogue Risk Task. The Balloon Analogue Risk Task (BART)-adolescent version is a valid, reliable, performance-based, computer task designed to measure risk-taking behavior (Lejuez et al., 2007). Participants attempt to earn points by pumping up balloons presented on the screen. The goal is to pump up each balloon as much as possible without causing it to explode. To obtain points, participants must click the "Save Points" button before the balloon explodes to transfer points into a column of the left side of the screen. If the balloon is pumped up past its explosion point, the balloon on the screen makes a popping sound and potential points are lost. Points are given based on the number of pumps for trials in which the

balloon is successfully saved. A new balloon appears after each time points are saved or a balloon explodes until the participant has pumped up all the balloons (30 trials). The column on the side of the screen reflects the amount of points earned and indicates the level of the prize they have won (small, medium or large prize).

Risk-taking is measured by the number of pumps per balloon as well as the total number of explosions, in that individuals who demonstrate a high number of pumps and/or a high number of explosions are classified as demonstrating higher levels of risky behavior. The probability that a balloon will explode increases with each pump (1/128 for the first pump 2/128 for the second, 3/128 for the third), making the average breakpoint 64 pumps. Since the total number of pumps is constrained on balloons that exploded, the average number of pumps excluding those balloons that exploded (adjusted number of pumps) is the primary measure for risk-taking on the BART (Lejuez et al., 2003). The adjusted average number of pumps is associated with drug and alcohol use, cigarette smoking, gambling, not wearing a seatbelt, unprotected sex and stealing, suggesting ecological validity for this task (Lejuez et al., 2002).

Risk-Taking Questionnaire. In addition to the computerized assessment of risk-taking, we also used a questionnaire items to assess actual risky behavior. These items include 10 yes-no questions used previously (Lejuez et al., 2002). Directions asked children if they have “engaged in the following behaviors over the past 12 months?” Due to item overlap with our measure of child delinquency, we excluded 6 items from this scale that were more closely related to delinquency. One additional item was removed from the current study after ten families refused to participate in the study based on the item’s content (“Had sexual intercourse without a condom?”). Remaining items included, “ridden a bicycle or motorcycle without a helmet (even once)”, “gambled for real money”, and “ridden in a car without wearing your seatbelt (even

once).” Items were summed for analyses such that high scores indicated great risk-taking behavior. Children’s scores ranged from 0 to 3. Internal consistency was not computed due to using count variables (i.e., yes-no).

Impulsivity

Impulsivity was also assessed using two measures to validate our methods of measurement and to capture multiple aspects of the construct. Caregivers completed a questionnaire measure reporting on the impulsivity of the child and children engaged in a laboratory computer task.

Point Scoring Reaction Time Task. The Point Scoring Reaction Time Task (PSRT, Avila, 2001) is a computerized task designed to measure individual differences in impulsivity, sensitivity to punishment, and sensitivity to reward. Participants perform a task measuring reaction time (RT) in the presence of cues for punishment (a red circle) and reward (points). This task was modified from the version used in children (Colder & O'Connor, 2004). The task involved 20 practice trials and 4 experimental blocks, each of which included 50 3-second trials. The experimental blocks were administered in a fixed order- pre-reward, reward, punishment, and post-punishment. In each trial, a colored circle was presented above a two-digit number, and the participant’s task was to push the appropriate response button depending upon whether the number is odd or even. The stimuli were the same across the 4 blocks. Correct discriminations were rewarded by earning a variable number of points, which depended on reaction time (earned points = $635/RT$ in ms.). Faster RTs were rewarded with more points. Incorrect discriminations were punished with a loss of points. The pre-reward block included children responding to items with no reward. However, they could lose 3 points for incorrect responses. Before beginning the reward block, the participant was told to ignore the circles, and that they would be rewarded for correct discrimination. Before initiating the punishment block, participants were told that

responding to either an odd or even number when it was accompanied by a red circle will lead to a loss of 50% of total points. Thus, a red circle became a cue for potential punishment. Of the 50 trials, 4 include a red circle (aversive trials). Prior to initiating the post-punishment block, participants are told that a red circle will not cause a loss of points, and they should respond during these trials. The PSRT described in this study includes three changes from the original task used by Avila (2001). First, the trial length was changed from 2 to 3 seconds to allow children more time to discriminate between odd and even numbers. Second, the number of points lost for incorrect responses was changed from 5 to 3 points so that children's motivation was not reduced during the task. Finally, a pre-reward trial was added so that a comparison of reaction times between reward and no reward could be examined.

The number of red circles responded to during the punishment block (passive avoidance errors) provides a measure of impulsivity, such that high levels of red circles responses suggests high levels of impulsivity. Passive avoidance errors predict externalizing symptoms but not internalizing symptoms, suggesting ecological validity of the tasks (Colder & O'Connor, 2004). Impulsivity has been defined as the failure to withhold a motivated response that will lead to punishment or as a deficit in passive avoidance learning (Gray, Owen, Davis, & Tsaltas, 1983). The range of errors on this task was 0-4.

Sensitivity to Punishment Sensitivity to Reward Questionnaire. Caregiver report of the “impulsivity/fun seeking” scale of the Sensitivity to Punishment Sensitivity to Reward Questionnaire (SPSRQ)-child version (Colder & O'Connor, 2004) was used to assess impulsivity. This scale consists of 7 items, including “your child has a lot of difficulty ending a fun activity” and “your child has difficulty staying focused on their school work in the presence of an attractive alternative.” Caregivers responded using a 5-point Likert scale (1 = strongly disagree

to 5 = strongly agree). The SPSRQ-child version was adapted from the SPSRQ, which is an adult self-report measure of behavior (Torrubia & Tobena, 1984). All 4 subscales of the SPSRQ-child version have been found to be reliable (standardized α 's = .69-.87; (Colder & O'Connor, 2004). The impulsivity/fun seeking scale has also demonstrated convergent validity, with high levels (but not low levels) of impulsivity/fun seeking associated with psychophysiological measures of disinhibition/impulsivity (heart rate reactivity: $p < .01$; Colder & O'Connor, 2004). Mean scores were computed and used for analyses. Scores ranged from 1.4 to 4.3. The internal consistency of this scale in the current sample was modest ($\alpha = .66$).

