A Behavioral Economic Approach to Preventing Adolescent Violence

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Abstract

Youth violence is a serious public health and criminal justice concern that disproportionately affects African American and Hispanic/Latinx youth. Prevention Science researchers have identified co-occurring behaviors and risk factors for adolescent violence (Hawkins et al., 1992; 2002; 2011), some of which have been explored by behavioral economic researchers. Research increasingly suggests that delay discounting may be a trans-disease process (Bickel et al., 2012). However, there is limited research examining the relationship between delay discounting (DD) or probability discounting (PD) and adolescent violence.

The study was conducted in the context of a broader violence prevention study with youth in Kansas City Kansas who are at elevated risk for violence (Southeast Kansas Education Service Center, 2018). The study was largely exploratory, examining impulsivity (i.e., delay discounting) and risk taking (i.e., probability discounting, three Risk Taking Assessments [RTAs]) in relation to seven individual- and community-level risk factors for violence. Male youth demonstrated steeper DD than female youth. Self-reports of past violence (e.g., fighting, serious attack) were associated with steep DD regardless of the youth's gender. PD was not associated with risk factors, except for an inverse association with academic performance. On the RTAs, self-reported likelihood of fighting was associated with past fighting, disciplinary referrals, and academic failure. Youth who reported higher community risk scores reported greater likelihood of fighting, marijuana use, and stealing.

The present research identified new associations between risk factors and behavioral economic measures. It provided a novel, efficient measure of risk taking (RTAs) that was more sensitive than probability discounting. The study points to the need for continued research on risk factors using behavioral economic measures, toward the goal of preventing youth violence.

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A Behavioral Economic Approach to Preventing Youth Violence

Violence is a problem of societal importance that disproportionately affects racial and ethnic groups (Sheats et al., 2018). Overall, homicide is the leading cause of death for African Americans aged 1-44 years and in the top five leading causes of death for Hispanic/Latinx people aged 1-44 years (Centers for Disease Control and Prevention [CDC], 2019b). The problem is not only severe, but persistent, with the CDC reporting racial/ethnic and gender disparities in homicide for at least the past two decades (CDC, 2019e).

There is also disparity in homicide rates for African American and Hispanic/Latinx youth, especially males. Homicide is the leading cause of death for Black male youth and the second leading cause of death for Hispanic/Latinx male youth 15-24 years (CDC, 2019b). In 2019, homicide rates for males aged 10 to 24 was 51.36 per 100,000 for African American youth and 5.1 for Caucasian youth (CDC, 2019c). Nationally, the rate of violent victimization is also higher on average for male compared to female youth (U.S. Department of Justice [DOJ], 2018). African American and Hispanic/Latinx youth are also more likely to be victims of violent crimes such as robbery, simple assault, aggravated assault, and rape/sexual assault (Child Trends, 2018; DOJ, 2018).

Locally, violence is a concerning problem in Kansas City, Kansas (KCK). Years of Potential Life Lost (YPLL) is way of measuring the impact of violence on a community. It is an estimated measure of premature mortality, which calculates the number of years a person would have lived if they had not died prematurely (i.e., before the age of 75 years). In the state of Kansas, YPLL due to homicide is 256.2 years per 100,000 people (Kansas Health Matters, 2019). Comparatively, the Kansas City Metropolitan area, this number is disproportionately higher for African Americans, with roughly 1,231 YPLL per 100,000 African Americans

compared with 131.6 YPLL per 100,000 Caucasians (Kansas Health Matters, 2019). Locally, in Kansas City, KS (KCK), in 2020 there were 52 homicide victims in KCK of which 33% were youth. Of the youth victims, 25% were Black and 50% Hispanic/Latinx and 88% were male (Kansas City Kansas Police Department, 2020).

Efforts to prevent youth violence focus on youth ages 10 to 24, encompassing two developmental stages: adolescence (i.e., ages 10 to 19) into young adulthood (i.e., ages 19 to 24) (CDC, 2019d; World Health Organization, 2019). Adolescence is a period of immense physical, emotional, and social change beginning just prior to puberty and ending when an individual assumes adult responsibilities (Hartley & Somerville, 2015). Adolescence is also a vulnerable period for the onset of variety of problem behaviors, including initiation of substance use, risky sexual behavior, criminal offenses, and behaviors that lead to both intentional and unintentional injury (Stranger et al., 2013; Casey et al., 2008). While older adolescents and young adults are more likely to experience homicide, more than 40% of all youth victims of homicide in 2018 were under age 12 (Global Change Data Lab, 2018; OJJDP, 2020). Alarmingly, younger adolescents (aged 12 to 14) experience higher rates of violent crime victimization compared to older youth (18 to 20) at a rate of 3,600 compared with 2,100 per 100,000 individuals (US DOJ, 2018). Thus, adolescence is a critical period for intervening and preventing youth violence.

Prevention Science

Prevention Science is a scientific approach that identifies environmental or contextual variables, called risk and protective factors, that predict undesirable health outcomes including youth violence (Hawkins et al., 2002). Risk factors are defined as, “characteristics within the individual or conditions in the family, school, or community that increase the likelihood that someone will engage in unhealthy behavior” (Hawkins & Catalano, 1992). Many of the risk

factors for youth violence are shared with other adolescent problem behaviors including delinquency, teen pregnancy, substance abuse, and school drop-out (Hawkins et al., 1992; Appendix A). There is also considerable overlap in the risk and protective factors between victims and perpetrators of violence; some researchers posit that youth perpetrators are likely to have been victims and vice versa (Russell et al., 2010). Thus, the CDC promotes addressing risk and protective factors for both violent victimization and perpetration to prevent violence (CDC, 2019, Appendix B).

Preventing complex behavior such as youth violence requires addressing the problem at multiple social-ecological levels (e.g., individual, relationship, community, societal) (CDC, 2019d, 2021; Appendix A and B). Individual-level risk factors are defined as biological and personal history factors that put him/her at risk for violence (CDC, 2021). For example, being male is an individual-level risk factor for violence. The CDC defines relationship-level risk factors as interactions between multiple people (e.g., peer, family) that may contribute to violence. Youth that show poor academic performance and low interest or lack of commitment to school are also more likely to associate with delinquent peers, which is one of the strongest predictors of serious violence (Herrenkohl et al., 2000). Community-level risk factors are defined as the settings in which social relationships occur and the characteristics of these settings that put individuals at risk for violence (CDC, 2021). Living in communities characterized by diminished economic opportunities or high concentrations of poor residents is a community-level risk factor for violence (CDC, 2020; Appendix B).

Youth violence can be prevented by reducing risk factors and increasing protective factors that influence an individual's behaviors and environments during development (Hawkins et al., 2002; CDC, 2019). Longitudinal research suggests that youths who are exposed to a

greater number of risk factors are more likely to perpetrate violence (Herrenkohl et al., 2000). Interventions across multiple domains are recommended to address the multiple risk factors for violence to prevent victimization and perpetration (Substance Abuse and Mental Health Services Administration, 2019).

Behavioral Economics

Behavioral economics researchers have a robust history of examining problem behavior including substance abuse, problem gambling, alcohol abuse, and obesity, many of which share risk factors with youth violence (for review, see MacKillop et al., 2011; Herrenkohl et al., 2000). It is generally assumed that adolescents engage in more impulsive and risky behavior compared to children and adults, although it may depend on the assessment of impulsivity or risk-taking (Hartley & Somerville, 2015; Casey et al., 2008). Both risk taking behavior and impulsivity are associated with adolescent problem behaviors, including violence. Impulsivity has been widely examined in relation to adolescent substance abuse (see, Argyriou et al., 2018) and is one of the strongest predictors of criminal behavior (Gottfredson & Hirishi, 1990; Farrington, 1995, Cruise et al., 2008). Risk-taking has been studied in relation to adolescent substance abuse and problem behavior, including violence (e.g., Feldstein & Miller, 2009; MacDonald et al., 2005). Additionally, researchers have found that involvement in health-related risk-taking behaviors such as risky sexual behavior, drug use, and alcohol use are associated with increased violence (MacDonald et al., 2005).

Impulsivity is broadly defined as a tendency to act immediately, disregarding alternative behaviors that might lead to longer-term success (Madden and Johnson, in Madden & Bickel, 2010, p. 11). For example, a child running into the street after a lost ball without looking for cars could be considered to have acted impulsively. The “marshmallow task” is a classic illustration

of impulsivity; children are asked to choose between eating one marshmallow now and two marshmallows later (e.g., delay of gratification tasks, Mischel & Ebbesen, 1970). Everyday examples of impulsivity include blurting out words or purchasing "impulse-buy" candy at the grocery check-out counter.

Risk taking is broadly defined as participation in behaviors that have probabilistic outcomes (Shead & Hodgins, 2009). In the same ball-in-the-road example given previously, risk taking would include running into the street to get the ball even after seeing that a car is closely approaching the ball in the road. In this case, the child might stop and see the car closely approaching, but still runs into the street, risking the possibility of being struck by the vehicle. Everyday examples of risk taking include gambling or speeding.

Behavioral economic researchers conceptualize delay discounting as an index of impulsivity and probability discounting as an index of risk-sensitivity (Shead & Hodgins, 2009; Madden & Bickel, 2010). Delay discounting tasks involve choosing between degrees of immediacy (e.g., delay) and magnitude (Jarmolowicz et al., 2012). Probability discounting tasks involve choosing between degrees of reward certainty (e.g., probability) and magnitude (e.g., amount, size, quantity) (Jarmolowicz et al., 2012). The two forms of discounting are sometimes assessed together, and researchers have questioned whether they reflect the same construct. However, research suggests that while they may share overlapping components, they reflect different processes (Olson et al., 2007; Jarmolowicz et al., 2012).

Delay Discounting

Delay discounting is used as an index of impulsivity and refers to how rapidly a reward loses its subjective value based on its temporal distance from receiving the reward (Madden and Bickel, 2010). In other words, the reward's subjective value is discounted based on how far it is

delayed in time (Mazur, 1987; MacKillop et al., 2011). In brief, delay discounting is generally assessed by asking participants to make several choices between smaller, sooner (SS) (e.g., $10 today) and larger, later (LL) (e.g., $100 in one month) rewards across time points until an indifference point is reached for each time point. For example, when offered the choice between $1 now or $10 after a delay of 1 day, a person may choose $10 after the delay (LL). However, when offered a subsequent choice between $5 now and $10 after 1 day, the person may choose to receive the $5 now (SS). In this case, the indifference point is the point at which the subjective value of the SS is equivalent to the LL (e.g., estimating the reward's value is approximately $2.50).

Delay discounting has been studied in humans with several procedural variations to the discounting task including written questionnaires, experiential tasks, and computerized tasks. Some common types of delay discounting procedures include the Monetary Choice Questionnaire (MCQ) (e.g., Kirby, 1997; Kirby et al., 1999), Experiential Discounting Task (EDT) (Reynolds & Shiffbauer, 2004), adjusting-delay procedures (e.g., Mazur, 1987), and adjusting-amount procedures (e.g., Rachlin et al., 1991). Discounting data can be summarized by calculating the Area Under the Curve (AUC) or using a formula for model fitting to produce the slope of the curve (Myerson et al., 2001; McKerchar et al., 2009). Once graphed, the slope of the curve of indifference points is described as relatively steep or shallow. Steep delay discounting curves indicate more discounting (e.g., more impulsivity, as the delay to receiving the reward increases, the reward loses value). Conversely, shallow delay discounting curves demonstrate less discounting (e.g., less impulsivity, even as the delay to the reward increases, the reward maintains its value).

Probability Discounting

In behavioral economics research, probability discounting is used to assess risk-sensitivity (Shead & Hodgins, 2009). Probability discounting refers to how rapidly a reward loses its subjective value based on its likelihood of receipt to the individual. In other words, the reward's value is discounted based on how probabilistic (certain/uncertain) it is to be received (McKerchar & Renda, 2012). Probability discounting is typically assessed by asking participants to make choices between guaranteed rewards and probabilistic rewards. For example, participants might be asked, "Would you rather be guaranteed to get $10 or have a 95% chance to get $100?" Questions are typically asked multiple times across monetary values and percentages of chance until indifference points are reached. Indifference points are defined as the average point at which the participant switched preference (Odum, 2011).

Probability data can be summarized by calculating the Area Under the Curve (AUC) or using a formula for model fitting to produce the slope of the curve. The slope of the curve of indifference points is described as relatively shallow or steep. Shallow probability discounting indicates more risk taking (i.e., even as the odds against receiving the reward increase, the value of the reward persists). Steep probability discounting represents less risk taking: the reward loses value as the reward becomes uncertain.

Discounting Research

A robust body of research on discounting exists with both humans and nonhuman animals. Researchers have examined discounting using different tasks, varying commodities, delays, currencies, and methods of presentation. Researchers have also systematically examined the effects of magnitudes of the reward (e.g., $1 or $1,000), gain or loss framing (e.g., get $100 or pay $100), and the effects of reward type (e.g., real, hypothetical) (McKerchar & Renda,

2012; Matta et al., 2012). Smaller, sooner rewards are typically preferred over larger, later rewards (Johnson & Bickel, 2008). Delay discounting is associated with addiction in adults; steeper discounting has repeatedly been found with individuals who abuse cocaine, alcohol, nicotine, stimulants, and opiates. Research on probability discounting is less robust; however, shallower probability discounting (more risk taking) has repeatedly been found with problem gamblers (e.g., Garami & Moustafa, 2019).

Individual differences in discounting are generally considered to be stable in the absence of intervention, but malleable based on contextual factors including treatment (Odum 2011; Mazur & Logue, 1978; Dixon & Holcomb, 2000; Bickel et al., 2011; Black & Rosen, 2011; Koffarnus et al., 2013). Delay discounting patterns are associated with addiction severity and predictive of treatment outcomes in individuals with substance abuse problems (Robles et al., 2011; Stranger et al., 2013). Thus, researchers have called for using delay discounting to identify and target individuals who are at risk for developing substance abuse disorder (Murphy et al., 2007, McKerchar & Renda, 2012). Delay discounting could also be a useful marker for targeted prevention efforts for other problem behaviors (e.g., violence).

Adolescent Populations

There is more research on delay and probability discounting with adult populations than adolescent populations (Moore, et al., in preparation). When examining discounting with adolescents, an important question is whether adolescents discount more steeply than adults and/or whether discounting patterns change with maturation. Cross-sectional research involves comparing groups of individuals of a certain age to groups of individuals of a different age. Most cross-sectional research indicates that younger individuals discount delays more than older individuals (Steinberg et al., 2009; Whelan & McHugh, 2009; Lee et al., 2013; Lee et al., 2015;

Hendrickson & Rasmussen, 2016; Olson et al., 2007; de Water et al., 2014). Only one study has been conducted to explore age-differences in *probability* discounting; no differences between age groups were found (Olson, et al., 2007). Cross-sectional research is interpreted to suggest that delay discounting is elevated in certain age groups. However, it does not necessarily mean that delay discounting improves with age.

A few authors have tested whether delay discounting changes with maturation using longitudinal research. In a two-year longitudinal study, significant test-retest correlations were observed for adolescents (aged 16 and 18 at baseline), indicating that individual differences in this age group are stable (Anokhin, Golosheykin et al., 2015). These results have been replicated twice using 2-year longitudinal designs (e.g., Achterberg et al., 2016, Peper et al., 2018). Researchers examining the reliability and stability of delay discounting tasks with adolescents demonstrated that the task showed acceptable temporal stability and very good internal consistency (Martinez-Loredo et al., 2017). This indicates that delay discounting in adolescents is at least stable in the absence of intervention for 2 years. Little to no research on probability discounting maturation have been conducted (Moore et al., in prep).

In addition to exploring developmental differences in discounting, discounting has been assessed with adolescents across a broad array of countries and a variety of locations in the United States of America. However, only approximately half of published research on adolescent discounting includes any race/ethnicity demographics (Moore et al., in prep). Further, of the studies reporting race/ethnicity demographics, most do not include African American participants (33% of published articles) or Hispanic/Latinx participants (15% of published articles). When demographics were reported, African American (AA) and Hispanic/Latinx participants usually made up between 0-20% participants (Moore et al., in prep).

Fewer researchers have explicitly sought to explore the relation between race/ethnicity and adolescent discounting. Cheong et al. (2014) recruited African American participants aged 15 to 25 from disadvantaged urban areas and examined discounting rates compared to existing published research. Steinberg and colleagues (2009) reported a small, but statistically significant difference between African Americans and other populations (i.e., Asian, Latinx, white, other) among individuals aged 10 to 30 on discounting tasks. Specifically, African Americans demonstrated more delay discounting than other groups. Little to no published research exists on relations between race/ethnicity and adolescent probability discounting.

Adolescent Violence

Overall, there are few studies examining the relation between discounting and violence in adolescent populations, most of which examined severe, pathological behavior (e.g., qualifying for a Diagnostic and Statistical Manual of Mental Disorders [DSM-V] mental health diagnosis). Researchers have looked at related constructs such as aggression, externalizing, antisocial behavior, and DSM-V diagnoses (Psychopathy, Narcissism, Machiavellianism, and Conduct Disorder) (Moore et al., in prep), yielding mixed results. The most consistent results observed for the association between steeper delay discounting and conduct disorder; steeper delay discounting and psychopathy; and shallower probability discounting and narcissism (Melanko et al., 2009; Fanti et al., 2015; Castellanos-Ryan et al., 2014, 2016; Malesa & Ostaszewski, 2016). Although these findings point to the importance of examining discounting in relation to violence or pathological behavior, the behaviors studied all represent a high degree of clinical severity. Thus, there is a need to examine discounting in relation to behaviors that one might exhibit (e.g., fighting, weapon carrying) prior to receiving a diagnosis for pervasive and persistent diagnosed behavior related to violence.

Other Adolescent Problem Behavior

Despite the paucity of research on adolescent violence and discounting, many behaviors that co-occur with violence have been explored in relation to delay discounting. Delay discounting has been examined in relation to adolescent smoking, substance abuse, alcohol use, risky sexual behavior, disordered eating, gaming, and gambling. Probability discounting has been explored in relation to adolescent gaming/gambling and smoking.

Most published research confirms that adolescent smokers delay discount at higher rates than adolescent non-smokers (Reynolds & Fields, 2012; Reynolds et al., 2007; Audrian-McGovern et al., 2009; Quinsberry et al., 2016). Binge drinking in adolescents is also associated with higher delay discounting (Jones et al., 2017), as is consuming higher quantities or higher rates of drinking (Field et al., 2007; Sullivan et al., 2016. Most of the published research suggests that adolescents who engage in substance use delay discount more steeply than non-substance using adolescents, with a few exceptions (see Isen et al., 2014; Gonzalez et al., 2012 for exceptions; Konecky & Lawyer, 2015, Martinez-Loredo et al., 2015, Richardson & Edalti, 2016; Thamotharan et al., 2017, Martinez-Loredo et al., 2018).

Risky sexual behavior (RSB), disordered eating, and gaming/gambling have also been explored in relation to delay discounting, although less frequently. Higher delay discounting rates are associated with adolescents reporting that they have ever had sex, early sexual initiation, and past or current pregnancy (Chesson et al., 2006; Khurana & Romer, 2012). A few researchers have found associations between steeper delay discounting and disordered eating with adolescents (Fields et al., 2013; Fields et al., 2011; Kulendran et al., 2018). Further, obese adolescents delay discount at higher rates than healthy weight adolescents, and obese smokers

delay discount more than healthy weight smokers, suggesting that the relationship between discounting, obesity, and smoking may be additive in adolescents (Fields et al., 2011).

A few researchers have examined discounting and gambling, or gaming (e.g., video game use) with adolescent populations. The findings generally suggest elevated delay discounting is associated with gaming/gambling, although the dimensions of gaming/gambling in adolescent studies vary widely (Secades-Villa et al., 2016; Tian et al., 2018; Cosenza & Nigro, 2015; Bailey et al., 2013). One study reported that steeper delay discounting was positively correlated with use of First-Person Shooter (FSP) video games, suggesting a possible link between violence and discounting (Bailey et al., 2013).

There are few published articles on probability discounting with adolescent populations (Moore et al., in prep). In these studies, shallower probability discounting (i.e., more risk behavior) was associated with externalizing behavior and Narcissism (Olson et al., 2007; Malesa and Ostaszewski, 2016) and not associated with Internet Gaming Disorder (Tian et al., 2018). Further research examining probability discounting with adolescents is needed due to the sparsity of research.

Contextual Variables

As several behaviors that co-occur with violence are associated with discounting, many contextual variables that predict adolescent problem behaviors have also been studied in relation to discounting. A few individual-level risk factors have been found to be associated with steep discounting and adolescent problem behavior, including stress (Fields et al., 2009; Lu et al., 2014; Nigro et al., 2017); anxiety (Nigro et al., 2017), depression (Nigro et al., 2017; Imhoff et al., 2014), and working memory (Khurana et al., 2017; Khurana et al., 2013). Research identifying the relation between stress, depression, anxiety, discounting, and adolescent problem

behavior are particularly relevant to youth exposed to chronic stress in the form of economic hardship, which is associated with depression and anxiety (Kahn & Pearlin, 2006; McLoyd, 1990).

In contrast, academic performance has been reported as inversely correlated with steep delay discounting in adolescents (Audrain-McGovern et al., 2017; Farley & Kim-Spoon, 2017; Freeney & O'Connell, 2010; Lee et al., 2013; Wang et al., 2017). Academic performance has been examined several ways including based on college entrance examination scores, recent grades on school exams, educational track, student's self-report of grades, and overall GPA. Thus, academic performance may be protective against steep delay discounting (Audrain-McGovern et al., 2017; Farley & Kim-Spoon, 2017; Freeney & O'Connell, 2010; Lee et al., 2013; Wang et al., 2017).

Limited research has been conducted on relationship-level risk factors for violence and adolescent discounting. Although there is no noted research examining the relation between adolescent discounting and family history of violence, there is research indicating that having a family history of substance use disorders or family history of alcoholism are related to steeper delay discounting (Dougherty et al., 2014; Dougherty et al., 2016; Jones et al., 2017; Sullivan et al., 2016; Hertig et al., 2010). Youth with family histories of substance abuse may show steeper discounting prior to the onset of substance abuse (Dougherty et al., 2014). Likewise, adolescents with a family history of alcoholism show greater delay discounting compared to adolescents without a family history of alcoholism even prior to alcohol use (Herting et al., 2010). These studies indicate that delay discounting may be useful for identifying risk and preventing adolescent substance use and alcohol use. Identifying delay discounting rates in youth at risk for violence may prove similarly useful for preventing violence.

Little research examining community-level risk factors in relation to discounting exists. Although delay and probability discounting are typically examined in relation to maladaptive behavior, discounting is adaptive in some situations, such as environments where the payoff is relatively likely or predictable (Hirsh et al., 2008). Correspondingly, discounting is maladaptive in unpredictable or unstable environments. Resource poor environments are characterized by deprivation in which the likelihood of reinforcement is lean or more variable. Thus, there is a need for examining the relation between exposure to community-level risk factors and adolescent discounting.

Prediction and Treatment

A small body of literature on adolescent discounting has moved from identifying associations between problem behavior and discounting, to exploring implications for prediction and treatment of problem behavior, an important goal of discounting research. The results of these studies have been mixed, with some researchers reporting that delay discounting was predictive of treatment outcomes (e.g., Krishnan-Sarin et al., 2006) and others reporting no relation (e.g., Stranger et al., 2012, Harris et al., 2014). Some researchers have successfully reduced delay discounting by implementing interventions (e.g., Hendrickson & Rasmussen, 2016; Kulendran et al., 2018). Taken together, although the present research is somewhat promising, further research is needed to determine whether delay discounting rates are useful for predicting or improving treatment outcomes. Given the relatively sparse literature on adolescent discounting and violence, the necessary first step is to establish whether a relation exists between steep discounting and violence.

Need for Present Study

Research increasingly suggests that delay discounting may be a trans-disease process (Bickel et al., 2012); yet more research is needed across behaviors and populations. Many of the risk factors and co-occurring behaviors associated with violence have been explored in relation to adolescent discounting (e.g., smoking, substance use, alcohol abuse, risky sexual behavior, gaming/gambling). Despite extensive literature demonstrating a relation between co-occurring behaviors and shared risk factors for violence, relatively little literature exists examining the relationship between delay discounting and adolescent violence. Even fewer studies exist examining probability discounting with adolescents in general or in relation to violence, which warrants further research. Further, African American and Hispanic/Latinx individuals and groups are underrepresented in the discounting literature overall (Moore et al., in prep).

There is emerging evidence that violence may be associated with steep delay discounting; however, published research has primarily examined psychopathy, antisocial behavior, and conduct disorder. Ideally, prevention efforts should occur before youth exhibit behaviors at the severity and frequency that would meet criteria for mental health diagnosis. The proposed study is designed to explore the relation between discounting and violent behavior (e.g., fighting) as well as individual- and community-level risk factors related to violence.

Prior research suggests that delay discounting may have predictive utility in the treatment of other problem behavior (e.g., Stranger et al., 2012). Thus, baseline rates of delay discounting may have utility for predicting and/or preventing adolescent violence. However, given the novelty of the behavior examined (i.e., violence), developing a reliable methodology for studying delay discounting is an important precursor to extending research. Delay discounting has been studied using a common set of measurement procedures across multiple adolescent problem

behaviors (Moore et al., in prep). Thus, research extending the methodology to explore violence and related risk factors would be appropriate at this time.

Purpose and Significance of Study

The present study is largely exploratory as it extends behavioral research in several ways. The general aims of the research project are to (a) extend the generality of behavioral economic measures by exploring discounting with African American and Hispanic/Latinx youth participants; (b) establish whether an association exists between violence and discounting; and (c) examine whether individual- and community-level risk factors for violence are associated with discounting, to help identify earlier incidences of problem behavior including violence. Lastly, the proposed project may contribute to future research and follow-up studies using behavioral economic methods examining individual-, peer-, family-, and community-level risk factors for violence in adolescents, ultimately toward the goal of predicting and preventing youth violence.

Method

Study Context

This study took place as a part of a larger study funded by the Department of Health and Human Services, Office of Minority Health, Minority Youth Prevention II (MYVP II), Grant number: 1 YEPMP170096-01-00. The Center for Community Health and Development (CCHD) at the University of Kansas is the recipient and of the grant. The CCHD uses a community-based participatory research approach where community partners and stakeholders work together as equal partners in the research process. The CCHD and collaborative partners developed ThrYve (Together Helping Reduce Youth Violence for Equity) to adapt/develop, implement, evaluate, and disseminate a multicomponent youth violence prevention program. ThrYve's vision is

"Empowered Youth Thriving and Prospering in a Safe Community". The study has been approved by the Internal Review Board at the University of Kansas.

ThrYve addresses risk and protective factors across multiple levels that influences violent behaviors among African American and Hispanic/Latinx youth ages 12-18. Compared to the state of Kansas, youth in KCK experience elevated risk for violence across several socioecological levels. Youth in KCK report individual-level risk factors including early initiation to antisocial behavior, early initiation to drugs, favorable attitudes toward antisocial behavior (Southeast Kansas Education Service Center, Kansas Communities that Care [KCTC], 2018). They are also more likely to report gang involvement, interaction with antisocial peers, peer drug use, and rewards for antisocial behavior (KCTC, 2018). Compared to the state of Kansas, youth in KCK report higher rates of academic failure, more days of skipping school, and less commitment to school (KCTC, 2018). Youth in KCK are more likely to report family histories of antisocial behavior, parental attitudes favorable to antisocial behavior, and poor family management compared to youth in the state of Kansas (KCTC, 2018). A greater percentage of youth report community disorganization such as the presence of crime, drug selling, fighting, abandoned buildings, and lots of graffiti in their neighborhood (KCTC, 2018). Fewer youth report feeling safe in their neighborhoods compared to youth in the state of Kansas (KCTC, 2018). In 2017, 35% of youth in Wyandotte County compared to 16% of youth in Kansas indicated not feeling safe in their neighborhood (KCTC, 2018).

The strategic components of the project can be classified into two main categories or types of activities: (a) universal community-level strategies, and (b) targeted supports focused on a cohort of youth (8th through 12th grades) and their families who reside in the zip code priority areas based on inclusion criteria. These zip codes feed into the Carl Bruce (formerly Northwest

Middle School) and Wyandotte High School catchment area. The priority area was selected based on the disproportionate amount of violence experienced by youth living in the area. Specifically, 88% of youth homicide victimizations in KCK occurred within this 11 square mile area which comprises only 9% of Kansas City, Kansas (KCK Police Department, 2016).

Participants

The study included a total of 65 participants between the ages of 14- and 18-years (M= 16 years). Most participants were African American (71%) or Hispanic/Latinx (25%). Roughly 54% of the participants were male, and 46% were female. Most youth lived in zip code 66104 (n=29), followed by 66101 (n=10), 66112 (n=6), and 66102, 66103, and 66106.

Socioeconomic Status

Socioeconomic status (SES) was determined using participants address, which was collected from all study participants during informed consent procedures. To identify the SES in relation to the national average, the experimenter inputted the youth's address into ArcGIS software for Socioeconomic Status (NSES Index) by Census Tract (ArcGIS, 2019). The NSES Index yields a score on a scale from 0 to 100, with 50 as the national average. The Index incorporates the following indicators: median household income, percent of households with income below the Federal Poverty Line, educational attainment of adults aged 25+, unemployment rate, and percentage of households with children under the age of 18 that are "female-headed" (no male present)" at the census tract level. Based on their address, the majority (83%) of participants lived in areas that scored below the national average for neighborhood socioeconomic status (NSES) (range, 28-57.3). In general, all study participants lived in neighborhoods that could be considered disadvantaged neighborhoods.

Recruitment

Participants were recruited for the larger study between January 1, 2018 and January 31, 2020. ThrYve's recruitment, information, assent, and consent forms are translated into both Spanish and English to allow for Hispanic/Latinx individuals to participate. ThrYve staff and graduate students recruited participants through tabling at the schools as well as teacher/staff referral for youth identified to have one or more risk factors for violence (based on Hawkins and Catalano, 2002; Appendix A). The inclusion criteria to be enrolled in ThrYve include being enrolled in 8th, 9th, 10th, or 11th grades at priority school areas. Participants must have lived in one of the following the zip codes at the time of enrollment: 66115, 66101, 66102, 66104, and 66105. At the start of the study, each participant was assigned a unique ID for the purposes of the study which was stored on a password protected server.

Measurement

The study included: (a) the behavioral economic Decision-Making Assessment; (b) Kansas Communities that Care (KCTC) survey; and (c) Kansas City, Kansas Public Schools student data for disciplinary referrals and academic performance. Dependent variables (outcome variables) for the study were collected through the Decision-Making Assessment. Independent variables (grouping variables) were collected using KCK Public Schools data and the KCTC survey. Due to statutory restrictions on individual-level data sharing (KSA 38-2310), the study does not include KCK Police Department data.

The present study is a largely exploratory, correlational study, thus independent variables were not directly manipulated. Instead, the variables that would be considered "grouping variables" are listed as independent variables in the following sections. These are the groupings

along which data were analyzed. The variables that would be considered "outcome variables" are listed as dependent variables in the following sections.

Dependent Variables

Dependent variables for the study were collected through the Decision-Making Assessment, a computerized survey developed for the study (see Table 1). The DMA included: 1) delay discounting, 2) probability discounting, 3) risk-taking measure for fighting, 4) risk-taking measure for stealing, 5) risk-taking measure for marijuana use, and 6) demographics.

Table 1

Dependent Variables

Assessment	Variable
Delay discounting (DD)	*k*, AUC
Probability discounting (PD)	AUC
Risk Taking Fighting (RTF)	AUC
Risk Taking Stealing (RTS)	AUC
Risk Taking Marijuana (RTM)	AUC

Delay Discounting. Delay discounting indifference points were obtained using a titrating task. Participants are asked to make selections between smaller sooner and larger later rewards using the question, "Which reward would you prefer?" to prompt choices across multiple delays (i.e., 1 week, 1 month, 6 months, 1 year, 5 years, and 25 years). Area Under the Curve (AUC) and *k* are the dependent variables derived from the indifference points.

Area Under the Curve (AUC) was calculated as described by Myerson et al., (2001). First, indifference points were collected using an adjusting-amount procedure. Next, data were normalized (i.e., expressing the values as a proportion of the maximum value). Lastly, data were entered into the following formula to find AUC:

$$\sum (x_2 - x_1)\left[\frac{y_1 + y_2}{2}\right]$$

where x_1 and x_2 represent successive delays/probabilities and y_1 and y_2 represent the subjective values of the delays/probabilities (i.e., Myerson et al., 2001). In delay discounting tasks, the sum of the area under the trapezoids, called AUC, ranges from 0 to 1, with values closer to 0 indicating steep delay discounting and values closer to 1 indicating shallower delay discounting, which can also be determined based on visual inspection of the data (Myerson et al., 2001).

The *k* value was derived from Rachlin (2006)'s two-parameter hyperbola equation: $V = \frac{A}{(1+kD^S)}$. Smaller *k* values represent steeper delay discounting. Larger *k* values represent shallower delay discounting.

Probability Discounting. Probability discounting indifference points were obtained using a titrating task. Participants are asked to make selections between certain and probabilistic rewards using the question, "Which reward would you prefer?" to prompt choices across probabilities (75%, 50%, 25%, 10%, 5%, and 1%).

Area Under the Curve (AUC) is the dependent variable derived from the indifference points. AUC for probability discounting was calculated as described previously (Myerson et al., 2001). In probability discounting tasks, the AUC ranges from 0 to 1, with values closer to 0 indicating steeper probability discounting (i.e., less risk seeking) and values closer to 1 indicating shallower probability discounting (i.e., more risk seeking/persistence).

Risk-Taking Assessment. Risk taking data points were obtained by asking participants to move a sliding bar to answer the question, "There's a (1%, 5%, 10%, 25%, 50%, 75%, and 95%) chance of getting in trouble if you (steal, fight, use marijuana). Would you do it?" Based on the participants choice, a value between 0 and 1,000 was recorded where 0 corresponded with "Definitely would not" and 1,000 corresponded with "Definitely would."

Area Under the Curve (AUC) is a dependent variable derived from the participant's choices. AUC for risk taking was calculated as described previously (Myerson et al., 2001). In risk-taking tasks, the AUC ranges from 0 to 1, with values closer to 0 indicating less risk taking and values closer to 1 indicating more risk seeking/persistence.

Independent Variables

Several independent variables were analyzed in relation to delay discounting, probability discounting, and risk taking. The independent variables that are proxy for violent behavior include self-reported fighting and self-reported serious attack, both identified through the Kansas Communities that Care (KCTC) survey. The independent variables that are individual-level risk factors for violence include self-reported handgun carrying, attendance (absenteeism), grade-point average (academic failure), and disciplinary referrals. These data were obtained from the KCTC survey (i.e., self-reported handgun carrying) and KCKPS data, respectively. The independent variables that are community-level risk factors for violence included KCTC scale scores Community Disorganization, Laws and Norms Favorable to Drug Use, and Low Neighborhood Attachment which were analyzed as a single measure of Community Risk Factors (CRF). For data analysis, youth were grouped into low-risk and high-risk categories (see Table 2, Appendix E).

Table 2

Independent Variable Groupings

Variable	Low-Risk Category	High-Risk Category
Attendance	< 7 days missed	7+ missed days
GPA	2.00-4.00	0.00-1.99
Disciplinary referrals	0	1+
Self-report of fighting in past 12 months	0	1+
	0	1+
	0	

Self-report of serious attack in past 12 months	0-18	1+
Self-report of handgun carrying in past 12 months		19-42
Community Risk Factor score		

Absenteeism. The KCKPS reported the number of days a student missed in the school year. Absenteeism was defined as missing 7 or more days of school. Non-absenteeism was defined as missing less than 7 days of school.

Grade Point Average. The KCKPS reported cumulative Grade-Point-Average (GPA) for students on a scale from 0.00 to 4.00. A GPA of 4.0 represents straight As, whereas a GPA of 0.0 represents straight Fs. Youth with a GPA of 2.00 to 4.00 primarily have grades consisting of As, Bs, and Cs. Youth with a GPA of 0.00 to 1.99 primarily have grades consisting of Ds and Fs. Academically passing was defined as having a GPA 2.0 or above, as a 2.0 can be obtained with primarily C grades. Academically failing was defined as having a GPA 1.99 or below.

Disciplinary Referrals. KCKPS reported the number of disciplinary referrals youth received including disciplinary referrals, in-school suspensions, short-term suspensions, long-term suspensions, and expulsions. Youth who have not received any disciplinary referrals were defined as “no disciplinary referral.” Youth who received one or more disciplinary referrals were defined as “1 or more disciplinary referral.”

Self-Reported Fighting. Self-reported fighting was assessed using the KCTC question, “How many times in the past year (12 months) have you been involved in a fight on school property?”. The response options included, “Never,” “1 to 2 times”, “3 to 5 times” “6 to 9 times” “10 to 19 times” “20 to 29 times” “30 to 39 times” and “40+times”.

Self-Reported Serious Attack. Self-reported serious attack was assessed using the KCTC question, “How many times in the past year (12 months) have you attacked someone with

the idea of seriously hurting them?". The response options were the same as for self-reported fighting.

Self-Reported Handgun Carrying. Self-reported handgun carrying was assessed using the KCTC question, "How many times in the past year (12 months) have you "carried a handgun?". The response options were the same as for self-reported fighting.

Community Risk Factors. Three risk factor scales from the KCTC were used. Community Disorganization, Laws and Norms Favorable to Drug Use, and Low Neighborhood Attachment are composite variables collected from multiple questions on the survey. The questions and scoring are summarized in Table 3.

Table 3

Community-level Risk Factors

Variable	Questions included in measure	Rating Scale	Score	Total Score Possible
Community Disorganization	How much do each of the following statements describe your neighborhood, or the area around where you live?: (a) crime and/or drug selling (b) fights (c) lots of empty or abandoned buildings (d) lots of graffiti (e) I feel safe in my neighborhood or the area around where I live (reverse coded)	NO! no yes YES!	0 1 2 3	0-12
Laws and Norms Favorable to Drug Use	How wrong would most adults in your neighborhood or the area around where you live, think it is for kids your age to: (a) use marijuana (b) drink alcohol (c) smoke cigarettes? If a kid … (a) smokes marijuana in your neighborhood or the area around where you live (b) drank some beer, wine or hard	very wrong wrong a little bit wrong not wrong at all NO! no yes YES!	0 1 2 3 3 2 1 0	0-21

	liquor (c) carried a handgun (d) smoked cigarettes would he or she be caught by the police?			
Low Neighbor-hood Attachment	(a) I would like to get out of my neighborhood, or the area around where I live. (b) If I had to move, I would miss the neighborhood I now live in (reverse coded) (c) I like my neighborhood, or the area around where I live (reverse coded)	NO! no yes YES!	0 1 2 3	0-9

Procedures

Data collection occurred between January 1st, 2020 and March 17, 2020. KCTC surveys were conducted between January 15th, 2020 and April 17, 2020 which overlaps with the standard administration window of the KCTC survey by the KCK Public Schools. Decision-making assessments were conducted between January 1st, 2020 and March 4, 2020.

Setting and Materials

Behavioral economic assessment measures and youth risk and behavior surveys (i.e., KCTC survey) were administered on computers equipped with a keyboard and mouse. The behavioral economic survey was programmed using VisualBasic® and stored on a flash-drive with a short-cut that allowed it to run on any computer. Workspace areas for survey completion were equipped with a table and chairs. No other items were permitted to be present during survey administration.

All experimental sessions took place in semi-private locations (e.g., private room/office, school library, section of classroom). Occasionally, multiple youth completed the computerized survey in the same room; however, participants were seated such that they could not see each other's computer screens. The researchers monitored to ensure that participants did

not talk, exchange information, or use computers for any purpose besides completing the assessments. The Decision-Making Assessment took approximately 15 to 30 minutes to complete. Researchers also informed the youth that they were sometimes completing different surveys so they might not all finish at the same time.

Data Collection and Administration

To begin the decision-making assessment, ThrYve research staff opened the survey, typed the participant ID, and then stepped aside to allow the participant to read and follow the written instructions (see Appendix C). The staff remained present in the room to monitor appropriate behavior but did not answer questions regarding the survey contents. If youth asked the purpose of the survey, the staff were instructed to inform the youth that, "we are trying to learn more about how youth make decisions."

Delay Discounting. The delay discounting assessment was a titrating, adjusting-amount procedure presented on a computer. The first screen included the instructions, "You will answer questions about money. For each question, pick what you would prefer: the smaller amount now or the larger amount later. You will not get the amount you choose but pretend you will really get this amount." When the participant clicks "Okay" the first choice is presented. The instructions at the top of the screen always say, "Which reward would you prefer? Please click the 'Choose' button for your choice." The first choice presented is the choice between $500.00 today and $1,000 in 1 day (see Appendix C for image).

Based on the participant's selection, the computerized algorithm adjusted the immediate reward by ±50%. For example, if the smaller, sooner (SS) reward is chosen on the first trial, it is reduced by 50% on the subsequent trial (i.e., $250 today or $1,000 in 1 day); if the larger, later (LL) reward was selected, the SS reward is increased by 50% on the subsequent trial (i.e., now

increasing to $375 today or $1,000 in 1 day in the example given). The delayed reward amount and time are held static until an indifference point is reached between the static delayed option and immediate adjusting options. The process repeated for each subsequent delay (i.e., 1 week, 1 month, 6 months, 1 year, 5 years, and 25 years). Once indifference points were collected for each delay, the instructions for the next assessment began.

Probability Discounting. The probability discounting assessment was also a titrating adjusting-amount procedure. It began with the instructions, "Now you will answer questions about money. For each question, pick what you would prefer: the smaller amount FOR SURE (guaranteed) or the CHANCE to receive the larger amount. You will not get the amount you choose but pretend you will really get this amount." When the participant clicked "Okay" the first choice was presented.

The instructions at the top of the screen always said, "Which reward would you prefer? Please click the 'Choose' button for your choice." The first choice is a "A 100% chance of receiving $500.00 (guaranteed)" versus "A 95% chance of receiving $1,000.00." Based on the participant's selection, the immediate reward was adjusted using a computerized algorithm that adjusts the dollar amount by ±50%. For example, if the guaranteed reward was selected, the guaranteed reward was adjusted downward by 50%; if the chance reward was selected, the guaranteed reward was adjusted upward by 50%. Once an indifference point was obtained for 95% chance rewards, the same process was repeated for 75%, 50%, 25%, 10%, 5%, and 1%.

Risk-Taking Assessments. The instructions for the risk-taking assessments began with, "Now you will be asked to imagine about what you would do. The chance of getting in trouble will change for each question. Click okay to begin." When the participant clicked "Okay" a sliding scale showed on screen (see Appendix C). The instructions on the left of the slider said,

"Please slide to choose then click okay." At the top of the page, the screen said, "There's a 1% chance of getting in trouble if you get into a fight. Would you do it?" with one of the following percentages filled in (1%, 5%, 10%, 25%, 50%, 75%, and 95%). The slider had the phrase "Definitely would NOT" on the far left, "Might or might not" in the middle, and "Definitely would" on the far right. When the participant moved the slider and selected "Okay" the next percentage in the set was presented until all percentages had been assessed. The same assessment format was used to examine (a) fighting, "There's a 1% chance of getting in trouble if you get into a fight. Would you do it?", (b) stealing, "There's a 1% chance of getting in trouble if you steal. Would you do it?", and (c) marijuana-use, "There is a 1% chance of getting in trouble if you use marijuana. Would you do it?"

Each selection yielded one value ranging from -50 to 1,000 per probability assessed. For example, if a participant moved the slider all the way to, "Definitely would" (far right) a score of 1,000 was recorded. As a second example, if the participant moved the slider to the midpoint, "Might or might not" a score of 500 was be recorded. As a final example, if the participant moved the slider just enough that the instructions disappear, to "Definitely would NOT" (far left), a score of 0 was recorded. The negative values were included to require participants to move the slider before advancing; negative values were re-coded as zeros during data analysis. The opportunity to advance screens was not available until the participant moved the slider to some degree.

Demographic Questions. The final assessment in the Decision-Making Assessment included demographic questions. The instructions screen stated, "Next we will ask you some questions about yourself. Your answers will be kept secret. Please answer honestly." The questions in the demographic form are included in Appendix C. Age was collected in mm/dd/yy

format and calculated to the nearest year by subtracting the assessment date from the birth date. Gender was collected from choice options: male, female, transgender. Socioeconomic status was determined based on address at the census tract level. Race/ethnicity was collected from choice options: African American/Black, Hispanic/Latinx, Native American, Asian/Pacific Islander, Caucasian/White, Other. After the participant completed the demographic questionnaire, the instructions stated, "Thank you! Contact the staff, you are done!"

Kansas Communities that Care (KCTC). Kansas Communities that Care Survey data were collected following the standard protocol for survey administration. The administration instructions are provided in Appendix D. If students asked the purpose of the survey, the survey administrator was instructed to inform the youth that, "we are trying to learn more about what life is really like for kids in the community."

Kansas Communities that Care (KCTC) survey data were provided to the researchers in Microsoft Excel format for surveys collected during the standard KCTC administration window. The data used in the study include Participant ID; self-reported frequency of fighting in the past year, serious attack in the past year, and carrying a handgun in the last year; and responses to fourteen questions comprising the Community Risk Factor (CRF) score. A codebook was also provided to the primary investigator.