Unsafe Neighborhood. Parents' perceptions of neighborhood safety were assessed using items adapted from the Self-Care Checklist (Posner & Vandell, 1994). This measure consists of 6 items regarding their feelings of personal safety as well as the safety of their child. High scores on this measure indicated feeling unsafe and/or that the neighborhood was dangerous for their child. Sample items include, "How safe do you feeling coming home alone?" and "How safe do you think it is for your child to play outside when you are home?" Parents responded on a 6-point Likert scale ranging from 1 = Very Safe to 6 = Very Unsafe. Mean scores were computed and used for analyses, where higher scores indicated more unsafe perceptions of the neighborhood. These items have been used previously in the ongoing Child Development Project, and safety has been shown to be associated with higher socioeconomic status ($r = .38$), intact marital status ($r = .33$) and lower levels of child externalizing behavior ($r = -.32$) with an internal consistency of .90 (Pettit et al., 1999). The internal consistency in the current sample was good ($\alpha = 0.87$).

Parental Monitoring. Caregiver reports on the Parental Monitoring and Knowledge Questionnaire were used to assess parental monitoring, or parents' knowledge of the child's

whereabouts, activities and associations (Stattin & Kerr, 2000). Previously, the “monitoring” scale of this questionnaire has been linked to lower incidences of normbreaking behavior, $r = -.34$, the internal consistency of parent-reported items was .89, and parents’ and children’s reports correlated at .38. Using 5-point Likert scales (1 = *never* to 5 = *always*), caregivers answered nine questions about their knowledge of their children. Sample items included, “Do you know where your child goes and what they do after school?” and “In the last month, have you ever had no idea of where your child was at night?” Items were reverse coded with higher scores indicating lower levels of monitoring. Means were computed and used for analyses. The internal consistency in the current sample was modest ($\alpha = 0.68$).

Physical Activity. Frequency of physical activity was assessed using caregiver reports of their child’s activities. The questionnaire items included “What type of physical activities (e.g., playing sports, riding bikes) does your child participate in” followed by “How often does your child engage in each of the activities”. Parents responded using a 7-point scale (0 = *never* to 6 = *5 or more times a week*). Two advanced graduate students then reviewed each of the activities provided by caregivers to ensure that they were indeed physical in nature. The highest frequency of physical activity was then identified and used for analyses.

Child Delinquency. Child delinquency was assessed using child report of Fergusson’s (1999) delinquency items. Children were asked to indicate whether they had engaged in a particular behavior in the past year by indicating yes or no on 14 items including “stolen or tried to steal something worth \$5 or less,” “skipped school without parents’ permission,” and “hit or threatened to hit someone (other than a family member).” This scale has been shown to be associated with many ecological factors such as family SES, parental conflict, mother/child interaction, parental alcoholism and parental criminal offending (Fergusson & Horwood, 1999).

During the consenting procedures, interviewers reassured children that all answers were private and parents would not be told their responses to any of these items. Scores were summed and used for analyses. Children's scores ranged from 0 to 4, out of a potential maximum of 14.

Data Analytic Strategy

SAS 9.1 statistical software was used to examine study hypotheses. Correlations, descriptive statistics (means and standard deviations), tolerance and variance inflation factor (VIF) values were first examined to test for multicollinearity. If tolerance was below 0.1 or VIF above 10, then there would be indication of multicollinearity issues (Kutner, Nachtsheim & Neter, 2001). A series of regression analyses were then used to evaluate the relation between impulsivity and delinquency as well as the relation between risk-taking and delinquency. Impulsivity and risk-taking were included in the same model to identify unique predictors of delinquency. Simultaneous regression was used to determine unique effects. Additionally, simultaneous regression is more appropriate than stepwise regression for small sample sizes (Tabachnick & Fidell, 2001). Following, regression analyses were used to examine neighborhood safety, parental monitoring, and physical activity (separately), as interactive effects of the relation between both impulsivity and risk-taking and delinquency. Note that age, gender, race and family income were examined as covariates in the regression model, as previous research has found demographic differences in delinquency (Coie & Dodge, 1998). All independent variables were centered prior to creating the interaction terms and prior to estimating the regression models to aid in the interpretation of the interactions. In an effort to be mindful of the relatively small sample size of the current study and to reduce the number of parameters estimated in a single model, interactions were examined in separate regression models. Significant interactions were conditioned at high (+1 SD) and low (-1 SD) levels of the

moderator to determine the nature of the interaction (Aiken & West, 1991). It was assumed that with the nature of delinquency in child, our outcome variable would be positively skewed. However, the decision not to transform data was made because many times transformation does not solve the problem of non-normality and can fundamentally alter the relationship between the independent and dependent variables (Allison, 1999). Additionally, a Bonferroni correction method was not used based on concerns with multivariate statistics and the reluctance to increase Type II error (Perneger, 1998).

Chapter 5

Results

Descriptive Statistics

Frequencies of delinquency items are reported in Table 1. The most commonly endorsed delinquent behavior was “hit or threatened to hit someone (other than family member).” Means, standard deviations, and correlations are reported in Table 2. The risk-taking questionnaire demonstrated concurrent validity with child delinquency ($r = 0.24, p < .05$) in the current sample; however, it did not demonstrate convergent validity with our risk-taking task (BART; $r = -0.04, p > .05$). The impulsivity items also demonstrated concurrent validity with child delinquency ($r = .29, p < .05$); however, although relations were in the expected direction, the measure was not significantly correlated with the impulsivity task (PSRT; $r = .15, p > .05$). Other correlations revealed that age was significantly positively associated with the risk-taking task (BART), but negatively associated with the impulsivity task (PSRT). Race was significantly positively associated with the impulsivity and risk-taking questionnaires, indicating that minority status was related to higher levels of these constructs. Family income was significantly positively associated with the risk-taking task and age. Unsafe neighborhood was significantly positively associated with the impulsivity questionnaire items and negatively associated with family income, indicating that unsafe perceptions of neighborhoods were related to higher levels of impulsivity and lower levels of family income. Physical activity was significantly negatively associated with race and unsafe neighborhood, indicating that higher levels of physical activity were related to Caucasian status and safer perceptions of neighborhoods. Based on correlations, variance inflation factors (VIF) and tolerance (TOL), there was no evidence of multicollinearity

among impulsivity (items: TOL = .78, VIF = 1.28; task: TOL = .81, VIF = 1.23) or risk-taking (items: TOL = .86, VIF = 1.16; task: TOL = .83, VIF = 1.20) variables.