Kansas City Public Schools (KCPS). Kansas City, Kansas Public School Data. KCK Public School data were provided to the researchers in Microsoft Excel format for the 2019 academic school year. The data used in the study included Participant ID; cumulative grade-point-average on a scale from 0.00-4.99; attendance (i.e., count of days missed in school year 2019), and count of disciplinary referrals.

Data Analysis

Demographic Data

Descriptive statistics were calculated for demographic variables: age, gender, race/ethnicity, and socioeconomic status. Age was calculated using mm/dd/yy of assessment minus date of birth in mm/dd/yy. Gender was counted based on participants self-report from the response options: male, female, and transgender. Race/ethnicity was collected from the multi-select choice options: African American/Black, Hispanic/Latino, Native American, Asian/Pacific Islander, Caucasian/White, Other.

All demographic variables were examined as co-variates. Pearson's correlations were conducted to test for associations between age (in months) for each dependent variable (i.e., probability discounting AUC, delay discounting AUC, *k*). Pearson's correlations were also conducted to test for associations between SES score and each dependent variable. Pearson's correlations were conducted using Microsoft Excel.

Shapiro-Wilks tests for normality were conducted using GraphPad Prism® to assess race/ethnicity and gender. Both were non-normally distributed; Mann-Whitney U tests were conducted. Mann-Whitey U tests were conducted to identify whether gender was associated with each dependent variable. Mann-Whitney U tests were conducted to identify whether race/ethnicity was associated with each dependent variable.

Delay Discounting

Delay Discounting data were analyzed in two ways. First, non-linear regression comparison of fits testing was completed using GraphPad Prism® to identify which formula best fit the data between Mazur's (1987) hyperbolic discounting formula and Rachlin's (2006) two-parameter hyperbola. Mazur's (1987) hyperbolic discounting formula is $V= A/(1+kD)$ where A is the amount, D is the delay, and *k* is the derived constant representing delay discounting. Based

on the results of the model testing, non-linear regression was then used to fit functions to the indifference points using Rachlin's (2006) two-parameter hyperbola, deriving a constant s-value to be shared among all data sets and a *k* value representing delay discounting. On nonlinear regression graphs of delay discounting, delay (in days) is scaled to the x-axis and the indifference point is scaled to the y-axis. R^2 was used to assess goodness-of-fit.

Second, delay discounting data were analyzed using Area Under the Curve (AUC) such that the delay in proportion to the total is scaled to the x-axis and the indifference point in proportion to the total is scaled to the y-axis. Average *k* values, r^2 values, and average AUC values are presented for each independent variable by risk group. For delay discounting data, smaller AUC indicates steeper discounting (more impulsivity). Larger *k* values represent steeper discounting and r^2 closer to 1 indicate better fit of the data to the curve.

Data were examined using Johnson & Bickel's (2008) criteria for identifying nonsystematic discounting. Nonsystematic data were examined in comparison to demographic variables, in relation to independent variables, and compared with the remaining dataset to determine whether individuals whose data were nonsystematic data differed systematically in any meaningful ways (e.g., if all straight A students reported nonsystematic discounting). To permit the largest sample size possible, nonsystematic data were included and analyzed.

Probability Discounting

Probability data were analyzed using AUC as previously described using Microsoft Excel®. Graphs are presented of average indifference points using AUC such that the odds against in proportion to the total is scaled to the x-axis and the indifference point in proportion to the total is scaled to the y-axis. Average AUC values are presented. When interpreting probability discounting curves, shallower curves represent more risk taking/risk perseverance

and steeper curves represent less risk-taking/risk perseverance. For probability discounting data, smaller AUC indicates less risk taking/risk perseverance and larger AUC represents more risk taking/risk perseverance.

Risk-Taking Assessments

Risk-Taking Assessment (RTA) data are explored in two ways. First, data are presented by chance of getting in trouble (in percentage) and percentage of likelihood of engaging in the problem behavior. The chance of getting in trouble is scaled to the x-axis and likelihood of engaging in the problem behavior (i.e., marijuana use, stealing, fighting) is scaled to the y-axis. The average values are plotted for each group, where the lowest score possible of 0 (Definitely Would Not) represented 0% chance of engaging in the behavior and the highest score possible of 1,000 (Definitely Would) represented an 100% chance of engaging in the behavior. In an example of examining gender differences in risk taking, if the male participants on average reported "Definitely Would Not" (resulting in a score of 0 recorded) to the question, "There is a 1% chance of getting in trouble if you smoke marijuana, would you do it?" the data point would occur where 1% chance of getting in trouble and 0% chance of marijuana use intersect on the graph. If the male participants in this example reported on average "Definitely Would" (resulting in a score of 1,000 recorded) to the same question, the data point would occur at the 100% chance of marijuana use and 1% chance of getting in trouble intersection on the graph. This graphing convention allows descriptive analysis of youths' self-reported likelihood of engaging in problem behavior across chances of getting in trouble.

Second, data were analyzed using Area Under the Curve as previously described using Microsoft Excel®. The odds against in proportion to the total is scaled to the x-axis and the indifference point is scaled to the y-axis, plotted as a proportion of the total. Interpreting AUC

data for Risk-Taking Assessments follows the same pattern as interpreting Probability Discounting data: larger AUC indicates more risk taking/risk persistence and smaller AUC indicates less risk taking/risk persistence. Average AUC data are presented for each assessment by group.

Statistical Analysis

Average indifference points (probability discounting and delay discounting) and AUC (probability discounting, delay discounting, and RTAs) were calculated after data were dichotomized into groups (see Table 2) using Microsoft Excel®. Shapiro-Wilks tests were conducted using GraphPad Prism® to identify whether data were normally distributed (Ghasemi & Zahediasl, 2012). If data were normally distributed, independent samples t-tests were conducted to test for differences between groups. If data were non-normally distributed, Mann-Whitney U tests were conducted to test for differences between groups. Statistical testing was conducted using GraphPad Prism®.

Results

Demographic Variables

No correlations were observed between socioeconomic status (SES) and delay discounting AUC (r = .13; p = .29); nor between SES and delay discounting *k* (r = - .05; p = .69). No correlation were observed between SES And probability discounting AUC (r = -.20; p = .29); nor between SES and Risk Taking Marijuana AUC (r = -.05; p = .74); nor between SES Risk Taking Fighting AUC (r = -.05; p = .74); nor between SES and Risk Taking Stealing AUC (r = -.21; p = .10).

No correlations were observed between race/ethnicity and delay discounting AUC $U(N_{African\ American}=46, N_{Hispanic/Latinx}=16) = 274.00$, $p = .13$); nor between race/ethnicity and delay

discounting *k* $U(N_{African\ American}$ =46, $N_{Hispanic/Latinx}$=16) = 309.00, *p* = .35). No correlations between race/ethnicity and probability discounting AUC were observed $U(N_{African\ American}$ =46, $N_{Hispanic/Latinx}$=16) = 294.00, *p* = .71); nor between race/ethnicity and Risk Taking Marijuana $U(N_{African\ American}$ =46, $N_{Hispanic/Latinx}$=16) = 272.00, *p* = .68). A statistically significant difference between race/ethnicity and Risk Taking Fighting AUC $U(N_{African\ American}$ =46, $N_{Hispanic/Latinx}$=16) = 184.00, *p* = .02) was observed. No correlation between race/ethnicity and Risk Taking Stealing AUC $U(N_{African\ American}$ =46, $N_{Hispanic/Latinx}$=16) = 285.00, *p* = .87) was observed.

No correlation between age and probability discounting AUC was observed (r = .18; p = .16) No correlation between age and Risk Taking Marijuana AUC was observed (r = -.07; p =.59); nor between age and Risk Taking Fighting AUC (r = .14 ; p = .32); nor between age and Risk Taking Stealing AUC (r = .12; p = .37). A weak positive correlation was observed between age and delay discounting AUC (r =.36; p < .01). No correlation was observed between age and delay discounting *k* (r =-.36; p =.60).

A gender difference in relation to independent variables was observed. Frequency data indicated that compared to female youth, male youth were more likely to experience the risk factors examined in the study (Figure 1). For example, male youth were more likely to have disciplinary referrals, academic failure, and to self-report fighting, serious attacks, and handgun carrying even though there were roughly the same percentage of male (54%) and female (46%) youth in the study.

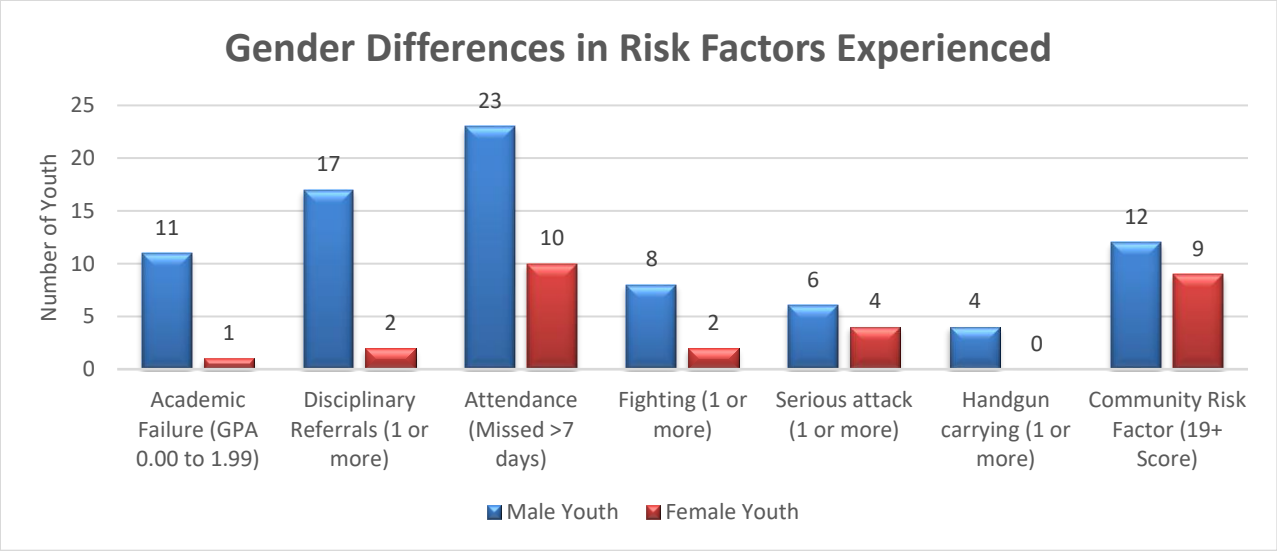

Figure 1. Gender Differences in Risk Factors Experienced

Delay Discounting

Gender Differences

Gender differences in delay discounting were observed, with male youth showing steeper delay discounting (more impulsivity) than female youth. The average *k* value for male youth was 0.33 (r^2 =.96) compared with 0.17 for female youth (r^2 = .96). The average AUC for male youth was 0.22 compared with an average AUC of 0.37 for female youth. Statistical testing confirmed the gender difference. A Mann-Whitney test indicated that the *k* values were significantly greater for male youth than for female youth, $U(N_{male}=35, N_{female}=30) = 356.00$, $p = 0.03$), indicating more impulsivity by male youth. A Mann-Whitney test also indicated that the AUC was significantly smaller for male youth than for female youth, $U(N_{male}=35, N_{female}=30) = 352.00$, $p = 0.03$), also indicating more impulsivity by male youth.

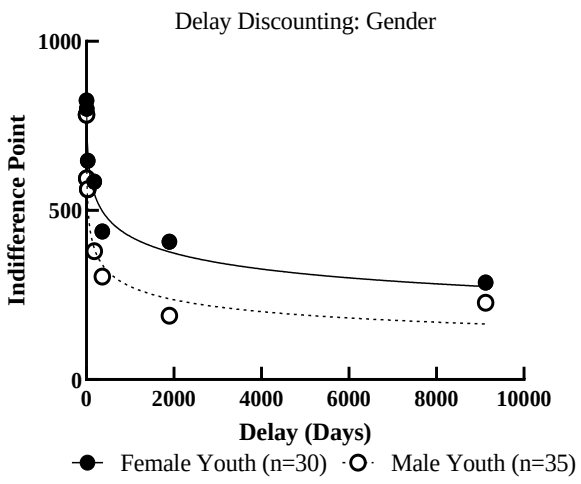

Figure 2. Gender Differences in Delay Discounting (Non-Linear Regression)

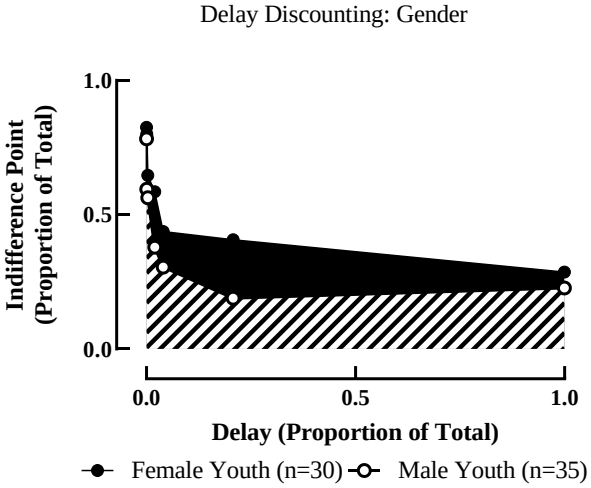

Figure 3. Gender Differences in Delay Discounting (AUC)

GPA/Academic Failure

Delay discounting data were analyzed for differences between groups of students based on academic performance (Table 4, Figure 4 and Figure 5). Average AUC was higher and average *k* was lower for youth who were academically passing compared to youth who were academically failing. A Mann-Whitney test indicated that there was not a statistically significant difference in delay discounting AUC between groups $U(N_{GPA\ 2.0+}=39, N_{GPA\ below\ 1.99}=12) = 169$, $p = 0.15$). A Mann-Whitney test indicated that there was not a statistically significant difference in *k* value between groups $U(N_{GPA\ 2.0+}=39, N_{GPA \leq 1.99}=12) = 177.00$, $p = 0.21$).

Table 4

Average Delay Discounting Values by Academic Status

Group	Average AUC	Average *k*	r^2
Academically Passing (GPA 2.0+)	.36	.02	.97
Academically Failing (GPA $\leq$ 1.99)	.22	.44	.87

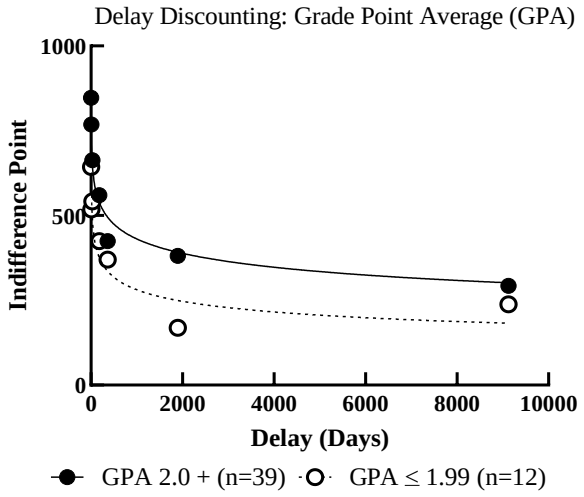

Figure 4. Delay Discounting by Grade Point Average (Non-Linear Regression)

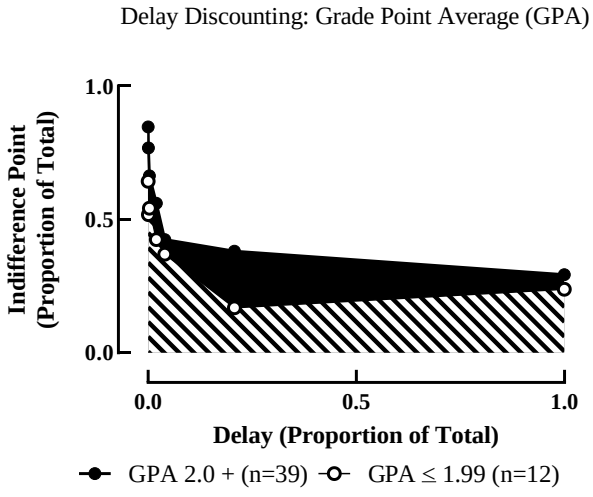

Figure 5. Delay Discounting by Grade Point Average (AUC)

Delay discounting data were subdivided by gender and academic performance (Figure 6 and Figure 7). The average AUC for female youth who were academically passing was 0.42 compared with 0.46 for female youth who were academically failing. The average AUC for male youth who were academically passing was .26 compared with .20 for male youth who were academically failing. The average *k* value for female youth who were academically passing was .22 (r^2= .88) compared with .44 (r^2= -14.06) for female youth who were academically failing. The average *k* value for male youth who were academically passing was .44 (r2= .85) compared with .55 (r^2= .87) for males who were academically failing.

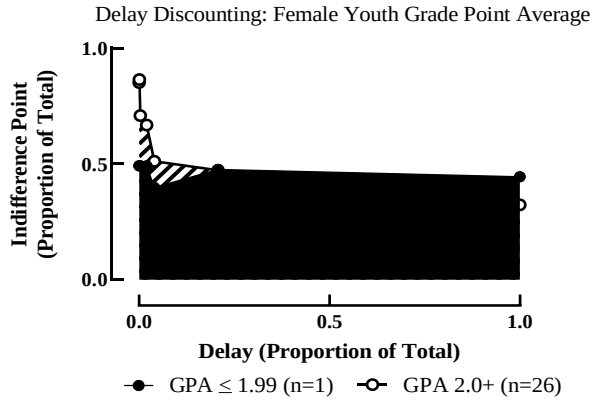

Figure 6. Delay Discounting by Female Youth Grade Point Average (AUC)

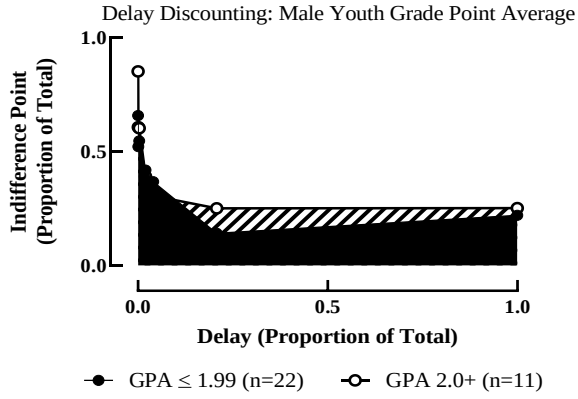

Figure 7. Delay Discounting by Male Youth Grade Point Average (AUC)

Attendance/Absenteeism

The average AUC was .33 and average *k* value was.19 (r^2 = .99) for youth who missed 7 or fewer days per year of school. The average AUC was .26 and average *k* value was .31 (r^2 = .91) for youth who missed more than 7 days of school per year. Figure 8 and Figure 9 depict delay discounting data based on attendance. A Mann-Whitney test indicated that there was not a statistically significant difference in delay discounting AUC between groups $U(N_{>7\ missed\ days}=33, N=31) = 419.00$, $p = .22$. A Mann-Whitney test indicated that there was not a statistically significant difference in *k* value between groups $U(N_{\leq 7\ missed\ days}=33, N=31) = 368.00$, $p = .05$).

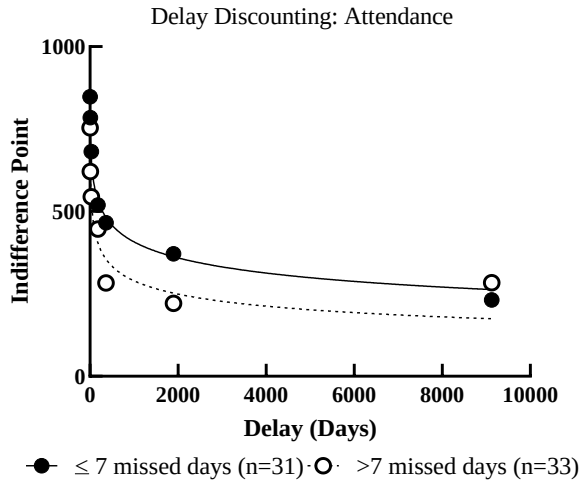

Figure 8. Delay Discounting by Attendance (Non-Linear Regression)

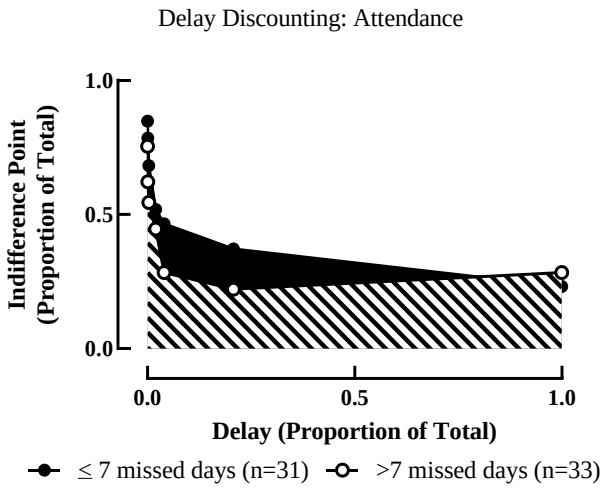

Figure 9. Delay Discounting by Attendance (AUC)

Figure 10 depicts delay discounting by gender and attendance group. The average *k* value for female youth with fewer days missed was .15 (r^2= .95) compared with .16 (r^2= .84) for female youth with more days missed. The average *k* value for male youth with more missed days was .26 (r^2= .95) compared with .22 (r^2= .93) for males with fewer missed days. The average AUC for female youth with fewer days missed was .38 compared with .39 for female youth with more days missed. The average AUC for male youth with fewer days missed was .26 compared with .22 for male youth with more days missed. No differences based on attendance status were

observed once groups were divided by gender.