Regression Analyses

Questionnaire Items. Child delinquency was simultaneously regressed on the impulsivity and risk-taking questionnaire items, unsafe neighborhood, parental monitoring, physical activity, age, sex, race and family income to examine unique associations (See Table 3). As expected, both impulsivity and risk-taking were significantly positively associated with child delinquency. Unsafe neighborhood, parental monitoring, physical activity and all demographic variables were unrelated to child delinquency.

Interactions Between Impulsivity Items and Contextual Factors. The interaction between impulsivity and unsafe neighborhood was then added to the model; however, no significant interaction was found ($B = -.14, p = .51$). Next, the impulsivity and parental monitoring interaction was added to the model and no significant interaction was found ($B = .69, p = .33$). Lastly, the impulsivity and physical activity interaction was added to the model and no significant interaction was found ($B = .02, p = .85$).

Interactions Between Risk-taking Items and Contextual Factors. The interaction between risk-taking and unsafe neighborhood was then added to the model and no significant interaction was found ($B = -.09, p = .61$). Next, the risk-taking and parental monitoring interaction was added to the model and no significant interaction was found ($B = -.26, p = .57$). Finally, the risk-taking and physical activity interaction was added to the model and no significant interaction was found ($B = .09, p = .18$).

Computer Tasks. Child delinquency was then regressed on the impulsivity and risk-taking computer tasks (PSRT and BART, respectively), unsafe neighborhood, parental monitoring,

physical activity, and the demographic variables (See Table 4). There were no significant associations in the model.

Interactions Between Impulsivity Task and Contextual Factors. The interaction between impulsivity and unsafe neighborhood was then added to the model and no significant interaction was found ($B = .18, p = .85$). Next, the impulsivity and parental monitoring interaction was added to the model and no significant interaction was found ($B = -.04, p = .99$). Lastly, the impulsivity and physical activity interaction was added to the model and no significant interaction was found ($B = .23, p = .53$).

Interactions Between Risk-taking Task and Contextual Factors. The interaction between risk-taking and unsafe neighborhood was then added to the model and no significant interaction was found ($B = .00, p = .98$). Next, the risk-taking and parental monitoring interaction was added to the model and no significant interaction was found ($B = -.01, p = .75$). Finally, the risk-taking and physical activity interaction was added to the model and a significant interaction was found ($B = -.01, p = .02$). At low levels of physical activity, risk-taking was positively associated with child delinquency ($B = .04, p = .02$). However, at high levels of physical activity, risk-taking and child delinquency were unrelated ($B = -.01, p = .36$).

Chapter 6

Discussion

The current study extended previous research by examining potential moderating effects of contextual factors on the links between both risk-taking and impulsivity and child delinquency. Additionally, the study attempted to replicate previous findings suggesting that impulsivity and risk-taking are related to delinquency (e.g., White et al., 1994; Leas & Mellor, 2000) and that the effects of impulsivity on delinquency are greater in at-risk neighborhoods (Lynam et al., 2000). Findings suggested impulsivity and risk-taking are positively related to child delinquency as measured by self-report questionnaires. Moreover, physical activity moderated the association between risk-taking propensity and child delinquency, such that the effect of risk-taking on delinquency was greater in children who engaged less frequently in physical activity.

As expected, impulsivity and risk-taking were positively associated with delinquency even when both variables were included in the same model, specifically when using questionnaire data. This indicates that these constructs are uniquely related to delinquency even when also considering the variance associated with the other temperament construct, as well as demographic and contextual factors. Current findings are consistent with previous research predicting adolescent delinquency from impulsivity and risk-taking propensity (Tremblay et al., 1994; Leas & Mellor, 2000). The current study also extends questionnaire measure findings by suggesting that these constructs uniquely account for variance in delinquency, providing evidence for these relations in pre-adolescence. Impulsivity is believed to result from behavioral disinhibition, or the tendency to act with less forethought than do most individuals of equal ability and knowledge (Dickman, 1993). This can lead to delinquent behavior in children

directly, by interfering with their ability to control behavior and think about future consequences and indirectly by causing academic problems leading to early school dropout and subsequent delinquent behavior (Moffitt, 1993). In contrast, risk-taking develops from valuing sensation-seeking over the anxiety of potential negative consequences of the behavior (Zuckerman, 1994). Thus, delinquency results from balancing the negative consequences of behavior with the perceived positive consequences (Gullone & Moore, 2000).

Contrary to expectation, the laboratory task measures of impulsivity (PSRT) and risk-taking (BART) were not related to delinquency. This was inconsistent with previous studies in which the BART predicted delinquent behavior independent of impulsivity (Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005) and various performance-based impulsivity tasks predicting delinquent behavior (White et al., 1994). Our non-significant finding for the PSRT task may be due to the limited range of the impulsivity variable. Impulsivity was measured by passive avoidance errors, which were based on only 4 punishment trials in which red circles were presented and may have restricted our variability. The BART, though positively correlated, was statistically unrelated to delinquency. This may be due to the low levels of risk-taking measured in this younger, community sample. The mean for this task in our pre-adolescent sample (24) was considerably less than an inner-city adolescent sample (38) previously reported (Lejuez, Aklin, Bornoalova, & Moolchan, 2005), and this difference may have attenuated the relation to delinquency.

Note, however, that current findings associated with the laboratory measures indicate that physical activity is a moderator of the relation between risk-taking propensity and child delinquency. It appears that physical activity may provide a protective function against risk-taking and its link to delinquency. However, children engaging in little or no physical activity are

vulnerable to the temptations associated with risk-taking propensity (i.e., delinquent behaviors). This extends previous research by further understanding the nature of the relation between risk-taking and delinquency in children. Physical activity appears to be an important factor to consider in the development of childhood problem behavior, based on evidence suggesting that physical activity has a positive impact on adolescent mental health (e.g., Fredricks & Eccles, 2005) and reduces the likelihood of risky behaviors (e.g., Nelson & Gordon-Larson, 2006). Physical activities may provide children with an environment with adult supervision and expose them to prosocial peers. This protective feature of physical activity is also consistent with research demonstrating a stress-buffering effect on anxiety (Carmack et al., 1999) and a relation to reduced risk for substance use (e.g., Werch et al., 2005). However, physical activity showed no significant interactions with impulsivity or either of the questionnaire measures. This may be due to the open-ended nature of our measure, which may have missed certain activities that parents did not consider to be related to exercise.

Surprisingly, neither parental monitoring nor neighborhood safety moderated any relations between impulsivity or risk-taking and delinquency. One potential explanation may be due to our neighborhood variable differing slightly from variables used previously. Lynam and colleagues (2000) characterized neighborhoods by SES while the current study used perceptions of neighborhood safety. Although safety is a key component of neighborhood disadvantage (Wandersman & Nation, 1998) it is only a single characteristic of the neighborhood. This may explain why our findings failed to replicate the impulsivity by neighborhood interaction (Lynam et al., 2000). Further, using perceptions of safety is a less objective measure of the neighborhood and official crime records may have produced a different result.

In addition, there were no significant interactions between parental monitoring and either risk-taking or impulsivity. One potential explanation may be the younger age range of the sample. Parental monitoring has been shown to limit problem behavior as well as moderate peer influences typically in adolescent samples (Pettit et al., 1999). The pre-adolescent age group in the current study did not show either of these effects and thus the effects of parental monitoring may be more robust when children reach adolescent and demonstrate more severe risky and delinquent behaviors (i.e., drug use, sexual riskiness). Further, there was a limited range of our parental monitoring variable, as no parents in the current sample reported extremely high levels of poor monitoring (up to 2.1 out of 5). Also, this scale demonstrated a low internal consistency, which may have limited the ability to detect significant effects.

Limitations, Conclusions and Implications

The current results need be considered in the light of their methodological limitations. First, this sample was small in size ($N = 89$) and may not have been powerful enough to detect certain effects. Secondly, the current study is cross-sectional in nature and thus longitudinal data is needed to fully understand the developmental implications of these associations. In addition, this was a community sample and children did not report high levels of delinquency. On average, children reported 0 or 1 delinquent behavior in the past year ($M = 0.5$, $SD = 0.9$); however the base rate was expected to be low because these were serious delinquent behaviors and thus indicate early engagement in child delinquency. Future studies should examine these relations in more severe delinquent populations and in lower SES, at-risk communities. Further, the risk-taking questionnaire consisted of only three items due to item overlap and thus there was a restricted range for this variable. Additionally, the physical activity variable was measured using an open ended question which made not account for the fully range of physical activity of the

child. The current study also employed self- and parent-reports. Although self-reporting is generally accepted as valid (e.g., Thornberry & Krohn, 2002), it would be useful for future studies to assess constructs using more objective measures such as legal records and neighborhood crime rates. Finally, internal consistencies of the impulsivity and monitoring measures in the current study were modest, which may have attenuated findings. Future studies using more internally consistent measures are needed.

Despite these limitations, physical activity appears to impact the relation between risk-taking propensity and child delinquency, suggesting that physical activity may be a protective factor to consider in future preventive interventions. Children demonstrating high levels of risk-taking propensity may benefit from organized extracurricular activities such as sports or other forms of exercise to reduce the likelihood of engaging in behaviors associated with risk-taking such as cigarette smoking (Lejuez et al., 2005). One intervention involving physical activity, Project SPORT, found long-term sustained effects of high-school students' reports of marijuana and cigarette use at 12-months postintervention (Werch et al., 2005). Future studies evaluating the effects of physical activity in school- and community-based interventions in preadolescent children is needed, particularly for those with higher risk-taking tendencies. If physical activity interventions prove to be effective in younger youth, they may prevent predisposed children from engaging in risky behavior and the potential serious legal consequences.

Child delinquency is a costly public health problem in our society. Taxpayers are burdened with the increase in multiple interventions provided by agencies such as special school services, child welfare services, and mental health agencies, such as family counseling centers. Further, there are barriers that often exist between agencies that include poor data sharing which like result in duplicated assessment and unintegrated service (Loeber & Farrington, 2000). The

cost to society to a single chronic youth offender for 4 years of offending as a juvenile and 10 years of offending as an adult is between \$1.7 to \$2.3 million (Cohen, 1998). Physical activity is an inexpensive prevention strategy that may reduce engagement in delinquent behavior, particularly for at risk youth.

References

- Acton, G. (2003). Measurement of impulsivity in a hierarchical model of personality traits: Implications for substance use. *Substance Use & Misuse, 38*, 67-83.
- Aiken, L. S., & West, S. G. (1991). *Multiple regression: testing and interpreting interactions*. Thousand Oaks, CA: Sage Publications, Inc.
- Aklin, W. M., Lejuez, C. W., Zvolensky, M. J. Kahler, C. W. & Gwadz, M. (2005). Evaluation of behavioral measures of risk taking propensity with inner city adolescents. *Behaviour Research and Therapy, 43*, 215-228.
- Allen, J. P., Aber, J., & Leadbeater, B. J. (1990). Adolescent problem behaviors: The influence of attachment and autonomy. *Psychiatric Clinics of North America, 13*, 455-467.
- Allison, P. D. (1999). *Multiple regression: a primer*. Thousand Oaks, CA: Pine Forge Press.
- Aneshensel, C. S., & Sucoff, C. A. (1996). The neighborhood context of adolescent mental health. *Journal of Health and Social Behavior, 37*, 293-310.
- Arnett, J. (1990). Contraceptive use, sensation seeking, and adolescent egocentrism. *Journal of Youth and Adolescence, 19*, 171-180.
- Arnett, J. (1992). Reckless behavior in adolescence: A developmental perspective. *Developmental Review, 12*, 339-373.
- Arthur, M. W., Hawkins, J., Pollard, J. A., Catalano, R. F., & Baglioni, A. (2002). Measuring risk and protective factors for substance use, delinquency, and other adolescent problem behaviors: The Communities That Care Youth Survey. *Evaluation Review, 26*, 575-601.
- Avila, C. (2001). Distinguishing BIS-mediated and BAS-mediated disinhibition mechanisms: A comparison of disinhibition models of Gray (1981, 1987) and of Patterson and Newman (1993). *Journal of Personality and Social Psychology, 80*, 311-324.