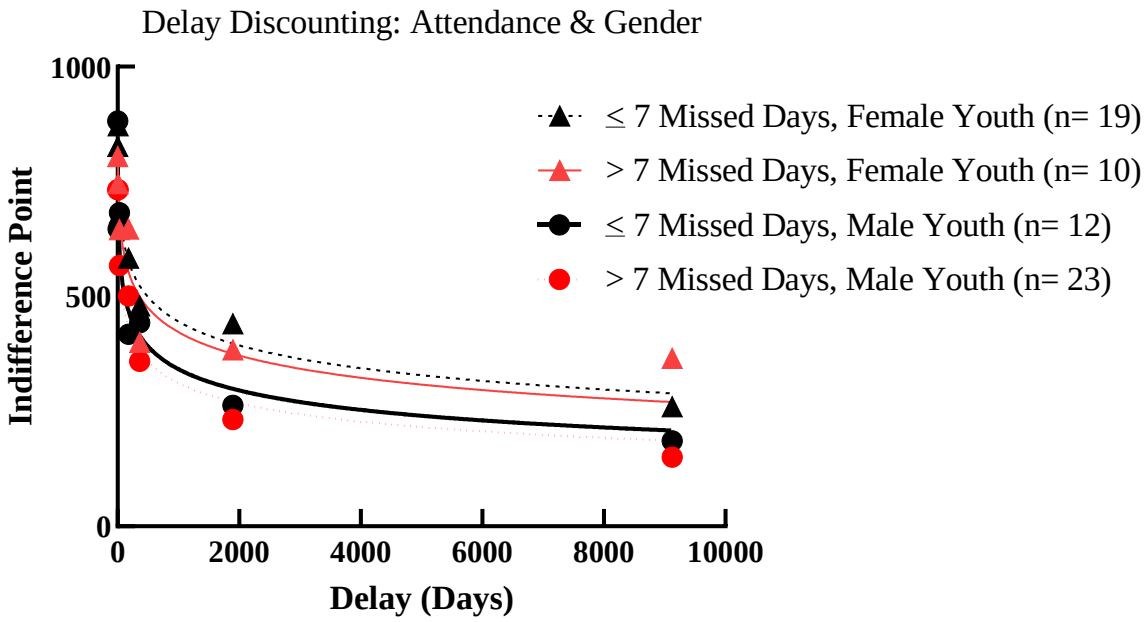

Figure 10. Delay Discounting by Attendance & Gender (Non-Linear Regression)

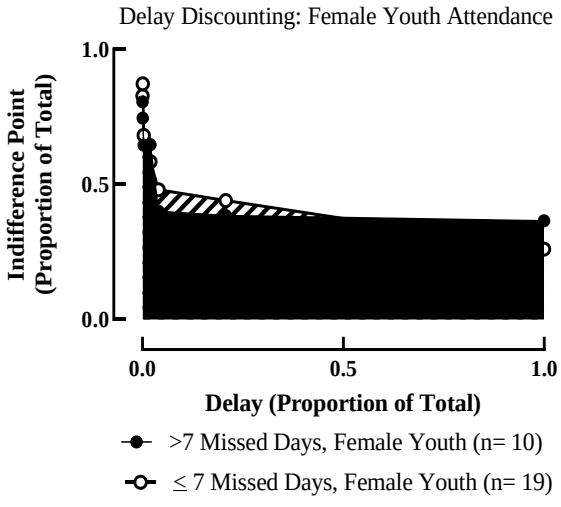

Figure 11. Delay Discounting by Female Youth Attendance (AUC)

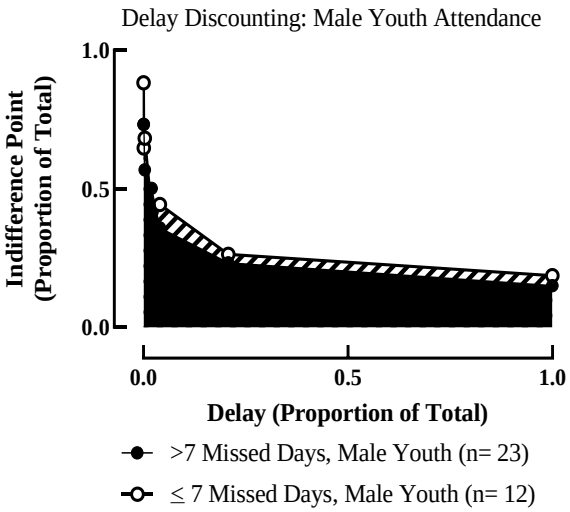

Figure 12. Delay Discounting by Male Youth Attendance (AUC)

Disciplinary Referrals

Table 5 depicts average AUC values, average *k* values, and r^2 values for youth who received disciplinary referrals and youth who did not. Average AUC values were larger and average *k* values were smaller for youth with no disciplinary referrals compared to youth with

disciplinary referrals. A Mann-Whitney test indicated that there was not a statistically significant difference in delay discounting AUC between groups $U(N_{\underline{0\ DR}} = 45, N_{1+\ DR} = 19) = 326.00$, $p = .014$. A Mann-Whitney test indicated that there was a statistically significant difference in *k* value between groups $U(N_{\underline{0\ DR}} = 45, N_{1+\ DR} = 19) = 181.00$, $p = .00$), indicating more impulsivity by youth with disciplinary referrals.

Table 5

Average Delay Discounting Values by Disciplinary Referrals

Group	Average AUC	Average *k*	r^2
No Disciplinary Referrals	0.32	.19*	.96
Disciplinary Referrals	0.22	.55*	.71

*p <.05

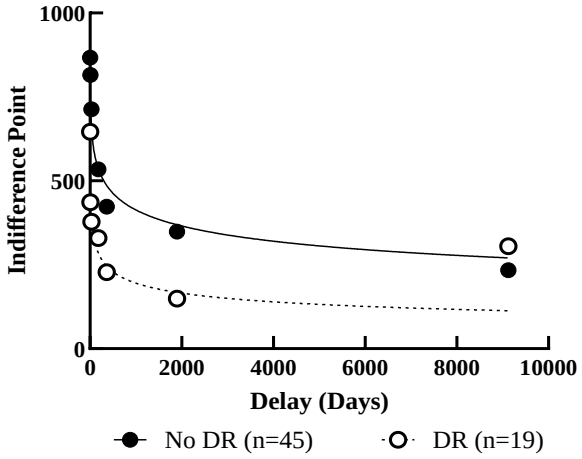

Figure 13. Delay Discounting by Disciplinary Referral (Non-Linear Regression)

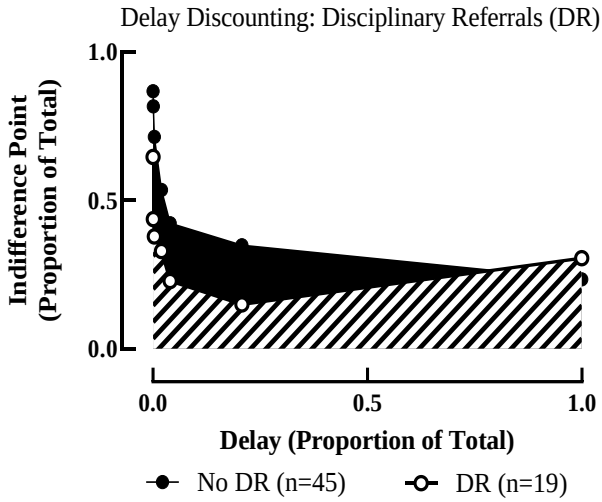

Figure 14. Delay Discounting by Disciplinary Referrals (AUC)

When data were subdivided by both gender and disciplinary referral group, the average *k* value was .34 (r^2: .78) and average AUC was .29 for male youth with no disciplinary referrals. The average *k* value was .03 (r^2: .85) and average AUC was .37 for female youth with no disciplinary referrals. The average *k* value was .80 (r^2: .78) and average AUC was .19 for male youth with one or more disciplinary referrals. The average *k* value was .44 (r^2: -.75) and average

AUC was .50 for female youth with one or more disciplinary referrals. Female youth with one or more disciplinary referrals demonstrated non-systematic discounting (i.e., reward value increased rather than decreased with delay; Figure 15).

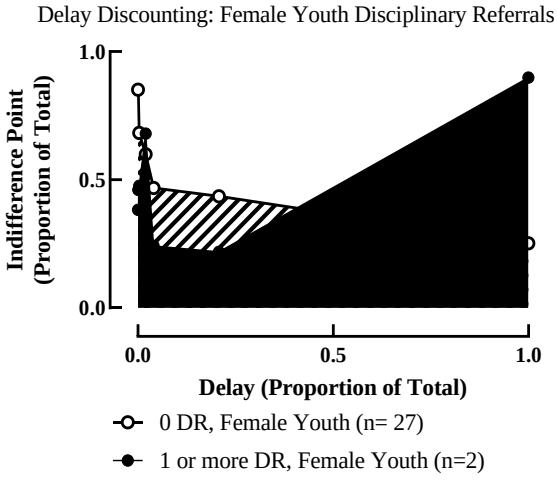

Figure 15. Delay Discounting by Female Youth Disciplinary Referrals (AUC)

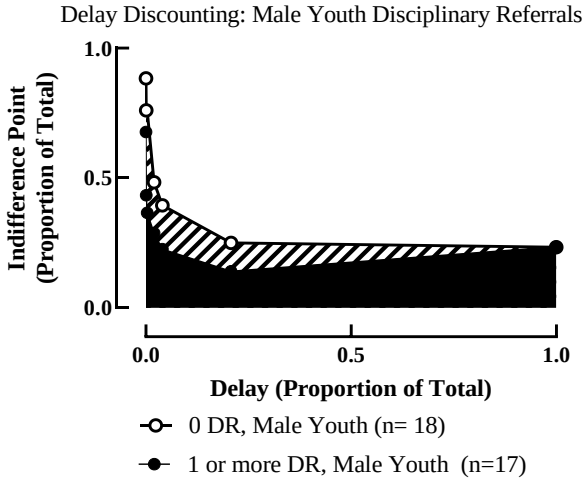

Figure 16. Delay Discounting by Male Youth Disciplinary Referrals (AUC)

Self-Reported Fighting

The average AUC was .36 and average *k* value was .18 (r^2 = .96) for youth who reported never fighting in the past year. The average AUC was .19 and average *k* value was .46 (r^2 = .86) for youth who reported one or more instances of fighting in the past year. Figure 17 and Figure 18 depict delay discounting data based on self-reported fighting. AUC values were smaller and *k* values were larger for youth who self-reported fighting in the past year compared to youth who self-reported never fighting in the past year. A Mann-Whitney test indicated that there was not a statistically significant difference in delay discounting AUC between groups $U(N_{0\ fights}$ =34, $N_{1+\ fights}$ =10)= 162.00, p = .84). A Mann-Whitney test indicated that there was not a statistically significant difference in *k* value between groups $U(N_{0\ fights}$ =34, $N_{1+\ fights}$ =10)= 99.5 p = .07).

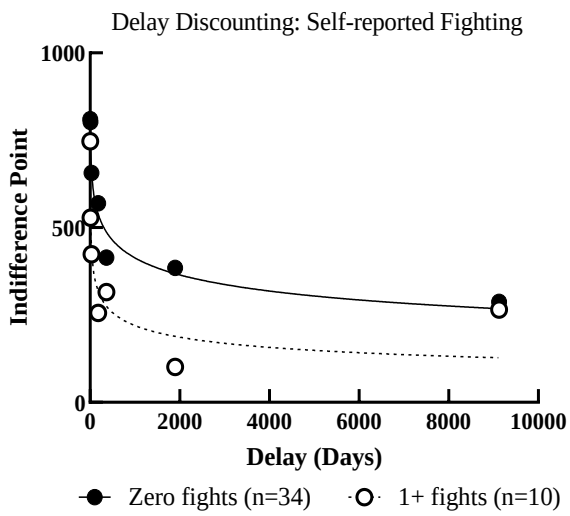

Figure 17. Delay Discounting by Self-Reported Fighting (Non-Linear Regression)

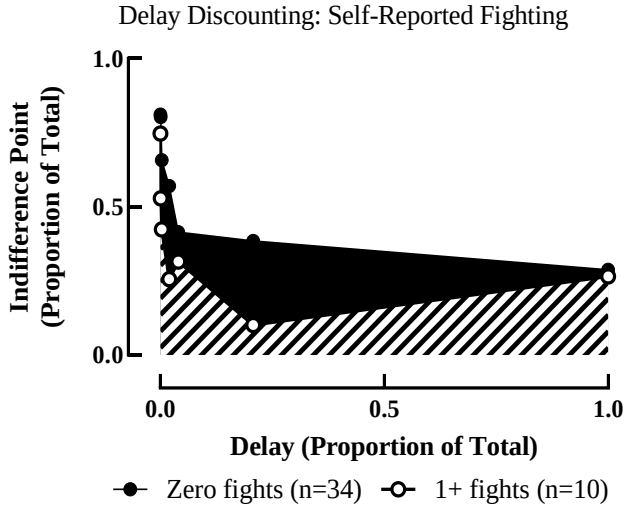

Figure 18. Delay Discounting by Self-Reported Fighting (AUC)

Delay discounting data based on self-reported fighting were subdivided by gender. The average *k* value was .15 (r^2 = .94) for female youth who reported no fighting. The average *k* value was .16 (r^2 = .59) for female youth who reported fighting. The average *k* value was .20 (r^2 = .80) for male youth who reported no fighting. The average *k* value was .55 (r^2 = .92) for male youth who reported fighting.

Figures 19 and 20 depict AUC data divided by gender and self-reported fighting. After subdividing by gender, delay discounting differences based on self-reported fighting were observed. The average AUC was smaller (.28) for female youth who reported fighting compared with female youth who reported no fighting (.38). The average AUC was smaller for male youth who reported fighting (.17) compared to male youth who reported no fighting (.30).

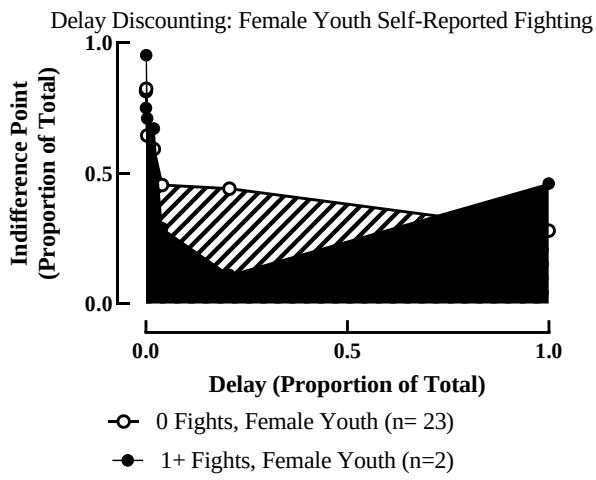

Figure 19. Delay Discounting by Female Youth Self-Reported Fighting (AUC)

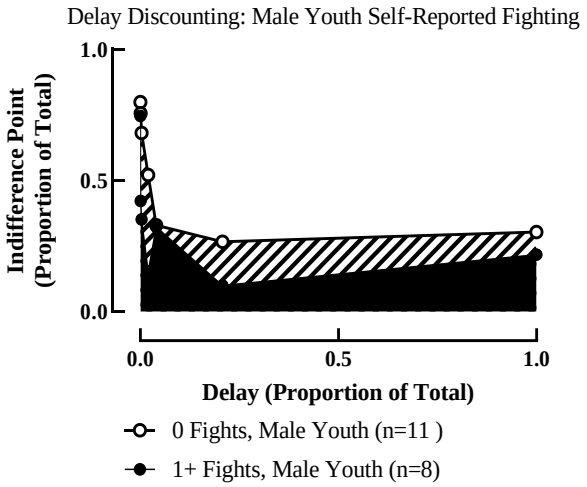

Figure 20. Delay Discounting by Male Youth Self-Reported Fighting (AUC)

Self-Reported Serious Attacks

The average AUC for youth who reported attacking someone with the idea of seriously hurting them (e.g., serious attacks) in the past year was .36 compared with .19 for youth who reported never attacking someone with the idea of seriously hurting them (e.g., no serious attacks) in the past year. The average *k* value was .18 (r^2 = .96) for youth who reported no serious attacks, compared.44 (r^2 = .90) for youth reporting serious attacks. Figures 21 and 22 depict delay discounting data based on self-reported serious attacks. A Mann-Whitney test indicated that there was not a statistically significant difference in *k* value between groups $U(N_{0\ serious\ attacks}$ =34, $N_{1+\ serious\ attacks}$ =10)= 102.00 p = .06). A Mann-Whitney test indicated that there was not a statistically significant difference in delay discounting AUC between groups $U(N_{0\ serious\ attacks}$ =34, $N_{1+\ serious\ attacks}$ =10)= 110.00, p = .10).

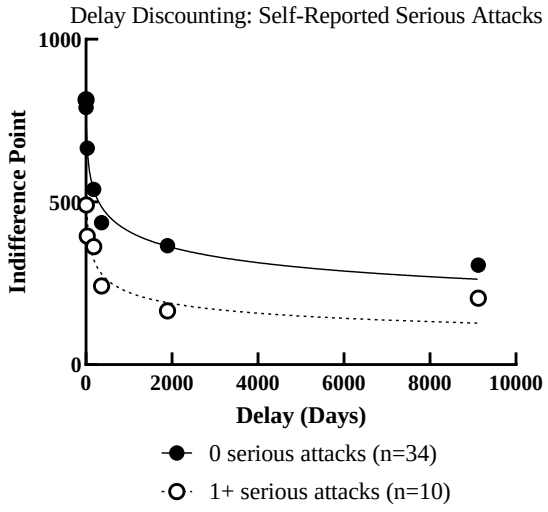

Figure 21. Delay Discounting by Self-Reported Serious Attacks (Non-Linear Regression)

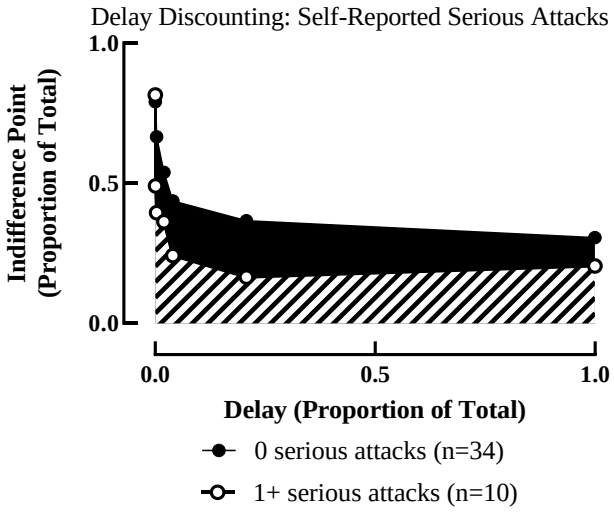

Figure 22. Delay Discounting by Self-Reported Serious Attacks (AUC)

Delay discounting data based on self-reported serious attacks were subdivided by gender. The average *k* value was .12 (r^2 = .87) for female youth who reported no past serious attacks; .22 (r^2 = .85) for female youth who reported past serious attacks; .20, (r^2 = .87) for male youth who reported no serious attacks; and .61 (r^2 = .61) for male youth who reported serious attacks. Female youth who reported no serious attacks had an average AUC of .41 compared to .18 for female youth who reported serious attacks. Males who reported youth with no serious attacks had an average AUC of .26 compared with .20 for male youth who reported serious attacks.

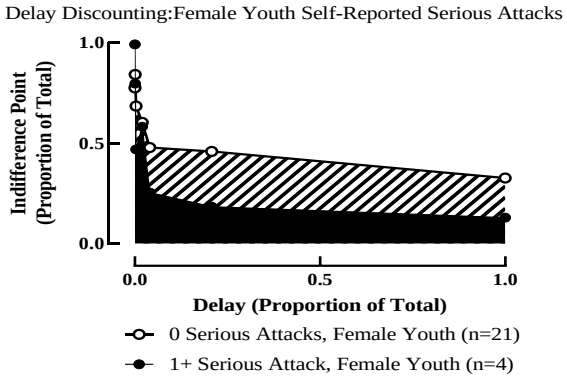

Figure 23. Delay Discounting by Female Youth Self-Reported Serious Attacks (AUC)

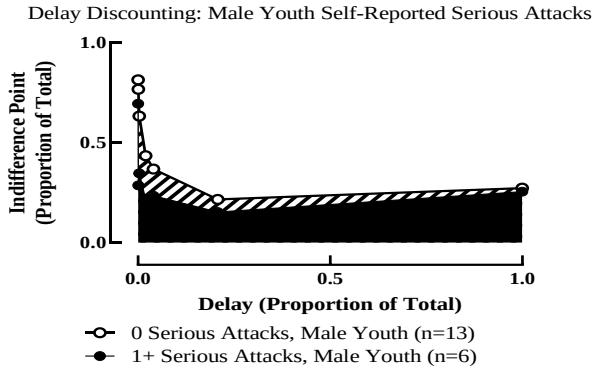

Figure 24. Delay Discounting by Male Youth Self-Reported Attacks (AUC)

Self-Reported Handgun Carrying

Figure 25 and Figure 26 depict delay discounting data by self-reported handgun carrying. The average AUC was .33 for youth who reported no handgun carrying in the past year (e.g., handgun carrying), compared with .22 for youth who reported carrying handgun at least once in the last year (e.g., no handgun carrying). The average *k* value for youth who reported no handgun carrying was .27 (r^2 = .96), compared with .94 (r^2 = .48) for youth who reported carrying handguns. Average AUC were smaller and average *k* values were larger for youth who reported carrying a handgun in the past year at least once compared to youth who reported that they did not carry a handgun in the past year. A Mann-Whitney test indicated that there was a statistically significant difference in *k* value between groups $U(N_{0\ handgun\ carrying}=39, N_{1\ +\ handgun\ carrying}=4) = 22.50$, $p = .02$. There was not a statistically significant difference in delay discounting AUC between groups $U(N_{0\ handgun\ carrying}=39, N_{1\ +\ handgun\ carrying}=4) = 55.50$, $p = .37$.

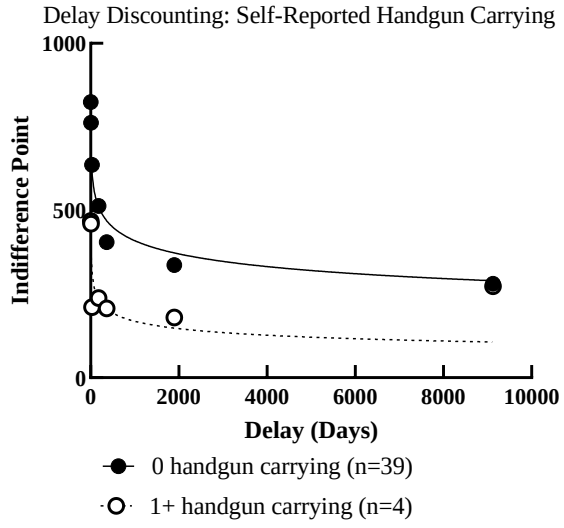

Figure 25. Delay Discounting by Self-Reported Handgun Carrying (Non-Linear Regression)

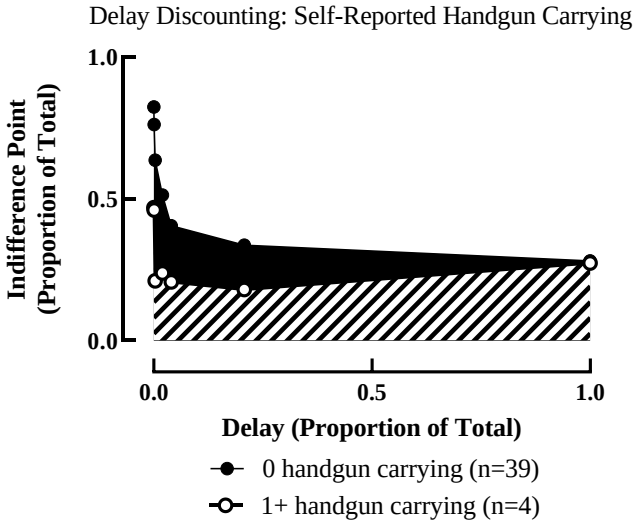

Figure 26. Delay Discounting by Self-Reported Handgun Carrying (AUC)

Delay discounting data by handgun carrying were subdivided by gender. Female youth who reported no handgun carrying had the smallest *k* value ($k = .20$, $r^2 = .94$), followed by male

youth who did not carry a handgun (k =.31 , r^2 = .92), followed by male youth who reported carrying a handgun (k =.86, r^2 = .38). AUC was greatest for female youth who reported never carrying a handgun (.38), followed by male youth who reported never carrying handguns (.26), and then male youth who reported carrying a handgun (.22). No female youth reported carrying a handgun. Figure 27 depicts AUC for male youth based on self-reported handgun carrying.