- Bauman, K. E., & Ennett, S. T. (1996). On the importance of peer influence for adolescent drug use: commonly neglected considerations. *Addiction, 91*, 185-198.
- Baumrind, D. (1991) The influence of parenting style on adolescent competence and substance use. *The Journal of Early Adolescence, 11*, 56-95.
- Brody, G. H. (2003). Parental monitoring: Action and reaction. In A. C. Crouter & A. Booth (Eds.), *Children's influence on family dynamics: The neglected side of family relationships* (pp. 163-169). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Bronfenbrenner, U. (1979). Contexts of child rearing: Problems and prospects. *American Psychologist, 34*, 844-850.
- Brooks-Gunn, J., Duncan, G. J., Klebanov, P. K., & Sealand, N. (1993). Do neighborhoods influence child and adolescent development? *American Journal of Sociology, 99*, 353-395.
- Cantillona, D., Davidson, W. S., & Schweitzer, J. H. (2003). Measuring community social organization: Sense of community as a mediator in social disorganization theory. *Journal of Criminal Justice, 31*, 321-339.
- Carmack, C. L., Boudreaux, E., Amaral-Melendez, M., Brantley, P. J., & de Moor, C. (1999). Aerobic fitness and leisure physical activity as moderators of the stress-illness relation. *Annals of Behavioral Medicine, 21*, 251-257.
- Casperson, C. J., Powell, K. E., & Christensen, G. M. (1985). Physical activity, exercise and physical fitness: Definitions and distinctions for health related research. *Public Health Reports, 100*, 126-131.

- Chassin, L., Pillow, D. R., Curran, P. J., Molina, B. S., & Barrera, M., Jr. (1993). Relation of parental alcoholism to early adolescent substance use: A test of three mediating mechanisms. *Journal of Abnormal Psychology, 102*, 3-19.
- Coie, J. D., & Dodge, K. A. (1998). Aggression and antisocial behavior. In N. Eisenberg & W. Damon (Eds.), *Handbook of child psychology, Vol. 3: Social, emotional, and personality development* (5th ed., pp. 779-862). New York: John Wiley & Sons Inc.
- Colder, C. R., Lengua, L. J., Fite, P. J., Mott, J. A., & Bush, N. R. (2006). Temperament in context: Infant temperament moderates the relationship between perceived neighborhood quality and behavior problems. *Journal of Applied Developmental Psychology, 27*, 456-467.
- Colder, C. R., & O'Connor, R. M. (2004). Gray's Reinforcement Sensitivity Model and Child Psychopathology: Laboratory and Questionnaire Assessment of the BAS and BIS. *Journal of Abnormal Child Psychology, 32*, 435-451.
- Colder, C. R., & Stice, E. (1998). A longitudinal study of the interactive effects of impulsivity and anger on adolescent problem behavior. *Journal of Youth and Adolescence, 27*, 255-274.
- Crouter, A. C., MacDermid, S. M., McHale, S. M., & Perry-Jenkins, M. (1990). Parental monitoring and perceptions of children's school performance and conduct in dual- and single-earner families. *Developmental Psychology, 26*, 649-657.
- Dickman, S. J. (1993). Impulsivity and information processing. In W. G. McCown, J. L. Johnson & M. B. Shure (Eds.), *The Impulsive Client: Theory, Research, and Treatment* (pp. 151-184). Washington, D.C.: American Psychological Association.

- DiClemente, R. J., Hansen, W. B., & Ponton, L. E. (1996). *Handbook of adolescent health risk behavior*. New York, NY: Plenum Press.
- Dishion, T. J., Capaldi, D., Spracklen, K. M., & Li, F. (1995). Peer ecology of male adolescent drug use. *Development and Psychopathology*, 7, 803-824.
- Duncan, S. C., Duncan, T. E., Strycker, L. A., & Chaumeton, N. R. (2002). Relations between youth antisocial and prosocial activities. *Journal of Behavioral Medicine*, 25, 425-438.
- Eccles, J. S., Barber, B. L., Stone, M., & Hunt, J. (2003). Extracurricular Activities and Adolescent Development. *Journal of Social Issues*, 59, 865-889.
- Eisenberg, N., Spinrad, T. L., Fabes, R. A., Reiser, M., Cumberland, A., Shepard, S. A., et al. (2004). The Relations of Effortful Control and Impulsivity to Children's Resiliency and Adjustment. *Child Development*, 75, 25-46.
- Eysenck, S. B. G., & Eysenck, H. J. (1977). The place of impulsiveness in a dimensional system of personality description. *British Journal of Clinical and Social Psychology*, 16, 57- 68.
- Farrington, D. P., & Loeber, R. (1999). Transatlantic replicability of risk factors in the development of delinquency. In P. Cohen, C. Slomkowski & L. N. Robins, *Historical and geographical influences on psychopathology* (pp. 299-329). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Farrington, D. P. (2007). Childhood risk factors and risk-focused prevention. In M. Maguire, Morgan, R., & Reiner, R., *The Oxford Handbook of Criminology* (4th ed.). Oxford: Oxford University Press.
- Fauth, R. C., Roth, J. L., & Brooks-Gunn, J. (2007). Does the neighborhood context alter the link between youth's after-school time activities and developmental outcomes? A multilevel analysis. *Developmental Psychology*, 43, 760-777.

- Felson, M. (2002). *Crime and Everyday Life*. Thousand Oaks, CA: Sage Publications, Inc.
- Fergusson, D. M. & Horwood, L. (1999). Prospective childhood predictors of deviant peer affiliations in adolescence. *The Journal of Child Psychology and Psychiatry*, 40, 581-592.
- Fergusson, D. M., Woodward, L. J., & Horwood, L. (1999). Childhood peer relationship problems and young people's involvement with deviant peers in adolescence. *Journal of Abnormal Child Psychology*, 27, 357-369.
- Fleming, C. B., Catalano, R. F., Mazza, J. J., Brown, E. C., Haggerty, K. P., & Harachi, T. W. (2008). After-school activities, misbehavior in school, and delinquency from the end of elementary school through the beginning of high school: A test of social development model hypotheses. *The Journal of Early Adolescence*, 28, 277-303.
- Fredricks, J. A., & Eccles, J. S. (2005). Family Socialization, Gender, and Sport Motivation and Involvement. *Journal of Sport & Exercise Psychology*, 27, 3-31.
- Gottfredson, M. R., & Hirschi, T. (1990). *A general theory of crime: (1990) A general theory of crime*.
- Gray, J. A., Owen, S., Davis, N., & Tsaltas, E. (1983). Psychological and physiological relations between anxiety and impulsivity. In M. Zuckerman, *Biological bases of sensation seeking, impulsivity, and anxiety* (pp. 181-217). Hillsdale, NJ: Erlbaum.
- Gullone, E. & Moore, S. (2000). Adolescent risk-taking and the five-factor model of personality. *Journal of Adolescence*, 23, 393-407.
- Hassmen, P., Koivula, N., & Uutela, A. (2000). Physical exercise and psychological well-being: A population study in Finland. *Preventive Medicine: An International Journal Devoted to Practice and Theory*, 30, 17-25.

- Hunt, M., & Hopko, D. (2009). Predicting High School Truancy Among Students in the Appalachian South. *The Journal of Primary Prevention, 30*, 549-567.
- Jessor, R., & Jessor, S. (1977). *Problem behavior and psychosocial development: a longitudinal study of youth*. New York, NY: Academic Press.
- Korbin, J., & Coulton, C. J. (1997). Understanding the neighborhood context for children and families: Combining epidemiological and ethnographic approaches. In J. Brooks-Gunn & G. J. Duncan (Eds.), *Neighborhood poverty: Vol. 2 Policy implications in studying neighborhoods* (pp. 65-79). New York: Russell Sage Foundation.
- Kulig, K., Brener, N., & McManus, T. (2003). Sexual activity and substance use among adolescents by category or physical activity plus team sports participation. *Archives of Pediatric Adolescent Medicine, 157*, 905-912.
- Kutner, M. H., Nachtsheim, C., and Neter, J. (2004). *Applied Linear Regression Models*. (4th ed.) New York: McGraw-Hill/Irwin.
- Lambert, S. F., Brown, T. L., Phillips, C. M., & Ialongo, N. S. (2004). The Relationship Between Perceptions of Neighborhood Characteristics and Substance Use Among Urban African American Adolescents. *American Journal of Community Psychology, 34*, 205-218.
- Lavery, B., Siegel, A. W., Cousins, J. H., & Rubovits, D. S. (1993). Adolescent risk-taking: An analysis of problem behaviors in problem children. *Journal of Experimental Child Psychology, 55*, 277-294.
- Leas, L., & Mellor, D. (2000). Prediction of delinquency: The role of depression, risk-taking, and parental attachment. *Behaviour Change, 17*, 155-166.
- Leigh, B. C. (1999). Peril, chance, adventure: Concepts of risk, alcohol use and risky behavior in young adults. *Addiction, 94*, 371-383.

- Lejuez, C. W., Aklin, W. M., Bornovalova, M. A., & Moolchan, E. T. (2005). Differences in risk-taking propensity across inner-city adolescent ever- and never-smokers. *Nicotine and Tobacco Research, 7*, 71-79.
- Lejuez, C. W., Aklin, W. M., Daughters, S. B., Zvolensky, M. J., Kahler, C. W., & Gwadz, M. (2007). Reliability and validity of the youth version of the Balloon Analogue Risk Task (BART-Y) in the assessment of risk-taking behavior among inner-city adolescents. *Journal of Clinical Child and Adolescent Psychology, 36*, 106-111.
- Lejuez, C. W., Aklin, W. M., Zvolensky, M. J., & Pedulla, C. M. (2003). Evaluation of the Balloon Analogue Risk Task (BART) as a predictor of adolescent real-world risk-taking behaviours. *Journal of Adolescence, 26*, 475-479.
- Lejuez, C. W., Read, J. P., Kahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., et al. (2002). Evaluation of a behavioral measure of risk taking: The Balloon Analogue Risk Task (BART). *Journal of Experimental Psychology: Applied, 8*, 75-84.
- Loeber, R. (1990). Development and risk factors of juvenile antisocial behavior and delinquency. *Clinical Psychology Review, 10*, 1-41.
- Loeber, R., & Farrington, D. P. (2000). Young children who commit crime: Epidemiology, developmental origins, risk factors, early interventions, and policy implications. *Development and Psychopathology, 12*, 737-762.
- Logue, A. (1988). Research on self-control: An integrating framework. *Behavioral and Brain Sciences, 11*, 665-709.
- Lynam, D. R., Caspi, A., Moffit, T. E., Wikstrom, P.-O., Loeber, R., & Novak, S. (2000). The interaction between impulsivity and neighborhood context on offending: The effects of

- impulsivity are stronger in poorer neighborhoods. *Journal of Abnormal Psychology, 109*, 563-574.
- Maggs, J. L., Frome, P. M., Eccles, J. S., & Barber, B. L. (1997). Psychosocial resources, adolescent risk behaviour and young adult adjustment: Is risk taking more dangerous for some than others? *Journal of Adolescence, 20*, 103-119.
- Markowitz, F. E. (2003). Socioeconomic disadvantage and violence: Recent research on culture and neighborhood control as explanatory mechanisms. *Aggression and Violent Behavior, 8*, 145-154.
- Meier, M. H., Slutske, W. S., Arndt, S., & Cadoret, R. J. (2008). Impulsive and callous traits are more strongly associated with delinquent behavior in higher risk neighborhoods among boys and girls. *Journal of Abnormal Psychology, 117*, 377-385.
- Metzler, C. W., Noell, J., Biglan, A., Ary, D., & Smolkowski, K. (1994). The social context for risky sexual behavior among adolescents. *Journal of Behavioral Medicine, 17*, 419-438.
- Miller, W. B. (1958) Lower class culture as a generating milieu of gang delinquency. *Journal of Social Issues, 14*, 5-19.
- Moffitt, T. E. (1993). Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Review, 100*, 674-701.
- Nelson, M. C., & Gordon-Larsen, P. (2006). Physical activity and sedentary behavior patterns are associated with selected adolescent health risk behaviors. *Pediatrics, 117*, 1281-1290.
- Norris, R., Carroll, D., & Cochrane, R. (1992). The effects of physical activity and exercise training on psychological stress and well-being in an adolescent population. *Journal of Psychosomatic Research, 36*, 55-65.