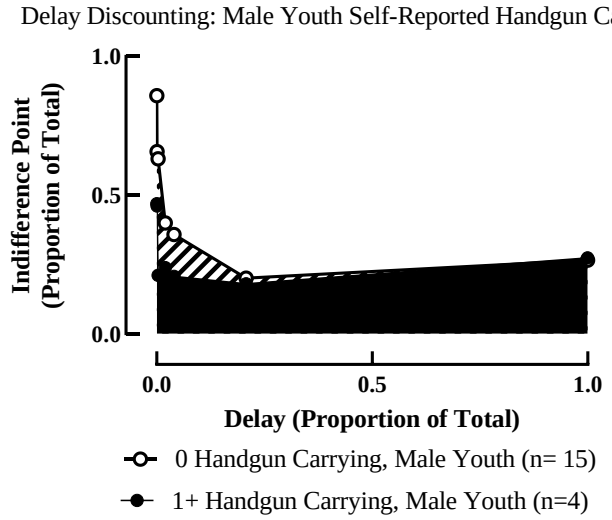

Figure 27. Delay Discounting by Male Youth Self-Reported Handgun Carrying (AUC)

Community Risk Factors

Figure 28 and Figure 29 depict delay discounting data based on Community Risk Factor (CRF) score. Youth who were categorized as lower CRF score (i.e., CRF score 0-18) had an average AUC of .39 and an average k value of .15 (r^2 = .97). Youth who were categorized as higher CRF score (i.e., CRF score 19+) had an average AUC of .29 and average k value of .28 (r^2 = .91). Average AUC was larger and average k was smaller for the lower CRF group compared to the higher CRF group.

The delay discounting AUC data were normally distributed for community risk factors. An independent samples t-test was conducted to identify differences between groups. There was not a significant difference in the delay discounting AUC between the lower CRF score group

(M =.39, SD =.32) and the higher CRF score group (M = .29, SD = .24); t(38)=1.11, p = 27. The 95% CI for the lower CRF score group was .23 to .53. The 95% CI for higher CRF score group was .18 to .40. The *k* value data were not normally distributed for community risk factors. A Mann-Whitney test was conducted indicated that there was not a statistically significant difference in *k* value between CRF score groups $U(N_{lower\ CRF}$ =19, $N_{higher\ CRF}$ =21)= 138, p = .10).

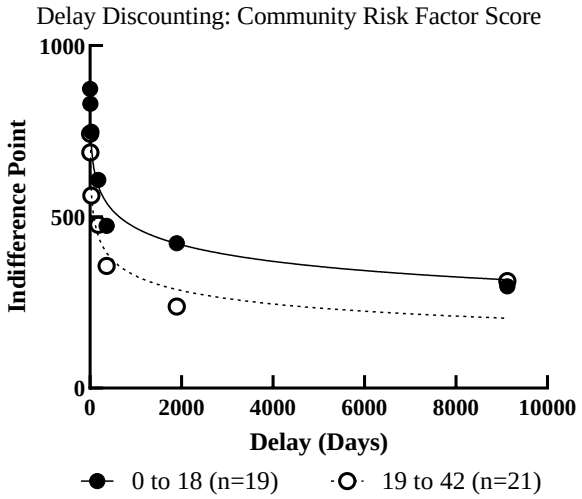

Figure 28. Delay Discounting by Community Risk Factor Score (Non-Linear Regression)

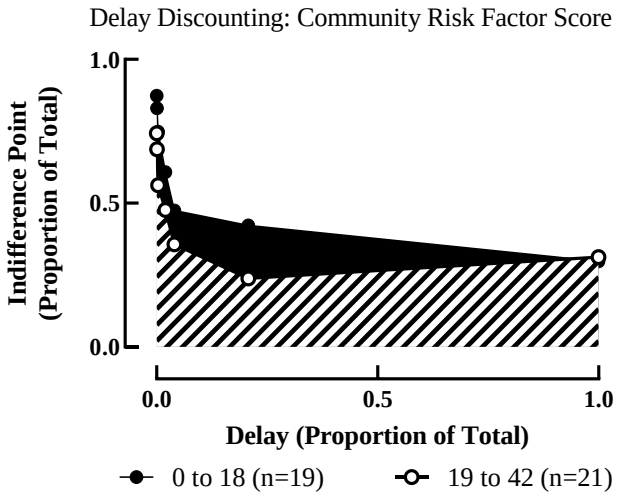

Figure 29. Delay Discounting by Community Risk Factor Score (AUC)

Delay discounting data based on community risk score (CRF) were subdivided by gender (Figure 30 and Figure 31). The average *k* value for female youth with lower risk scores was .11 (r^2 = .92). The average *k* value for male youth with lower risk scores was .13 (r^2 = .82). The average *k* value for female youth with higher risk scores was .13 (r^2 = .90). The average *k* value for male youth with higher risk scores was .39 (r^2 = .64). Female youth with higher CRF scores had smaller AUC (.33) compared to female youth with lower CRF scores (.43). Male youth with lower CRF scores had greater AUC (.28) compared to male youth with higher CRF scores (.38).

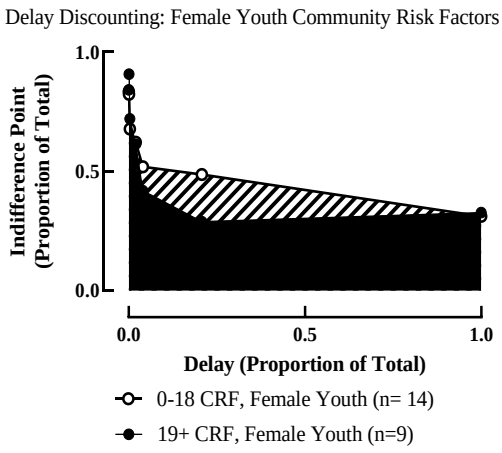

Figure 30. Delay Discounting by Female Youth Community Risk Factor Score (AUC)

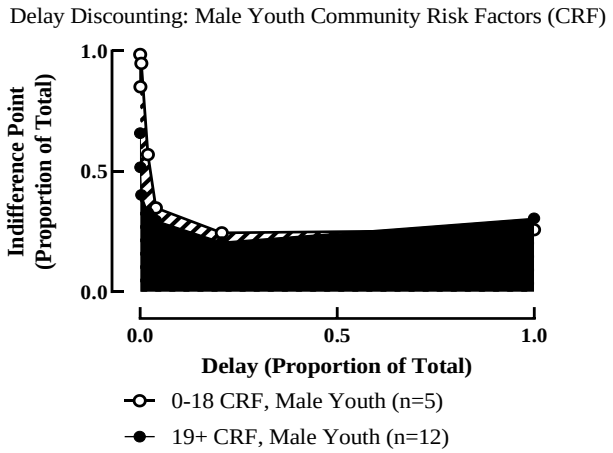

Figure 31. Delay Discounting by Male Youth Community Risk Factor Score (AUC)

Nonsystematic Discounting

Data for 34 out of 65 participants met at least one of Johnson & Bickel's (2008) criteria identifying nonsystematic discounting. Most commonly, criterion 1 was violated (i.e., the reward value increased rather than decreased at the next delay presented by more than 20%) (n=29). Criterion 2 was violated (i.e., the last indifference point not lower than the first by at least 10% of the larger, later reward) by 15 out of 65 participants.

Summary

Table 6 depicts a summary of average *k* values and average AUC for each independent variable for low- and high- risk groups. All *k* values were larger (i.e., more delay discounting) for high-risk groups compared with low-risk groups. All AUC values were smaller (i.e., more delay discounting) for high-risk groups compared with low-risk groups.

Table 6

Summary of Delay Discounting Variables

Risk Factor	*k* value		AUC	
	Low Risk	High Risk	Low Risk	High Risk
GPA	.02	.44	.36	.22
Attendance	.19	.31	.33	.26
Disciplinary Referrals	.19*	.55^*	.32	.22
Fighting	.18	.46	.36	.19
Serious Attacks	.18	.44	.36	.19
Handgun Carrying	.27*	.94^*	.33	.22
CRF Score	.15	.28^	.39	.29

^ = r^2 below .80

*= $p < .05$

Table 7 depicts a summary of average AUC values for each independent variable subdivided by gender and Table 8 depicts a summary of average *k* values for each independent variable subdivided by gender. The average *k* value for high-risk male youth was larger (more delay discounting) than the average *k* value for low-risk male youth for all independent variables. The average AUCs for high-risk male youth were smaller (more delay discounting) than the average AUCs for low-risk male youth for six of seven independent variables. The average *k* values for high-risk female youth were larger (more delay discounting) than the average *k* values for low-risk female youth for all independent variables. The average AUCs for high-risk female youth was smaller (more delay discounting) than the average AUCs for low-risk female youth for four of six independent variables.

Table 7

Summary of Delay Discounting AUC by Gender and Risk

Risk Factor	Low Risk		High Risk	
	Male Youth	Female Youth	Male Youth	Female Youth
GPA	.26	.46	.20	.42
Attendance	.26	.38	.22	.39
Disciplinary Referrals	.29	.37	.19	.50
Fighting	.30	.38	.17	.28
Serious Attacks	.26	.41	.20	.18
Handgun Carrying	.26	.37	.22	NA
CRF Score	.28	.43	.26	.33

Table 8

Summary of Delay Discounting k by Gender and Risk

Risk Factor	Low Risk		High Risk	
	Male Youth	Female Youth	Male Youth	Female Youth
GPA	.44	.22	.55	.44^
Attendance	.22	.15	.26	.16
Disciplinary Referrals	.34^	.03	.80^	.44^
Fighting	.20	.15	.55	.16^
Serious Attacks	.22	.12	.61^	.20
Handgun Carrying	.31	.20	.86^	NA
CRF Score	.13	.11	.39	.13

^ $r^2 < .80$

Probability Discounting

Gender Differences

No gender differences in probability discounting were observed. The average AUC for male participants was .20 compared with an average AUC of .17 for female participants (Figure 32). A Mann-Whitney test indicated that there was not a statistically significant difference in probability discounting AUC by gender, $U(N_{male}=35, N_{female}=30) = 475.50$, $p = 0.10$).

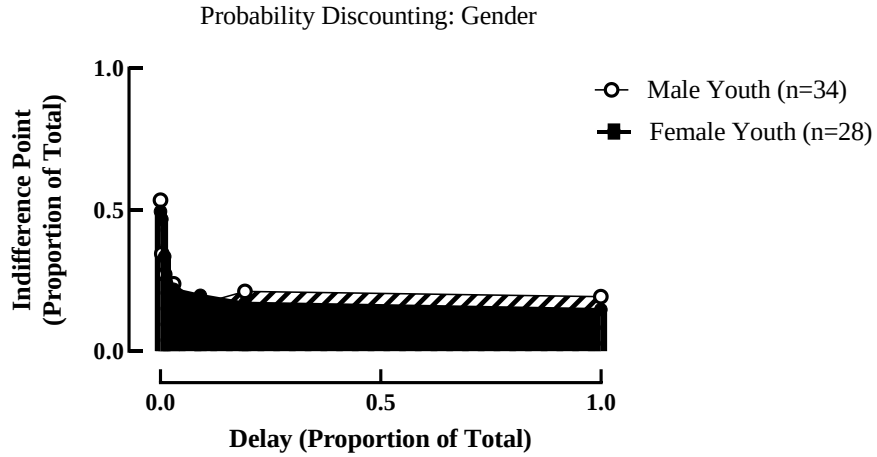

Figure 32. Probability Discounting by Gender

GPA/Academic Failure

Probability discounting data were analyzed for differences between groups of students based on academic performance (Figure 33). The average AUC for youth who were academically failing was .40 and the average AUC for youth who were academically passing was .12. A Mann-Whitney test indicated that there was a statistically significant difference in probability discounting AUC between groups $U(N_{GPA\ 2.0+}=37, N_{GPA \leq 1.99}=12) = 129.00$, $p = 0.03$). Youth who were academically passing showed more risk taking compared to youth who were academically failing.

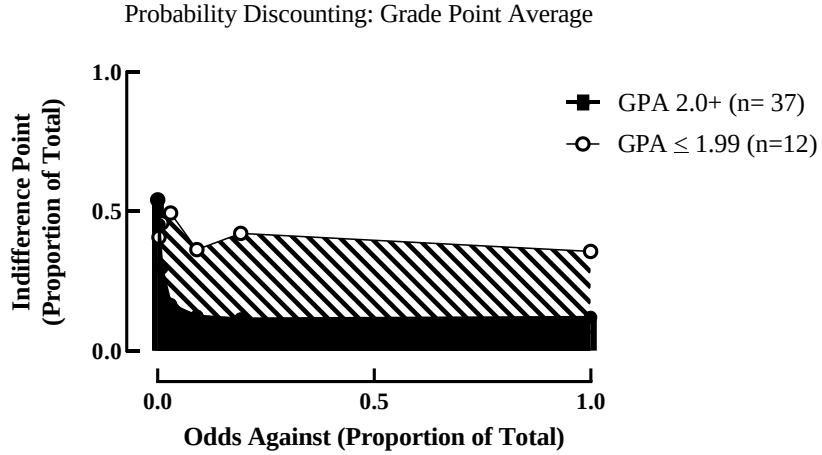

Figure 33. Probability Discounting by Grade Point Average

Attendance/Absenteeism

The average AUC was .17 for youth who missed 7 or fewer days per year of school. The average AUC was .21 for youth who missed more than 7 days of school. Figure 34 depicts probability discounting data based on attendance. A Mann-Whitney test indicated that there was not a statistically significant difference in probability discounting AUC between groups $U(N_{\leq 7 \text{ missed days}}=31, N_{> 7 \text{ missed days}}=29) = 416.00, p = .49)$.

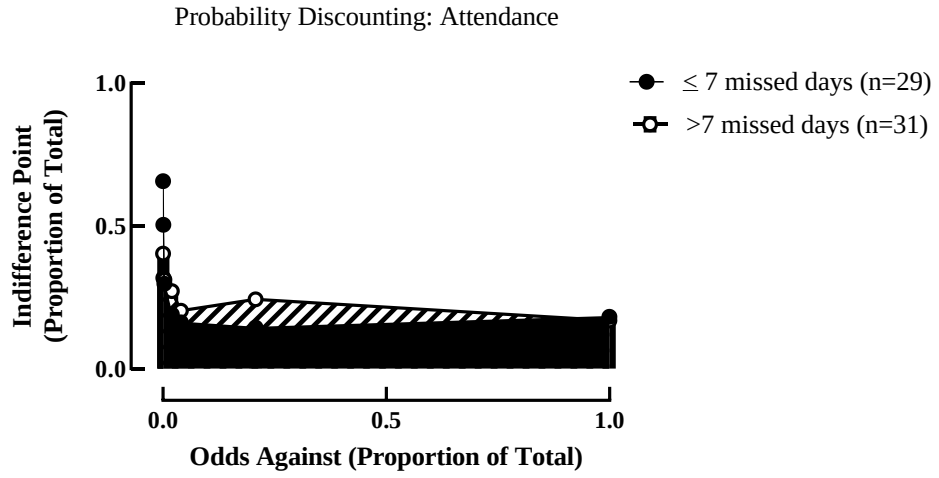

Figure 34. Probability Discounting by Attendance

Disciplinary Referrals

The average AUC was .16 for youth who received no disciplinary referrals and .20 for youth who received at least one disciplinary referral. Figure 35 depicts probability discounting data based on disciplinary referrals. A Mann-Whitney U test indicated that there was not a statistically significant difference in probability discounting AUC between groups $U(N_{0\ DR}=42, N_{1+DR}=19) = 386.00, p = .84)$.

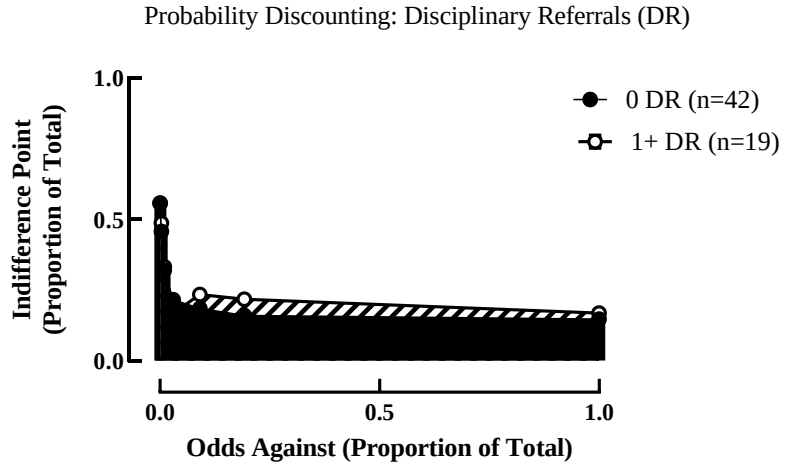

Figure 35. Probability Discounting by Disciplinary Referrals

Self-Reported Fighting

The average AUC was .13 for youth who reported no fighting in the past year compared with .15 for youth who reported fighting at least once in the past year. Figure 36 depicts probability discounting data based on self-reported fighting. No differences in probability discounting were observed based on self-reported fighting. A Mann-Whitney test indicated that there was not a statistically significant difference in probability discounting AUC between groups $U(N_{0\ fights}=32, N_{1+\ fights}=10) = 142.5, p = .62$).

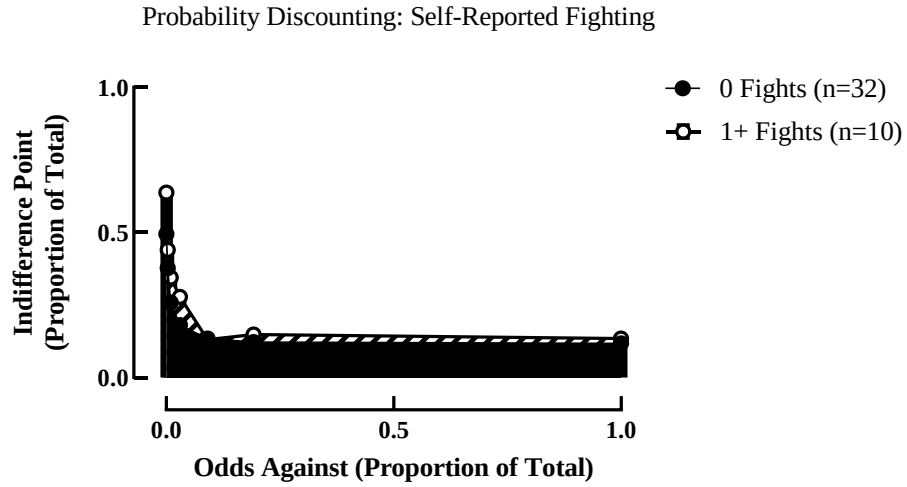

Figure 36. Probability Discounting by Self-Reported Fighting

Self-Reported Serious Attacks

The average AUC for youth who reported never attacking someone with the idea of seriously hurting them in the past year was .14. The average AUC for youth who reported attacking someone with the idea of seriously hurting them in the past year at least once was .13. Figure 37 depicts probability discounting data based on self-reported serious attacks. No differences in probability discounting were observed based on self-reported serious attacks. A Mann-Whitney U test indicated that there was not a statistically significant difference in probability discounting AUC between groups $U(N_{0\ serious\ attacks} = 32, N_{1+serious\ attacks} = 10) = 153.00$, $p = .85$).

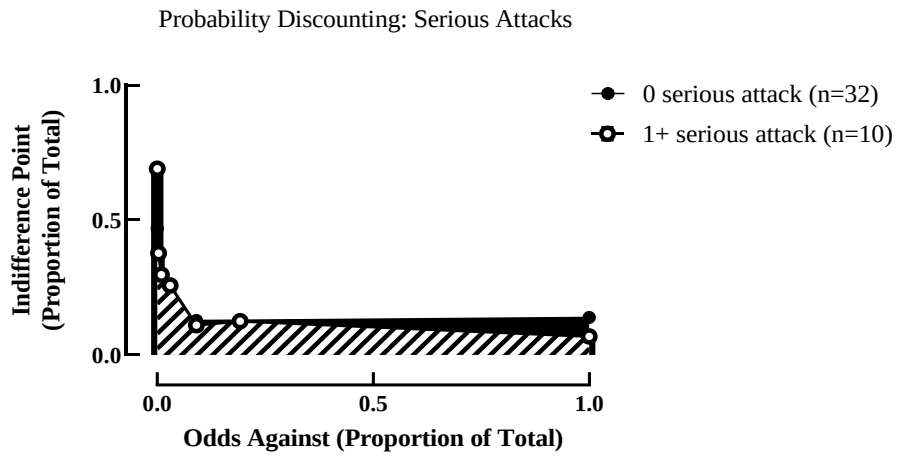

Figure 37. Probability Discounting by Self-Reported Serious Attack

Self-Reported Handgun Carrying

The average AUC for youth who reported no handgun carrying was .14 compared with .10 for youth who reported carrying a handgun at least in the past year. Figure 38 depicts probability discounting data based on self-reported handgun carrying. No differences in probability discounting were observed based on self-reported handgun carrying. A Mann-Whitney U test indicated that there was not a statistically significant difference in probability discounting AUC between groups $U(N_{0\ handgun\ carrying} = 37, N_{1+handgun\ carrying} = 4) = 44.50$, $p = .21$).

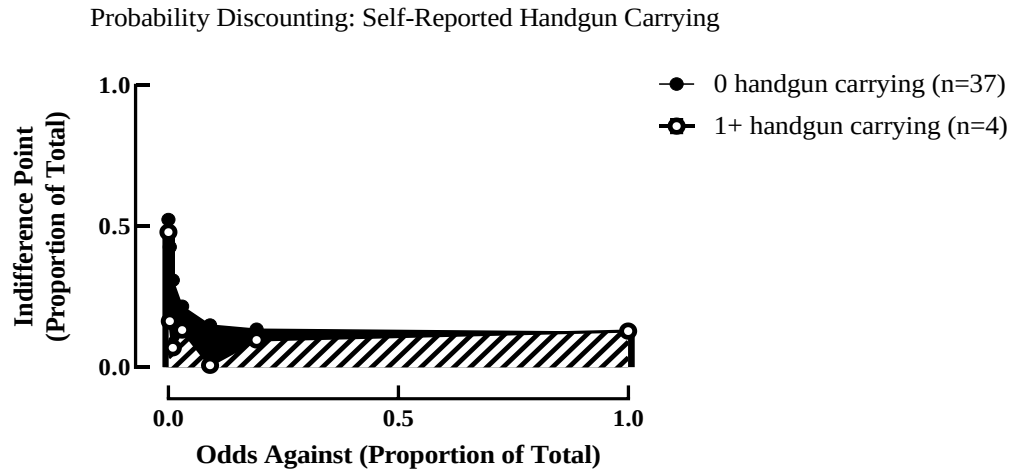

Figure 38. Probability Discounting by Self-Reported Handgun Carrying

Community Risk Factors

Figure 39 depicts probability discounting data based on Community Risk Factor (CRF) score. The average AUC for youth categorized as experiencing fewer CRF was .09 compared with .17 for youth categorized as experiencing higher CRF. A Mann-Whitney test indicated that there was not a statistically significant difference in probability discounting AUC between groups $U(N_{lower\ CRF}=18, N_{higher\ CRF}=20) = 165.0, p = .67$).

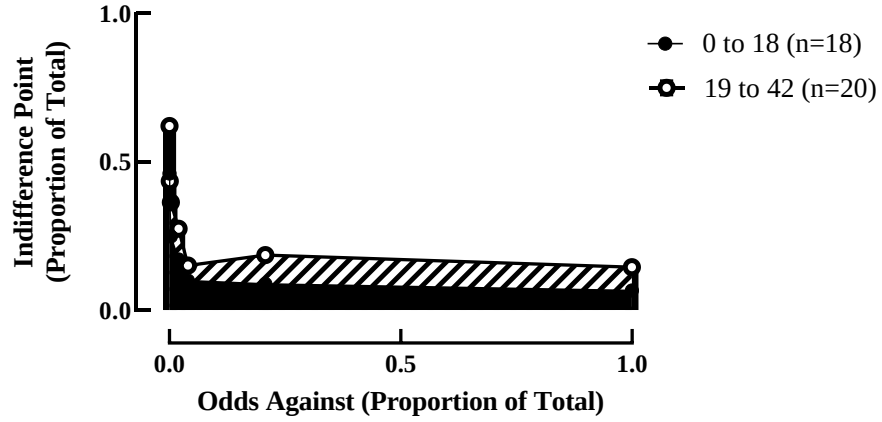

Figure 39. Probability Discounting by Community Risk Factor Score

Summary

Table 9 depicts a summary of average probability discounting AUC values for each independent variable for low- and high- risk groups. Average AUC values were larger (e.g., more risk taking) for five of seven independent variables. Differences between groups were statistically significant based on Grade Point Average.

Table 9

Summary of Probability Discounting Dependent Variables

Risk Factor	Low Risk AUC	High Risk AUC
GPA	.12*	.40*
Attendance	.17	.20
Disciplinary Referrals	.16	.20
Fighting	.13	.15
Serious Attacks	.14	.13
Handgun Carrying	.14	.10
CRF Score	.09	.17

*= $p < .05$

Risk-Taking Assessments

Gender Differences

Data from each Risk-Taking Assessment (RTA) were analyzed for differences between groups of youth based on gender (Table 10, Figure 40 through Figure 45). The average AUC was higher for male youth on all tasks compared with the average AUC for female youth. The average reported likelihood of engaging in problem behavior was below 50% for both male and female youth. Figure 42, Figure 42, and Figure 44 permit descriptive analysis of risk-taking patterns between male and female youth. Visual differences in average trend were observed between groups (e.g., decreasing trend in reported problem behavior likelihood for female youth as risk of getting in trouble increases).

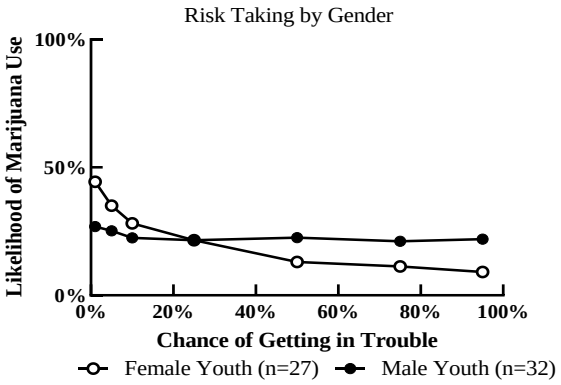

Figure 40. Risk Taking (Marijuana Use) by Gender

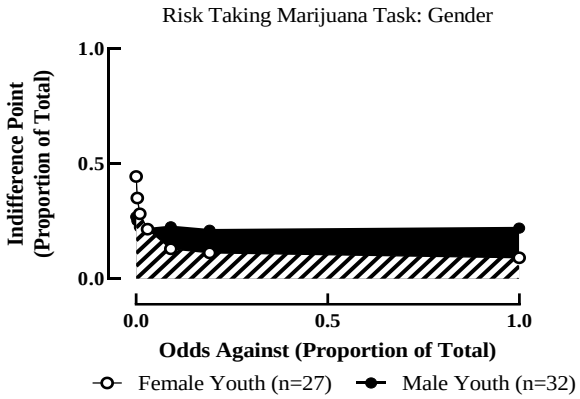

Figure 41. Risk Taking (Marijuana Use) by Gender (AUC)

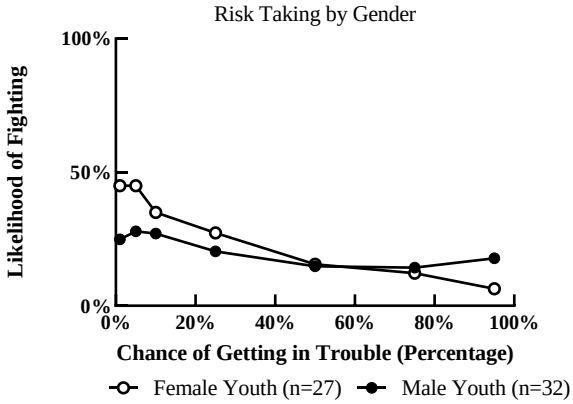

Figure 42. Risk Taking (Fighting) by Gender

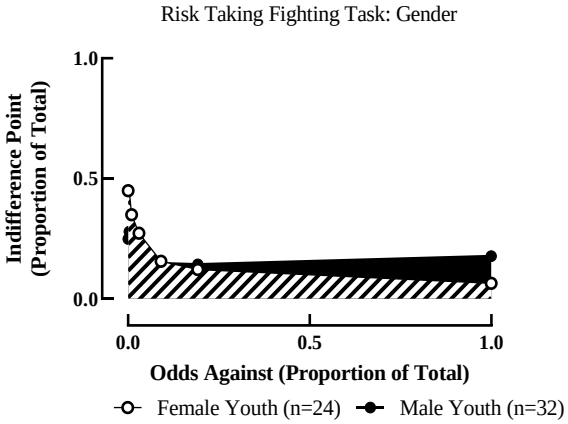

Figure 43. Risk Taking (Fighting) by Gender (AUC)

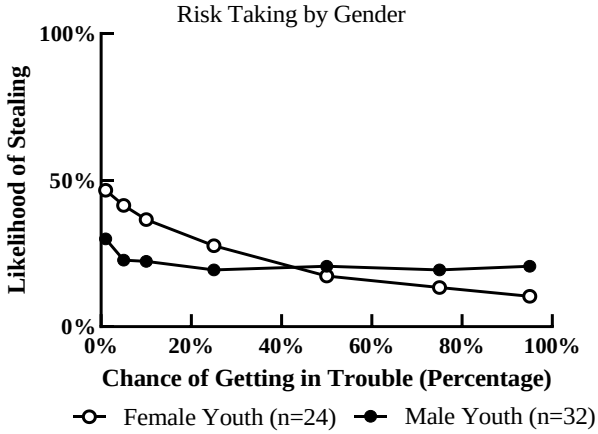

Figure 44. Risk Taking (Stealing) by Gender

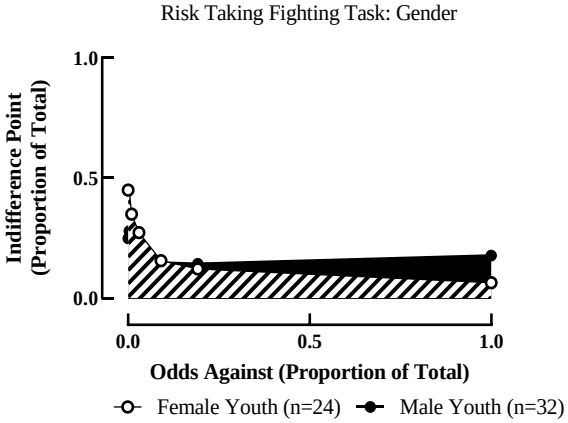

Figure 45. Risk Taking (Stealing) by Gender (AUC)

Table 10

Average Risk-Taking Area Under the Curve (AUC) by Gender

Dependent Variable	Male Youth	Female Youth
RT Marijuana Task AUC	.22	.11
RT Fighting Task AUC	.16	.11
RT Stealing Task AUC	.20	.13

Mann-Whitney U tests indicated that there was not a statistically significant difference in Risk Taking (Marijuana) AUC by gender, $U(N_{male}=32, N_{female}=27) = 334.00$, $p = 0.14$. Mann-Whitney U tests indicated that there was not a statistically significant difference in Risk Taking (Stealing) AUC by gender, $U(N_{male}=32, N_{female}=24) = 349.00$, $p = 0.57$. Mann-Whitney U tests indicated that there was not a statistically significant difference in Risk Taking (Fighting) AUC by gender, $U(N_{male}=32, N_{female}=27) = 397.00$, $p = 0.60$.

GPA/Academic Failure

Figure 46 through Figure 51 depict Risk-Taking Assessment (RTA) data per task based on Grade Point Average (GPA). The average AUC was higher for youth who were academically failing compared to youth who were academically passing on all RTAs (Table 11). As risk of getting in trouble increased, decreasing trends in reported likelihood of problem behavior were observed for youth who were academically passing, but not for youth who were academically failing.

A Mann-Whitney test indicated that there was not a statistically significant difference in AUC on the Risk Taking Marijuana task between groups $U(N_{GPA\ 2.0+}=35, N_{GPA\ below\ 1.99}=12) = 154.00$, $p = .18$). A Mann-Whitney test indicated that the AUC on the Risk Taking Fighting task was statistically significantly higher for youth who were academically failing compared to youth

who were academically passing $U(N_{GPA\ 2.0+}=32, N_{GPA\ below\ 1.99}=11) = 102.00$, $p = .04$. A Mann-Whitney test indicated that there was not a statistically significant difference in AUC on the Risk Taking Stealing task between groups $U(N_{GPA\ 2.0+}=35, N_{GPA\ below\ 1.99}=12) = 158.00$, $p = .21$.

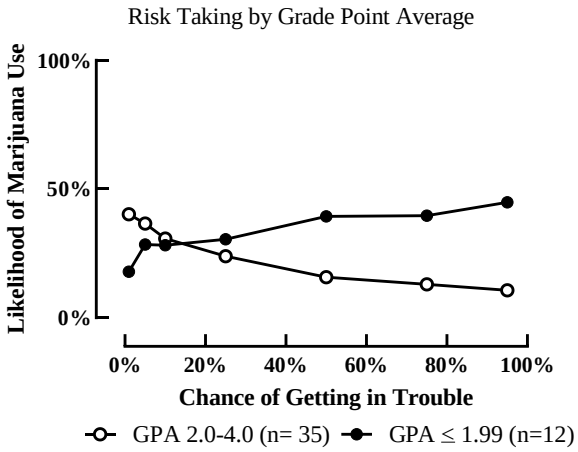

Figure 46. Risk Taking (Marijuana Use) by GPA

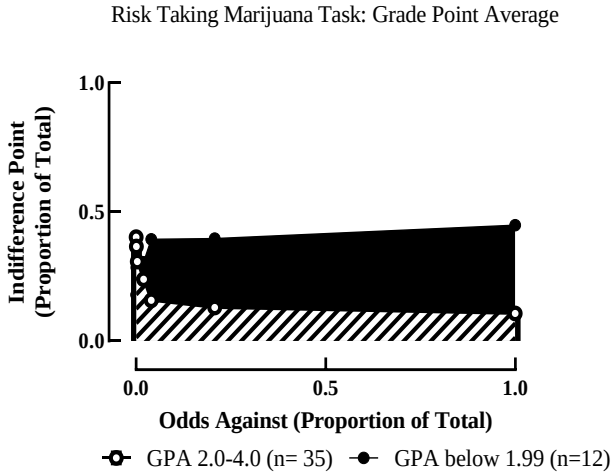

Figure 47. Risk Taking (Marijuana Use) by GPA (AUC)

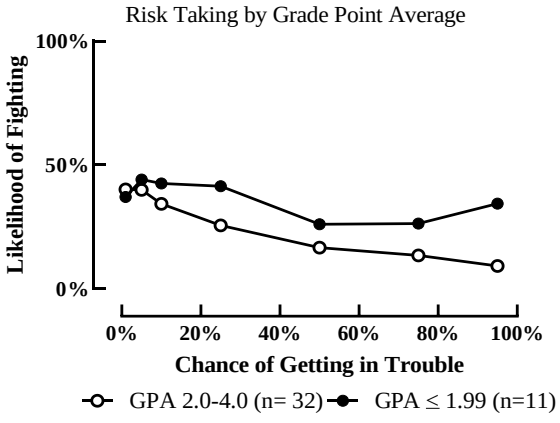

Figure 48. Risk Taking (Fighting) by GPA

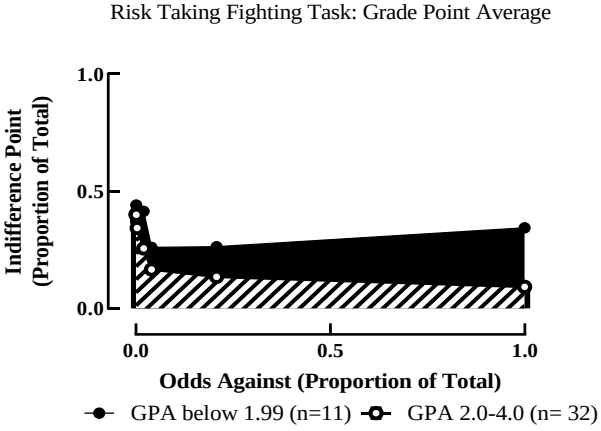

Figure 49. Risk Taking (Fighting) by GPA (AUC)

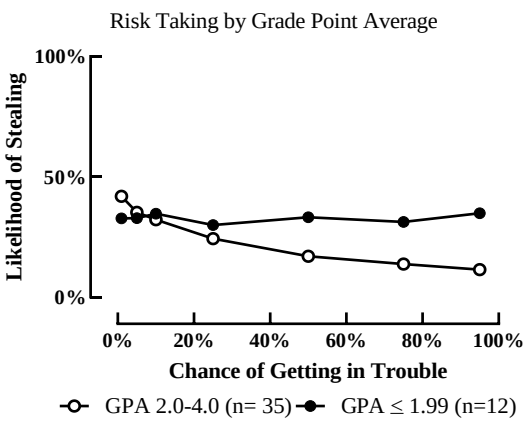

Figure 50. Risk Taking (Stealing) by GPA

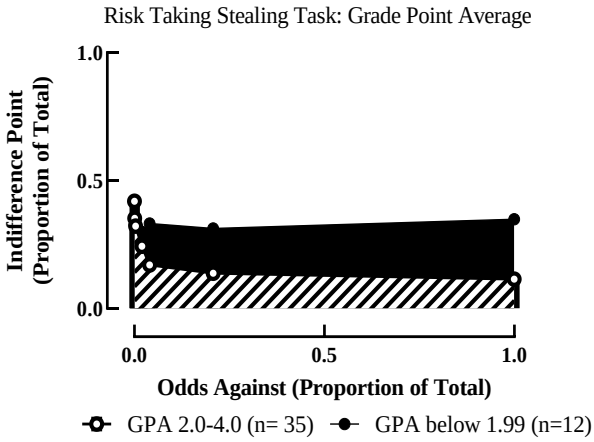

Figure 51. Risk Taking (Stealing) by GPA (AUC)

Table 11

Average Risk-Taking Area Under the Curve by Grade Point Average

Grade Point Average (GPA)	RT Marijuana Task AUC	RT Fighting Task AUC	RT Stealing Task AUC
1.99 and below	.41	.33*	.30
2.0 to 4.0	.13	.14*	.12

*p <.05

Attendance/Absenteeism

Figure 52 through 57 depict RTA data per task based on attendance. Average AUC on all tasks was greater for youth who had more absences compared to youth who had fewer absences (Table 12). As risk of getting in trouble increased, decreasing trends in reported likelihood of problem behavior were observed for youth who had fewer absences, but not for youth who had more absences. A Mann-Whitney test indicated that there was not a statistically significant difference in Risk-Taking marijuana AUC between groups $U(N_{\leq 7 \text{ missed days}} = 31, N_{>7 \text{ missed days}} = 27) = 304.00$, $p = .07$); nor in Risk-Taking fighting AUC between groups $U(N_{\leq 7 \text{ missed days}} = 30, N_{>7 \text{ missed days}} = 25) = 317.50$, $p = .34$); nor in Risk-Taking stealing AUC between groups $U(N_{\leq 7 \text{ missed days}} = 31, N_{>7 \text{ missed days}} = 27) = 325.00$, $p = .15$).

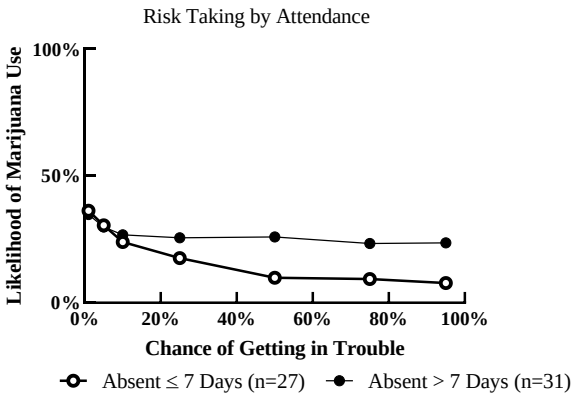

Figure 52. Risk Taking (Marijuana Use) by Attendance

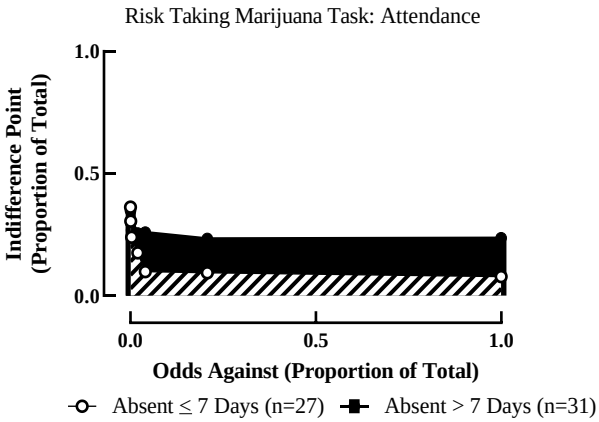

Figure 53. Risk Taking (Marijuana Use) by Attendance (AUC)

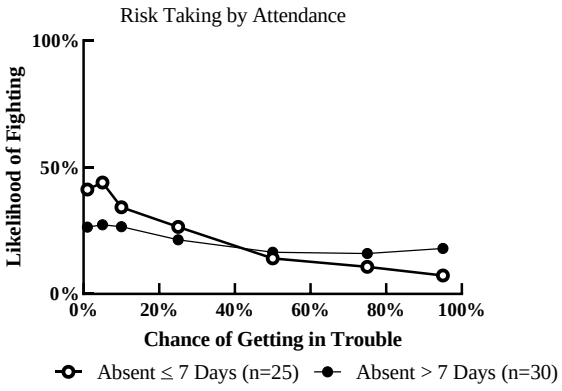

Figure 54. Risk Taking (Fighting) by Attendance

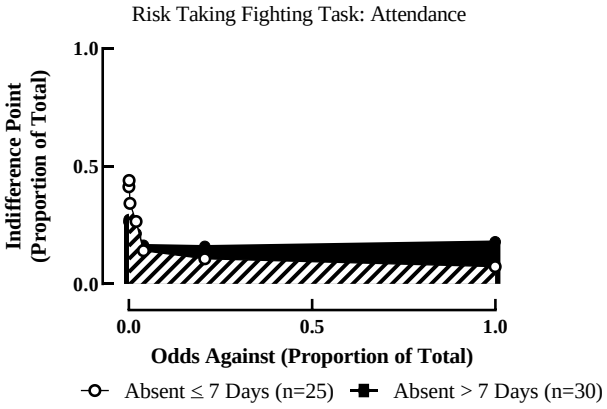

Figure 55. Risk Taking (Fighting) by Attendance (AUC)

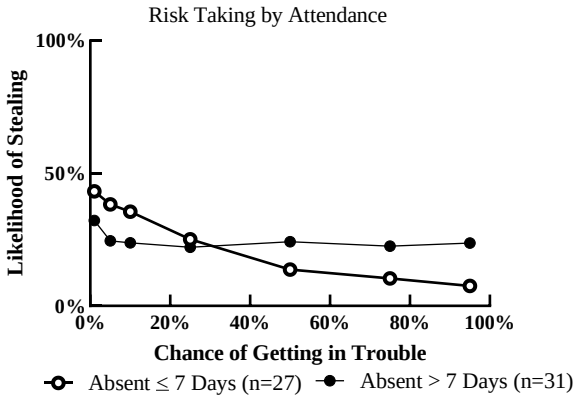

Figure 56. Risk Taking (Stealing) by Attendance

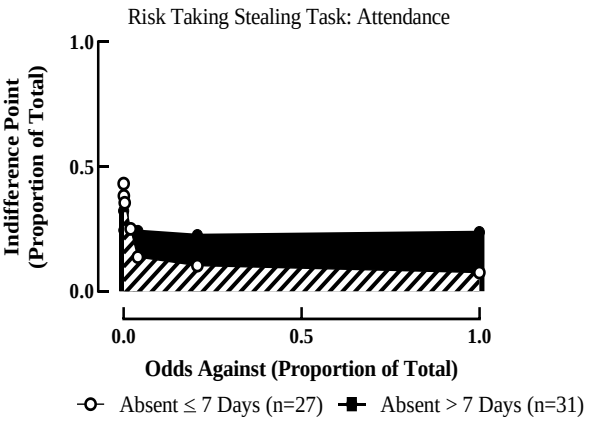

Figure 57. Risk Taking (Stealing) by Attendance (AUC)

Table 12

Average Risk-Taking Task Area Under the Curve by Attendance Group

Grade Point Average	RT Marijuana Task AUC	RT Fighting Task AUC	RT Stealing Task AUC
Missed ≤ 7 days	.09	.10	.10
Missed 7+ days	.24	.17	.23

Disciplinary Referrals

Figure 58 through 63 depict RTA data per task based on disciplinary referrals. Average AUC on all RTA tasks was greater for youth with disciplinary referrals compared to youth with no disciplinary referrals (Table 13). As risk of getting in trouble increased, decreasing trends in reported likelihood of problem behavior were observed for youth who had no disciplinary referrals, but not for youth who had one or more disciplinary referrals (Figure 58, Figure 60, Figure 62).