- O'Neil, R., Parke, R. D., & McDowell, D. J. (2001). Objective and subjective features of children's neighborhoods: Relations to parental regulatory strategies and children's social competence. *Journal of Applied Developmental Psychology, 22*, 135-155.
- Pate, R. R., Heath, G. W., Dowda, M., & Trost, S. G. (1996). Associations between physical activity and other health behaviors in a representative sample of US adolescents. *American Journal of Public Health, 86*, 1577-1581.
- Patterson, C., & Newman, J. P. (1993). Reflectivity and learning from aversive events: Toward a psychological mechanism for the syndromes of disinhibition. *Psychological Review, 100*, 716-736.
- Patterson, G. R., DeBaryshe, B. D., & Ramsey, E. (1989). A developmental perspective on antisocial behavior. *American Psychologist, 44*, 329-335.
- Patterson, G. R., & Dishion, T. J. (1985). Contribution of families and peers to delinquency. *Criminology, 23*, 63-77.
- Perneger, T. V. (1998). What's wrong with Bonferroni adjustments? *British Medical Journal, 316*, 1236-1238.
- Peterson, G. W., Steinmetz, S.K., Wilson, S.M. (2005). *Parent-youth relations: cultural and cross-cultural perspectives*. Binghamton, NY: Haworth.
- Pettit, G. S., Bates, J. E., Dodge, K. A., & Meece, D. W. (1999). The impact of after-school peer contact on early adolescent externalizing problems is moderated by parental monitoring, perceived neighborhood safety, and prior adjustment. *Child Development, 70*, 768-778.
- Physical Activity and Health: A Report of the Surgeon General*. (1996). Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.

- Piaget, J. (1972). Some aspects of operations. In M. W. Piers (Ed.), *Play and development* (pp. 15-27). New York: Norton.
- Posner, J. K., & Vandell, D. L. (1994). Low-income children's after-school care: Are there beneficial effects of after-school programs? *Child Development, 65*, 440-456.
- Reddon, J. R., Pope, G. A., Friel, J. P., & Sinha, B. K. (1996). Leisure motivation in relation to psychosocial adjustment and personality in young offender and high school samples. *Journal of Clinical Psychology, 52*, 679-685.
- Reid, J. B., & Patterson, G. R. (1989). The development of antisocial behaviour patterns in childhood and adolescence. *European Journal of Personality, 3*, 107-119.
- Romer, D., Black, M., Ricardo, I., Feigelman, S., & et al. (1994). Social influences on the sexual behavior of youth at risk for HIV exposure. *American Journal of Public Health, 84*, 977-985.
- Rothbart, M. K., & Bates, J. E. (1998). Temperament. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology: Vol 3. Social, emotional, and personality development* (5th ed., pp. 105-176). Mahwah, NJ: Erlbaum.
- Schwebel, D. C., & Bounds, M. L. (2003). The Role of Parents and Temperament on Children's Estimation of Physical Ability: Links to Unintentional Injury Prevention. *Journal of Pediatric Psychology, 28*, 505-516.
- Sample, S. J., Zians, J., Grant, I., & Patterson, T. L. (2005). Impulsivity and methamphetamine use. *Journal of Substance Abuse Treatment, 29*, 85-93.
- Snyder, H. (2008). Juvenile Arrests 2006. *Office of Juvenile Justice and Delinquency Prevention*.
- Spinella, M. (2004). Neurobehavioral correlates of impulsivity: evidence of prefrontal involvement. *International Journal of Neuroscience, 114*, 95-104.

- Stattin, H., & Kerr, M. (2000). Parental monitoring: A reinterpretation. *Child Development, 71*, 1072-1085.
- Steinberg, L. (2007). Risk taking in adolescence: New perspectives from brain and behavioral science. *Current Directions in Psychological Science, 16*, 55-59.
- Tabachnick B., & Fidell, L. (2001). *Using Multivariate Statistics*. (4th ed.) New York: Harper Collins.
- Torrubia, R., & Tobena, A. (1984). A scale for the assessment of susceptibility to punishment' as a measure of anxiety: preliminary results. *Personality and Individual Differences, 5*, 371-375.
- Tremblay, R. E., Pihl, R. O., Vitaro, F., & Dobkin, P. L. (1994). Predicting early onset of male antisocial behavior from preschool behavior. *Archives of General Psychiatry, 51*, 732-739.
- U.S. Physical Activity Statistics*. (2007). U.S. Department of Health and Human Services, Center for Disease Control and Prevention.
- Valois, R. F., MacDonald, J. M., Bretous, L., Fischer, M. A., & Drane, J. (2002). Risk factors and behaviors associated with adolescent violence and aggression. *American Journal of Health Behavior, 26*, 454-464.
- Vitaro, F., Brendgen, M., & Tremblay, R. E. (2000). Influence of deviant friends on delinquency: Searching for moderator variables. *Journal of Abnormal Child Psychology, 28*, 313-325.
- Vitulano, M., Fite, P. J., & Rathert, J. (in press). Delinquent Peer Influence on Childhood Delinquency: The Moderating Effect of Impulsivity. *Journal of Psychopathology and Behavioral Assessment*.

- Wandersman, A., & Nation, M. (1998). Urban neighborhoods and mental health: Psychological contributions to understanding toxicity, resilience, and interventions. *American Psychologist, 53*, 647-656.
- Weintraub, K. J., & Gold, M. (1991). Monitoring and delinquency. *Criminal Behaviour and Mental Health, 1*, 268-281.
- Welsh, B. C., Loeber, R., Stevens, B. R., Stouthamer-Loeber, M., Cohen, M. A., & Farrington, D. P. (2008). Costs of Juvenile Crime in Urban Areas: A Longitudinal Perspective. *Youth Violence and Juvenile Justice, 6*, 3-27.
- Werch, C., Moore, M. J., DiClemente, C. C., Bledsoe, R., & Jobli, E. (2005). A Multihealth Behavior Intervention Integrating Physical Activity and Substance Use Prevention for Adolescents. *Prevention Science, 6*, 213-226.
- White, J. L., Moffitt, T. E., Caspi, A., Bartusch, D. J., Needles, D. J., & Stouthamer-Loeber, M. (1994). Measuring impulsivity and examining its relationship to delinquency. *Journal of Abnormal Psychology, 103*, 192-205.
- Whiteside, S., & Lynam, D. R. (2001). The Five Factor Model and impulsivity: using a structural model of personality to understand impulsivity *Personality and Individual Differences, 30*, 669-689.
- Wikstrom, P. H., & Loeber, R. (2000). Do disadvantaged neighborhoods cause well-adjusted children to become adolescent delinquents? A study of male juvenile serious offending, individual risk and protective factors, and neighborhood context. *Criminology, 38*, 1109-1142.
- Wills, T. A., Sandy, J., & Shinar, O. (1999) Cloninger's Constructs Related to Substance Use Level and Problems in Late Adolescence: A Mediational Model Based on Self-Control

- and Coping Motives. *Experimental and Clinical Psychopathology*, 7, 122-134.
- Wood, P. B., Pfefferbaum, B., & Arneklev, B.J. (1993). Risk-taking and self-control: social psychological correlates of delinquency. *Journal of Crime and Justice*, 16, 111-130.
- Wood, M. D., Read, J. P., Mitchell, R. E., & Brand, N. H. (2004). Do parents still matter? Parent and peer influences on alcohol involvement among recent high school graduates. *Psychology of Addictive Behaviors*, 18, 19-30.
- Zuckerman, M. (1979). *Sensation Seeking: Beyond the Optimal Level of Arousal*. Hillsdale, NJ: Erlbaum.
- Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking*. New York, NY: Cambridge University Press.