A Mann-Whitney U test indicated that there was not a statistically significant difference in Risk Taking Marijuana AUC between groups $U(N_{0\,DR}=41, N_{1+DR}=17) = 280.00$, $p = .25$). A Mann-Whitney U test indicated that there was a statistically significant difference in AUC between youth with disciplinary referrals and youth without disciplinary referrals on the Risk Taking Fighting assessment $U(N_{0\,DR}=39, N_{1+DR}=16) = 203.00$, $p = .04$). A Mann-Whitney U test indicated that there was not a statistically significant difference in Risk Taking Stealing AUC between groups $U(N_{0\,DR}=41, N_{1+DR}=17) = 268.5$, $p = .17$).

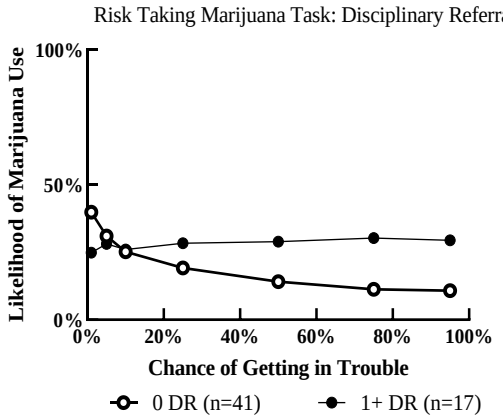

Figure 58. Risk Taking (Marijuana Use) by Disciplinary Referrals

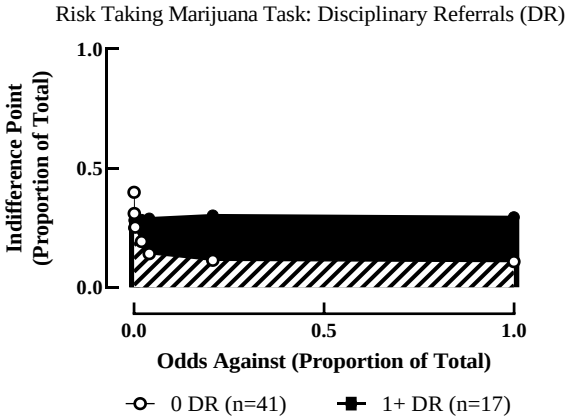

Figure 59. Risk Taking (Marijuana Use) by Disciplinary Referrals (AUC)

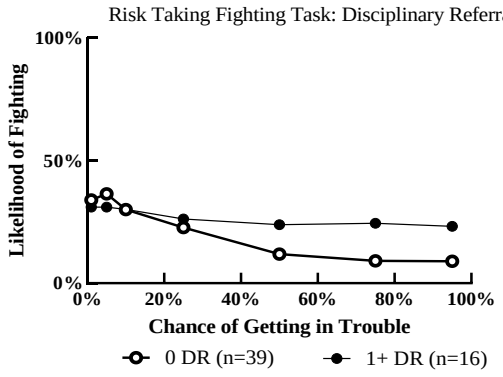

Figure 60. Risk Taking (Fighting) by Disciplinary Referrals

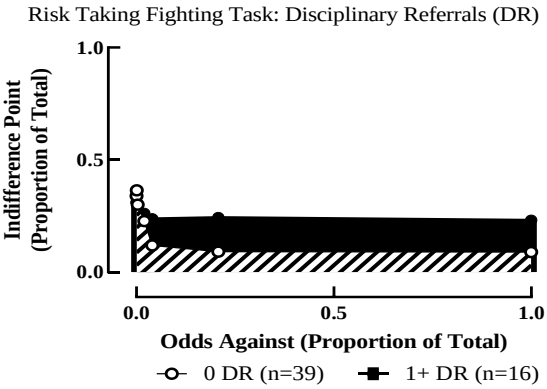

Figure 61. Risk Taking (Fighting) by Disciplinary Referrals (AUC)

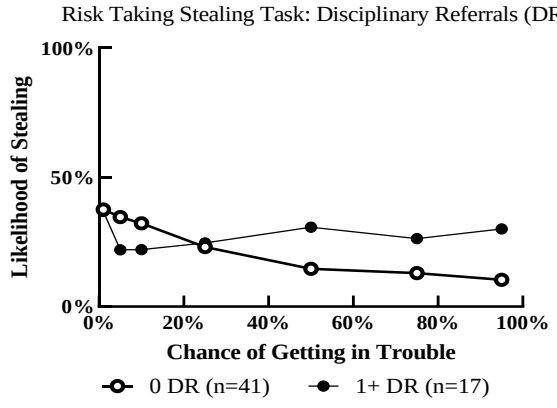

Figure 62. Risk Taking (Stealing) by Disciplinary Referrals

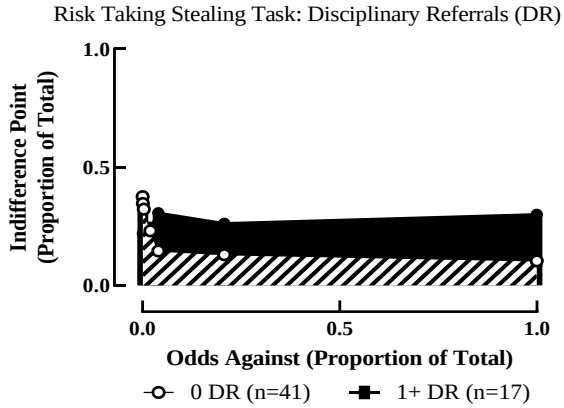

Figure 63. Risk Taking (Marijuana Use) by Disciplinary Referrals (AUC)

Table 13

Average Risk-Taking Task Area Under the Curve by Disciplinary Referral Group

Number of Disciplinary Referrals (DR)	RT Marijuana Task AUC	RT Fighting Task AUC	RT Stealing Task AUC
0 DR	.12	.13*	.10
1+ DR	.30	.28*	.24

* p <.05

Self-Reported Fighting

Figure 64 through Figure 69 depict RTA data per task based on self-reported fighting. Average AUCs on all RTAs were greater for youth who reported fighting in the past year compared with youth who reported never fighting in the past year. As the risk of getting in trouble increased, decreasing trends in reported likelihood of marijuana use and stealing were observed for youth who reported zero fights. Youth who reported fighting in the past year at least once also reported greater than 50% likelihood of engaging in fighting on the RTA (Figure 66).

A Mann-Whitney U test indicated that there was not a statistically significant difference in Risk Taking Marijuana AUC between groups $U(N_{0\ fights}=30, N_{1+fight}=10) = 105.5, p = .17$). A Mann-Whitney U test indicated that there was a statistically significant difference in AUC on the Risk Taking Fighting task between youth who reported no fighting and youth who reported fighting $U(N_{0\ fights}=27, N_{1+fight}=8) = 50, p = .02$). A Mann-Whitney U test indicated that there was no statistically significant difference in Risk Taking Stealing AUC between groups $U(N_{0\ fights}=28, N_{1+fight}=10) = 87.5, p = .08$).

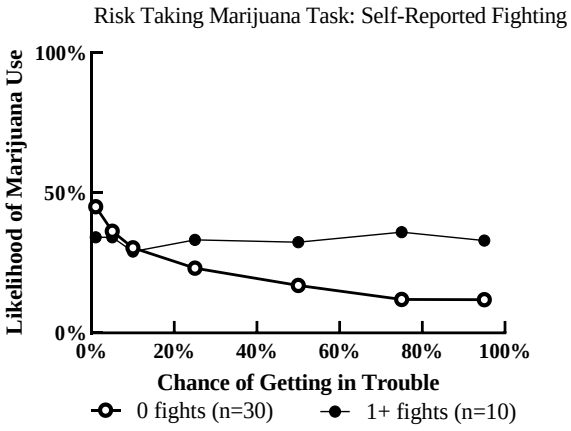

Figure 64. Risk Taking (Marijuana Use) by Self-Reported Fighting

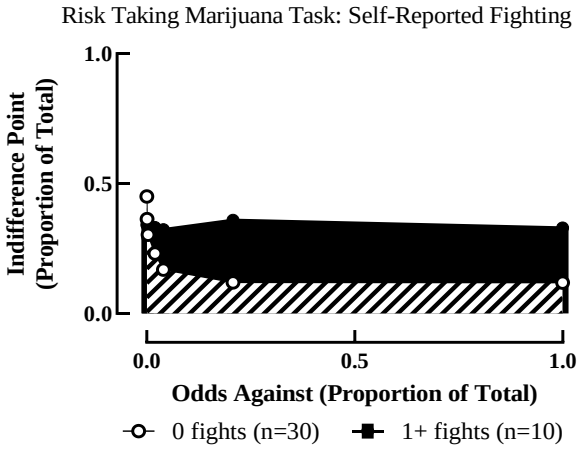

Figure 65. (Marijuana Use) by Self-Reported Fighting (AUC)

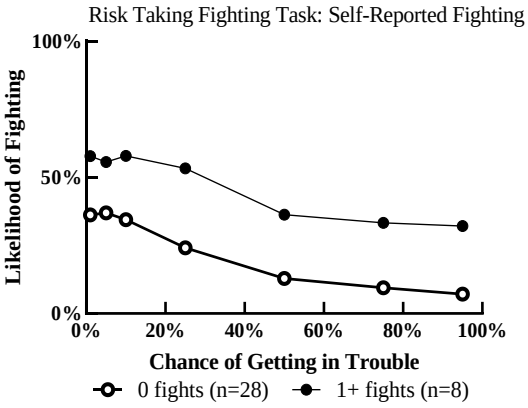

Figure 66. Risk Taking (Fighting) by Self-Reported Fighting

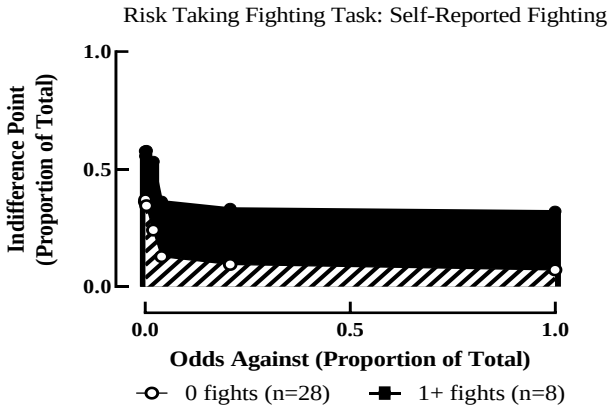

Figure 67. Risk Taking (Fighting) by Self-Reported Fighting (AUC)

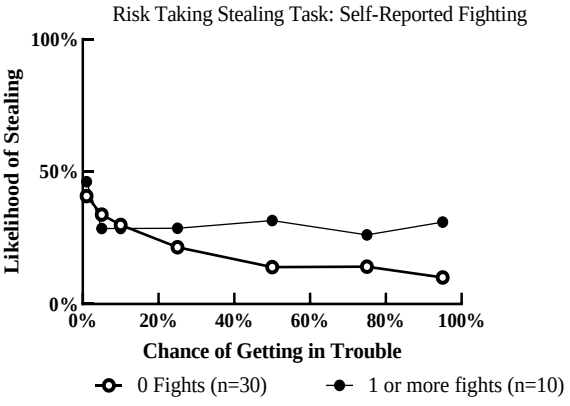

Figure 68. Risk Taking (Stealing) by Self-Reported Fighting

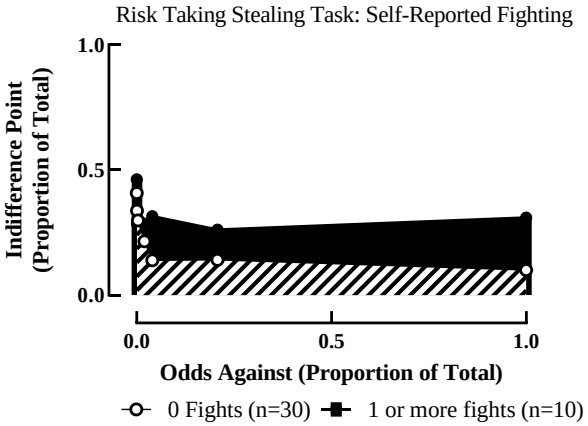

Figure 69. Risk Taking (Stealing) by Self-Reported Fighting (AUC)

Table 14

Average Risk-Taking Task Area Under the Curve by Self-Reported Fighting

Number of fights	RT Marijuana Task AUC	RT Fighting Task AUC	RT Stealing Task AUC
0 Fights	.13	.13*	|.13
1+ Fights	.34	.29*	.29

* p <.05

Self-Reported Serious Attacks

Figure 70 to Figure 75 depict RTA data per task based on self-reported serious assaults. Average AUC was greater on all tasks for youth who reported attacking someone with the intent to seriously harm them in the past year (e.g., serious attacks) compared with youth who did not (Table 15). As risk of getting in trouble increased, decreasing trends in reported likelihood of problem behavior were observed all groups. Youth who reported serious attacks reported a greater likelihood of engaging in all three problem behaviors compared to youth who reported no serious attacks.

A Mann-Whitney U test indicated that there was not a statistically significant difference in AUC on the Risk Taking Marijuana task between groups $U(N_{0\ serious\ attacks} = 30, N_{1+serious\ attacks} = 10) = 111.00$, $p = .23$). A Mann-Whitney U test indicated that there was not a statistically significant difference in AUC on the Risk Taking Fighting task between groups $U(N_{0\ serious\ attacks} = 26, N_{1+serious\ attacks} = 10) = 98.00$, $p = .27$). A Mann-Whitney U test indicated that there was no statistically significant difference in AUC on the Risk Taking Stealing task between groups $U(N_{0\ serious\ attacks} = 30, N_{1+serious\ attacks} = 10) = 97.00$, $p = .10$).

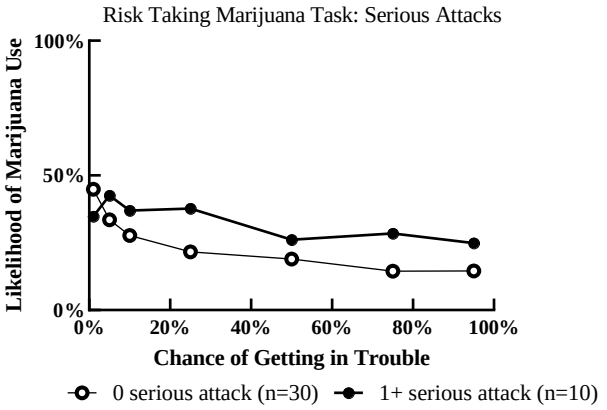

Figure 70. Risk Taking (Marijuana Use) by Self-Reported Serious Attacks

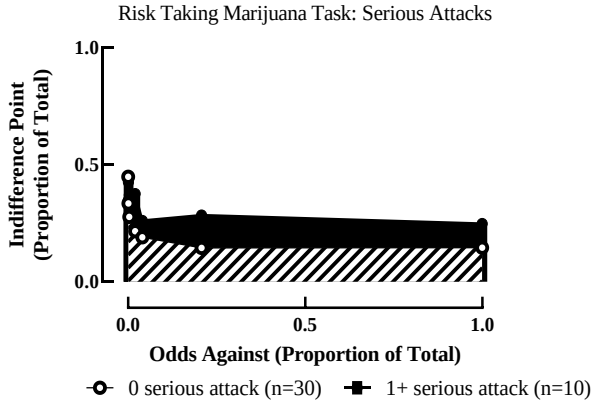

Figure 71. Risk Taking (Marijuana Use) by Self-Reported Serious Attacks (AUC)

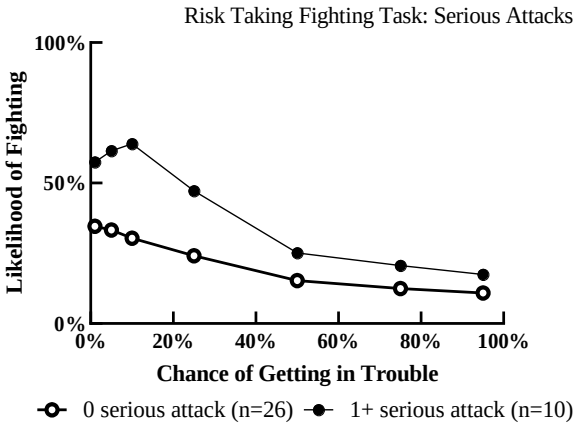

Figure 72. Risk Taking (Fighting) by Self-Reported Serious Attacks

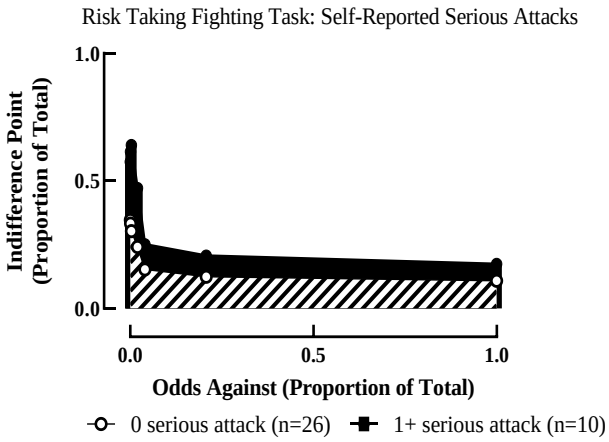

Figure 73. Risk Taking (Fighting) by Self-Reported Serious Attacks (AUC)

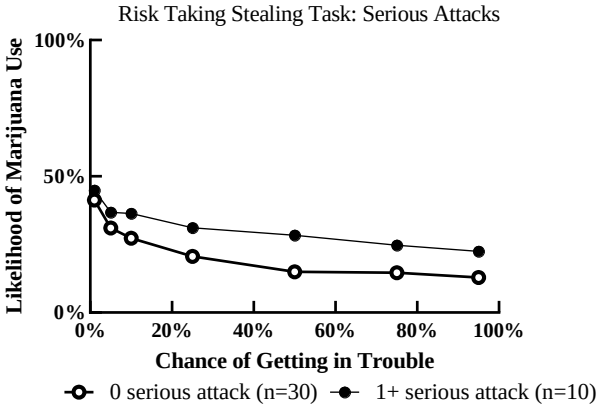

Figure 74. Risk Taking (Stealing) by Self-Reported Serious Attacks

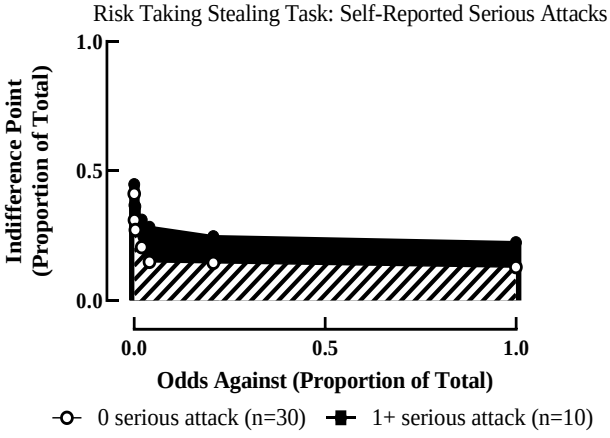

Figure 75. Risk Taking (Stealing) by Self-Reported Serious Attacks (AUC)

Table 15

Average Risk-Taking Task Area Under the Curve by Self-Reported Serious Attacks

Number of Serious Attacks	RT Marijuana Task AUC	RT Fighting Task AUC	RT Stealing Task AUC
0 Serious Attacks	.13	.09	.13
1+ Serious Attacks	.34	.34	.29

Self-Reported Handgun Carrying

Figure 76 through Figure 81 depict RTA data per task based on self-reported handgun carrying. Average AUC on all tasks was greater for youth who had more absences compared to youth who had fewer absences (Table 16). As risk of getting in trouble increased, decreasing trends in reported problem behavior were observed for youth who reported no handgun carrying, but not for youth who reported handgun carrying (Figure 52, Figure 54, Figure 56). Youth who reported carrying a handgun in the past year at least once also reported greater than 50% likelihood of engaging in fighting on the RTA (Figure 78).

A Mann-Whitney U test indicated that there was not a statistically significant difference in AUC on the Risk Taking Marijuana task between groups $U(N_{0\ handgun\ carrying} = 36, N_{1+handgun\ carrying} = 3) = 38.50$, $p = .44$). A Mann-Whitney U test indicated that there was not a statistically significant difference in AUC on the Risk Taking Fighting task between groups $U(N_{0\ handgun\ carrying} = 32, N_{1+handgun\ carrying} = 3) = 19.0$, $p = .09$). A Mann-Whitney U test indicated that there was not a statistically significant difference in AUC on the Risk Taking Stealing task between groups $U(N_{0\ handgun\ carrying} = 36, N_{1+handgun\ carrying} = 3) = 32.5$, $p = .27$).