Appendices

Table 1. Delinquency Item Frequencies

Item	N (%)
1. Purposely damaged property (not family members)	3 (3)
2. Stolen or tried to steal something worth more than \$50	0 (0)
3. Purposely set fire to property, or tried to	2 (2)
4. Used alcohol with parents permission	0
5. Carried a hidden weapon	0
6. Stolen or tried to steal something worth \$5 or less	9 (10)
7. Used marijuana or hashish	0
8. Sold marijuana or hashish	0
9. Attacked someone with the idea of seriously hurting or killing them	2 (2)
10. Stole things from parents or family members	10 (11)
11. Hit or threatened to hit someone (other than family member)	14 (16)
12. Smoked cigarettes	0
13. Skipped school without parents' permission	1 (1)
14. Been in trouble with the police	6 (7)

Table 2. Correlations, Means, Standard Deviations of study variables

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12
Outcome														
1. Child Delinquency	.53	.93	-											
Predictor														
2. Impulsivity (items)	2.75	.56	.29*	-										
3. Risk-taking (items)	1.19	.84	.25*	.17	-									
4. Impulsivity (PSRT)	.13	.18	-.18	.15	-.17	-								
5. Risk-taking (BART)	24.45	11.44	.17	.05	-.04	-.21	-							
Demographic														
6. Age	10.44	1.14	.10	.05	.13	-.34*	.26*	-						
7. Sex	1.44	.50	-.16	-.17	-.12	.15	-.20	-.08	-					
8. Race	1.26	.44	.08	.26*	.27*	.09	-.19	-.07	.00	-				
9. Family Income	62,666	50,916	.16	-.10	-.01	-.16	.23*	.26*	-.02	-.18	-			
Moderator														
10. Unsafe Neighborhood	1.87	.78	-.06	.21*	.01	-.01	-.13	-.17	.21	.06	-.23*	-		
11. Parental Monitoring	1.35	.27	.11	.23	.14	.08	-.02	.09	-.08	.15	.03	.14	-	
12. Physical Activity	4.67	1.87	.01	-.16	.10	-.10	-.01	-.04	-.20	-.25*	.10	-.26*	.06	-

M = mean, *SD* = standard deviation, BART = Balloon Analog Risk Task, PSRT = Point Scoring Reaction Time, Sex (1 = male, 2 = female), Race (1 = Caucasian, 2 = Minority); * $p \leq 0.05$

Table 3. Child Delinquency regressed on Questionnaire Items

F(9,74) = 2.07, R² = 0.20

Variable	B	SE	<i>t</i>
Impulsivity (items)	.56	.20	2.78**
Risk-taking (items)	.24	.13	1.95*
Unsafe Neighborhood	-.12	.14	-.90
Parental Monitoring	-.00	.38	-.00
Physical Activity	-.02	.06	-.31
Age	-.01	.09	-.07
Sex	-.05	.22	-.23
Race	-.01	.25	-.04
Family Income	.00	.00	1.67

*p ≤ .05, **p ≤ .01

Table 4. Child Delinquency regressed on Computer Tasks

F(9,65) = 1.14, R ² = 0.14			
Variable	B	SE	<i>t</i>
Impulsivity (PSRT)	-.75	.74	-1.00
Risk-taking (BART)	.01	.01	1.06
Unsafe Neighborhood	-.07	.16	-.43
Parental Monitoring	.64	.44	1.44
Physical Activity	.00	.08	.06
Age	-.06	.12	-.53
Sex	-.26	.25	-1.06
Race	.23	.30	.80
Family Income	.00	.00	1.07

*p ≤ .05, **p ≤ .01

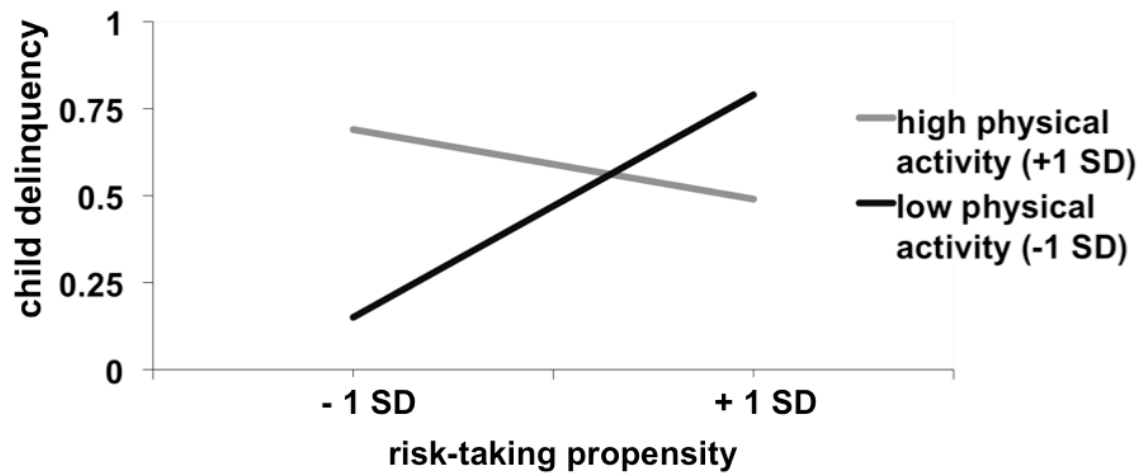


Figure 1.

Association between risk-taking propensity (measured by the BART) and child delinquency at high and low levels of physical activity

Vita

I received my B.A. from Wesleyan University in May, 2006. My current research interests include individual and contextual risk and protective factors for childhood psychopathology as well as the developmental progression of ADHD and disruptive behavior. I am also interested in how community factors (e.g., neighborhood, organizations) influence child development.