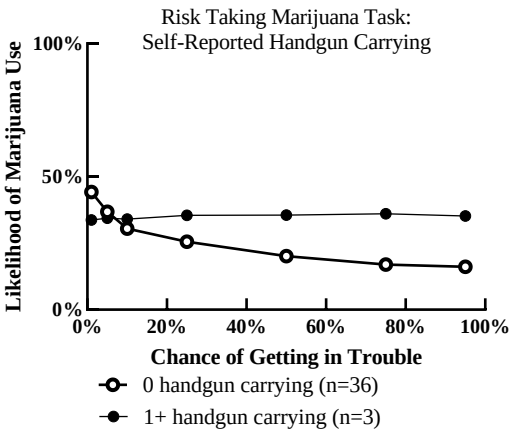

Figure 76. Risk Taking (Marijuana Use) by Self-Reported Handgun Carrying

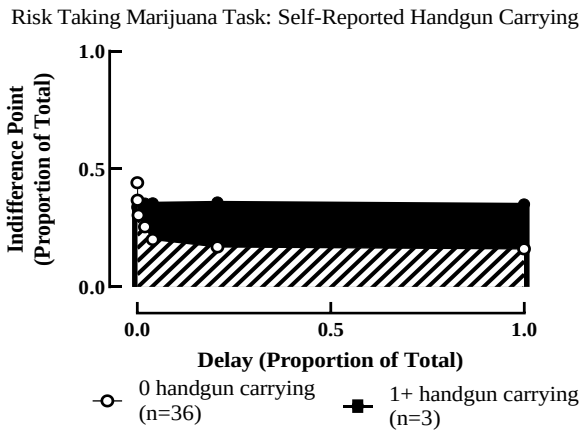

Figure 77. Risk Taking (Marijuana Use) by Self-Reported Handgun Carrying (AUC)

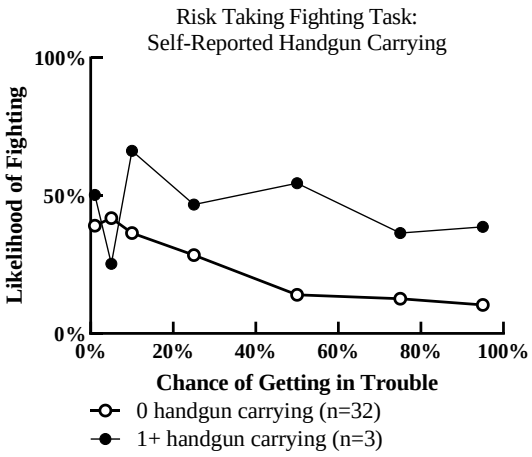

Figure 78. Risk Taking (Fighting) by Self-Reported Handgun Carrying

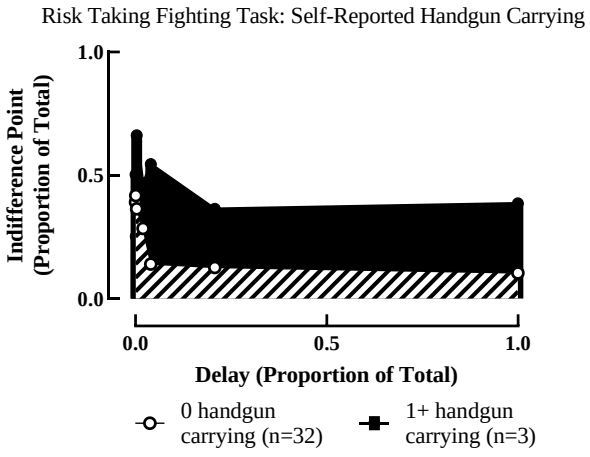

Figure 79. Risk Taking (Fighting) by Self-Reported Handgun Carrying (AUC)

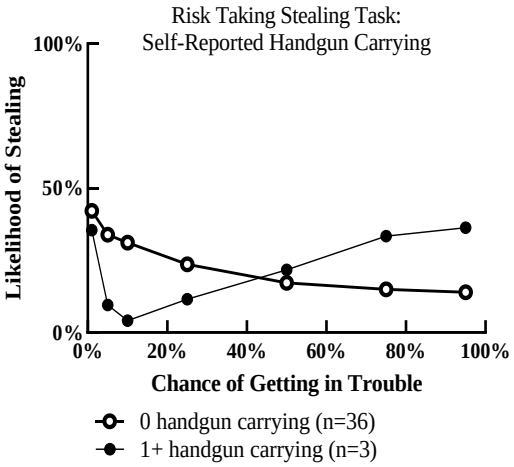

Figure 80. Risk Taking (Stealing) by Self-Reported Handgun Carrying

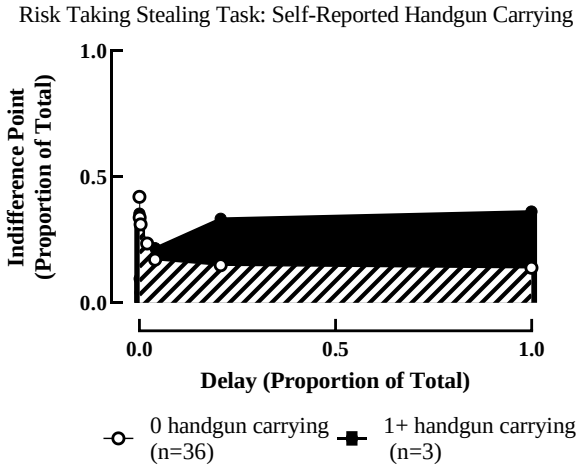

Figure 81. Risk Taking (Stealing) by Self-Reported Handgun Carrying (AUC)

Table 16

Average Risk-Taking Task Area Under the Curve by Self-Reported Handgun Carrying

Number of DR	RT Marijuana Task AUC	RT Fighting Task AUC	RT Stealing Task AUC
0 Handgun Carrying	.19	.13	.16
1+ Handgun Carrying	.52	.39	.48

Community Risk Factors

Figures 82 through 87 depict RTA data per task based on Community Risk Factor (CRF) score. On all tasks, average AUC was greater for youth who higher CRF scores compared to youth who had lower CRF scores (Table 17). As risk of getting in trouble increased, decreasing trends in reported problem behavior were observed for youth who had lower CRF scores. Youth with higher CRF scores reported greater than 50% likelihood of engaging in fighting on the RTA at least once (Figure 84).

A Mann-Whitney U test indicated that there was not a statistically significant difference in Risk Taking Marijuana AUC between groups $U(N_{lower\ CRF} = 18, N_{1+higher\ CRF} = 18) = 105.00$, $p = .07$). A Mann-Whitney U test indicated that there was a statistically significant difference in AUC on the Risk Taking Fighting task between low CRF youth and high CRF youth $U(N_{lower\ CRF} = 14, N_{1+higher\ CRF} = 19) = 56.00$, $p = .00$). A Mann-Whitney U test indicated that there was a statistically significant difference in AUC on the Risk Taking Stealing task between groups $U(N_{lower\ CRF} = 18, N_{1+higher\ CRF} = 18) = 97.50$, $p = .04$).

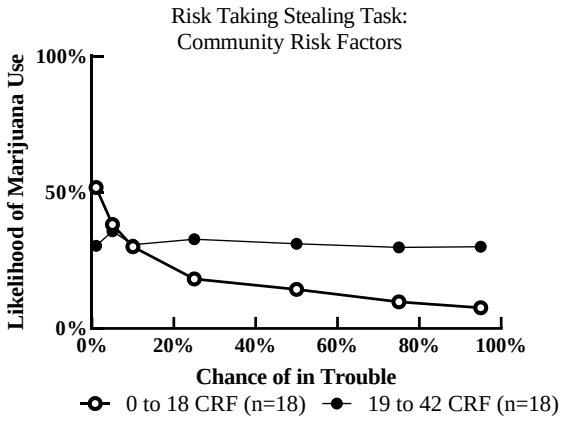

Figure 82. Risk Taking (Marijuana Use) by Community Risk Factor Score

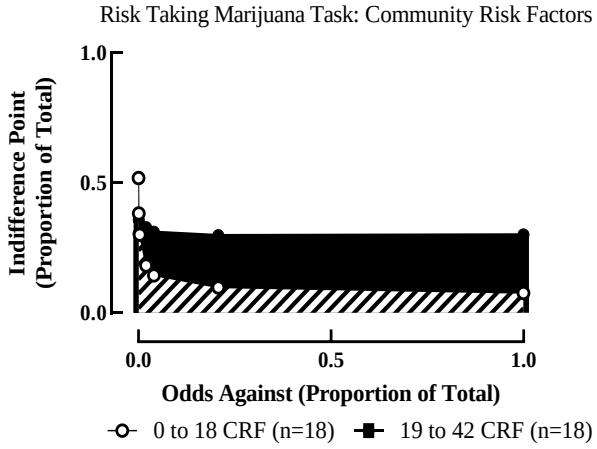

Figure 83. Risk Taking (Marijuana Use) by Community Risk Factor Score (AUC)

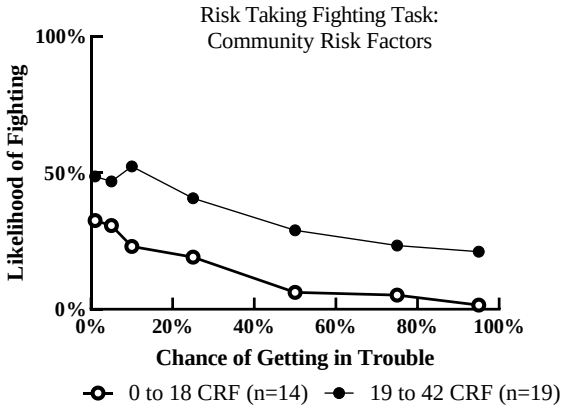

Figure 84. Risk Taking (Fighting) by Community Risk Factor Score

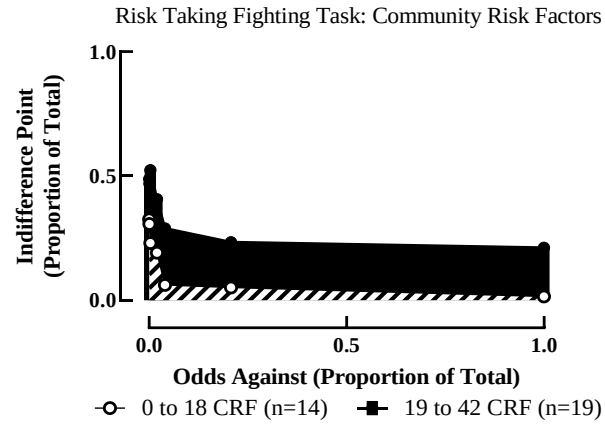

Figure 85. Risk Taking (Fighting) by Community Risk Factor Score (AUC)

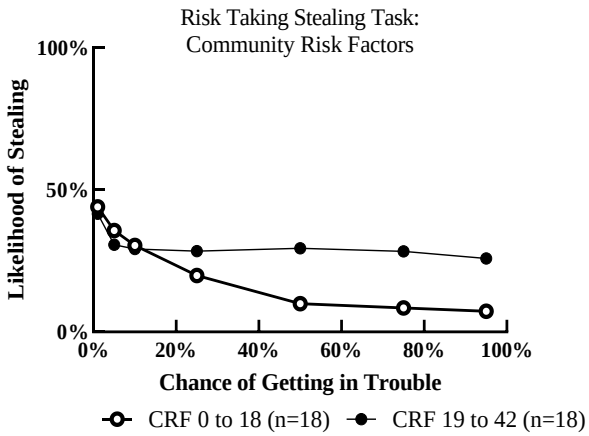

Figure 86. Risk Taking (Stealing) by Community Risk Factor Score

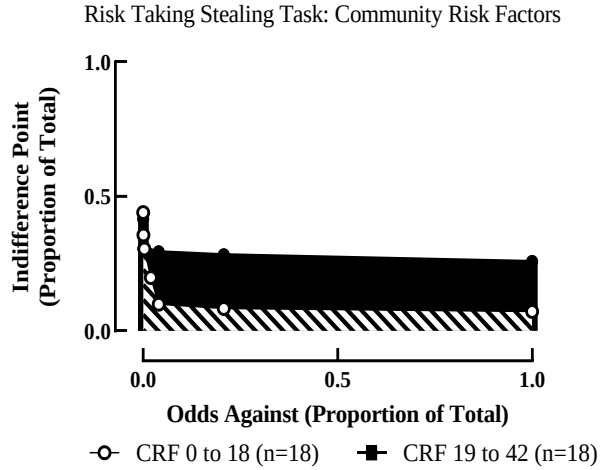

Figure 87. Risk Taking (Stealing) by Community Risk Factor Score (AUC)

Table 17

Average Risk-Taking Area Under the Curve by Community Risk Factor (CRF) Score

CRF Score	RT Marijuana Task AUC	RT Fighting Task AUC	RT Stealing Task AUC
0-18	.10	.04*	.09*
19+	.30	.24*	.27*

Summary

Table 18 depicts a summary of average Risk-Taking Assessment (i.e., RTF, RTM, RTS) AUC values for each independent variable for low- and high- risk groups. Average AUC values were larger (e.g., more risk taking) for high-risk groups on seven of seven independent variables.

Table 18

Summary of Risk-Taking Assessment Dependent Variables

Risk Factor	Average AUC Low Risk Group			Average AUC High Risk Group		
	RTM	RTF	RTS	RTM	RTF	RTS
GPA	.13	.14*	.12	.41	.33*	.30
Attendance	.09	.10	.10	.24	.17	.23
Disciplinary Referrals	.12	.13*	.10	.30	.28*	.24
Fighting	.13	.13*	.13	.34	.29*	.29
Serious Attacks	.13	.09	.13	.34	.34	.29
Handgun Carrying	.19	.13	.16	.52	.39	.48
Community Risk Factor score	.10	.04*	.09*	.30	.24*	.27*

*p <.05

Correlations between Assessments

A weak positive correlation was found between probability discounting Area Under the Curve (AUC) and delay discounting AUC ($r = .25$, $p < .05$). No correlations were found between delay discounting AUC and AUC on the Risk-Taking Marijuana task ($r = -.01$, $p = .95$). No correlations were found between delay discounting AUC and AUC on the Risk-Taking Fighting task ($r = -.08$, $p = .55$). No correlations were found between delay discounting AUC and AUC on the Risk-Taking Stealing task ($r = -.03$, $p = .81$).

A weak positive correlation was found between AUC on the Risk-Taking Fighting Task and probability discounting AUC ($r = .27$, $p < .05$). No correlation was found between AUC on the Risk-Taking Stealing Task and probability discounting AUC ($r = .18$, $p = .17$). A weak, positive correlation was found between AUC on the Risk-Taking Marijuana Task and probability discounting AUC ($r = .30$, $p = .02$).

A strong positive correlation was found between AUC for RT Stealing & RT Marijuana ($r = .83$, $p < .001$). A strong positive correlation was found between AUC for RT Fighting & RT Marijuana ($r = .86$, $p < 001$). A strong positive correlation was found between AUC for RT Fighting and RT Stealing ($r = .78$, $p < .001$).

Discussion

Delay Discounting

Gender Differences

In the present study, male youth discounted more steeply than female youth. These findings most closely resemble those found by Malesa and Ostaszewski (2016) who reported that young adult males showed steeper delay discounting compared to young adult females. However, previous research on gender differences and discounting in adolescent populations has

been equivocal. In the adolescent discounting literature, some researchers have controlled for gender by starting with matched samples. Only a few researchers have explored gender differences, with mixed results (Thamotharan et al., 2017; Sullivan et al., 2017; Reynolds et al., 2007; Martinez-Loredo et al., 2018; Malesa & Ostaszewski, 2016).

Male youth in the study were also more likely to experience risk factors such as academic failure, disciplinary referrals, self-reported fighting, and self-reported handgun carrying compared to female youth. These findings mirror those reported by Martinez-Loredo et al. (2018) who found interactions between gender, risk factors, and delay discounting. In the present study, high-risk male youth generally showed the most impulsivity and low-risk female youth generally showed the least impulsivity compared to all other groups. Thus, future research using larger, matched samples are needed to explore main and interaction effects between gender and risk factors.

Grades/Academic Failure

Previous research suggests that steep delay discounting is associated with poorer academic performance. Academic performance has most frequently been determined based on youth self-report or a combination of parent- and youth- self-report (Farley & Kim-Spoon, 2015; Freeney & O'Connell, 2010; Audrain-McGovern et al., 2004); educational track (Lee et al., 2013); end-of-year grades (Lee et al., 2012) and scores on college entrance examinations (Wang et al., 2017). Thus, the present study adds to the existing literature by using GPA as a marker of academic performance. While the findings in the present study were not statistically significant, the AUC values found in the present study were comparable to AUC values reported in existing research (see Lee and colleagues, 2013, Table 1) and in the expected direction. However, the differences by GPA in the present study were not observed when groups were subdivided by

gender. There has been limited research examining whether the association found between delay discounting and academic performance can be explained by a main or interaction effect related to gender. Thus, the relation between academic performance, gender, and discounting requires further investigation.

Violence

Gender did not fully explain the differences observed by youth who reported past violent behavior. This was the first noted study to examine adolescent discounting and fighting or serious assault, thus findings cannot be directly compared with previous research. The existing research on adolescent discounting and constructs related to violence (e.g., psychopathy, antisocial behavior, narcissism) have yielded mixed results. However, research consistently suggests that Conduct Disorder, a severe form of violence, is associated with steeper delay discounting in adolescents (e.g., Castellanos-Ryan, 2014; White et al., 2014; Fanti et al., 2015).

Conduct Disorder is a severe disorder involving, "repetitive and persistent pattern[s] of behavior in which the basic rights of others or major age-appropriate societal norms or rules are violated . . ." such as bullying/threatening/intimidation, initiating physical fights, using weapons, physical cruelty to people or animals, forced sexual activity, deliberate fire setting, truancy, running away, etc. (American Psychiatric Association [APA], 2013). Youth must exhibit persistent patterns of these behaviors (i.e., three or more of these behaviors within the past six months) to qualify for diagnosis (APA, 2013). Importantly, several of the behaviors examined in this study are behaviors that might precipitate a CD diagnosis (i.e., fighting, serious assault, handgun carrying). Thus, the present study findings corroborate the existing research on Conduct Disorder and discounting and show that subcomponents of CD (i.e., fighting, serious assault) are associated with steeper delay discounting.

Probability Discounting

The results for the probability discounting assessments were, much like the literature on discounting, less robust for probability discounting than for delay discounting. This study was the first study known to explore probability discounting in adolescents in relation to grades/academic performance, attendance, disciplinary referrals, self-reported fighting, self-reported serious attacks, self-reported handgun carrying, or community risk factor score. Except for grades/academic performance, probability discounting was not different between high- and low-risk groups.

One possible explanation is that there is no relation between PD and the other behaviors/risk factors. However, the AUCs reported in the present study were comparable to previous research reporting statistically significant associations between probability discounting and externalizing behavior (Olson et al., 2007). Additionally, the AUCs on the Risk-Taking Assessments (RTA) and the PD task were correlated. Thus, given that the PD task has rarely been applied with adolescent populations, it would be premature to conclude no relation between PD and risk factors altogether; future research is warranted.

Some possible explanations for the lack of differences between groups could be related to the PD task itself. For example, perhaps the PD assessment was not sensitive enough to detect differences between groups. Many of the dependent variables trended in the direction suggesting more risk taking by high-risk youth. It is also possible that the PD task lacks ecological validity; youth may have limited experience choosing between probabilistic monetary rewards.

PD assessments have rarely been studied with adolescents (Moore et al., in prep). Hartley & Somerville (2015) caution researchers when attempting to apply adult models of decision-making to adolescent populations. Research on *delay* discounting assessments suggests that task

parameters and formats affect discounting rates (e.g., Robles and Vargas, 2007, 2008; Tesch and Sanfey, 2008; Robles et al., 2009; Rodzon et al., 2011). However, comparable research exploring PD task parameters has not yet been conducted with adolescents. Thus, further research exploring PD task dimensions and generality of the assessment with adolescents is needed.

Gender Differences

Gender differences were not observed on probability discounting tasks. Of the few published studies on probability discounting in adolescents, none are known to have reported a difference in probability discounting by gender. Tian et al. (2018) matched groups at the study outset along age, gender, and years of education. Malesa and Ostaszewski (2016) did not explicitly report whether probability discounting was associated with gender or not. Olson and colleagues (2007) reported that gender and probability discounting (AUC) were uncorrelated. Reynolds and colleagues (2003) found no main effects and no interaction effects of gender. Thus, the present study is consistent with existing research, but future research is warranted.

Grades/Academic Failure

This is the first study to examine academic performance in relation to adolescent probability discounting. Academic failure was found to be associated with probability discounting. Youth who are less willing to take risks might perform better in academic settings; a youth who is averse to getting a poor grade might put more time or effort into schoolwork, yielding better grades. The present study adds to the probability discounting literature by demonstrating an association between grades and probability discounting. Given that this is the first known study to identify this association, it is important for future research to examine if the finding can be replicated.

Violence

No relation between probability discounting and violence (e.g., self-reported fighting, self-reported serious attack) was observed in the present study. It is unclear whether the results are due to the to the measurement tool, which has rarely been used with adolescent populations or due to a lack of relation between violence and probability discounting. Previous research on probability discounting in relation to adolescent violence is sparse. The closest variable studied has been externalizing behavior; however, the definition of externalizing conflated multiple problem behaviors, including substance use which has already been shown to be associated with steeper probability discounting (Olson et al., 2007; see Bickel et al., 2015). Thus, future research on probability discounting and violence is still needed.

Risk-Taking Assessments

The novel Risk-Taking Assessments (RTA) allowed for statistical and descriptive analysis of risk-taking behavior, which proved to be important given the limited differences between groups observed on the PD assessments (e.g., another measure of risk taking). Different patterns of responding were observed between high- and low-risk groups across most RTAs, suggesting that high-risk groups show more risk persistence. All low-risk groups showed a decreasing likelihood of problem behavior as the chance of getting in trouble increased, suggesting that low-risk groups demonstrated risk sensitivity.

Gender Differences

Some patterns of responding were replicated across RTA tasks (i.e., marijuana use, fighting, stealing) based on gender. Female youth's reported likelihood of marijuana use, fighting, and stealing all decreased as the chance of getting in trouble increased. In contrast, male youth's reported levels of likelihood were roughly similar even as the risk increased. This could

suggest that male youth were less sensitive to the risk of getting in trouble compared to female youth. Previous research on risk-taking in general suggests that men take more risks compared to women (for review see, Byrnes et al., 1999).

Academic Performance & School Attendance

The present study was the first to examine academic performance in relation to the Risk-Taking Assessments. On the Risk-Taking Fighting task, youth who were academically failing showed more risk taking/persistence compared to youth who were academically passing. One plausible explanation is that youth who are academically failing are less concerned about consequences (e.g., risk of getting in trouble).

On the Risk-Taking Marijuana task, academically failing youth reported more likelihood of using marijuana as the risk of getting caught increased. This generally aligns with previous research in Prevention Science suggesting that academically failing youth are more likely to report past marijuana use, current marijuana use, early initiation, and using marijuana on school property (Centers for Disease and Control and Prevention, 2009). However, further research should attempt to replicate this finding as well as explore it with a larger sample size.

Differences were not observed between groups of youth who were absent more than 7 days versus those who were absent 7 or fewer days. To examine whether the groupings explained the lack of differences, additional explorations of the data were conducted that suggested no association between risk taking based on attendance across multiple cut off points. Future research is needed to further understand if there is a relation between absenteeism and risk taking.

Community-Risk Factors (CRF)

The present study found that youth with higher CRF scores reported greater likelihood of fighting and stealing compared to youth with lower CRF scores. On the Risk-Taking Marijuana task, the difference between groups was not significantly different but did approach statistical significance, suggesting that youth with higher CRF scores were also more likely to report that they would use marijuana. These findings are not surprising given that the CRF scale measures youth's reports of community disorganization; laws and norms favorable to drug use; and low neighborhood attachment. High CRF scores generally characterize neighborhoods where youth report common exposure to crime/drug selling, fighting, graffiti, and lack of felt safety; adults who condone problem behavior such as substance use; and lack of policing of illegal behavior (KCTC, 2019). Thus, in the present study, youths self-reported behavior of what they would likely do (i.e., fight, steal, use marijuana) was consistent with the experiences they reported in their neighborhood (e.g., drug use, fighting, crime). Reporting a greater likelihood of stealing or fighting in an unstable/unsafe environment could be considered an adaptive response to food scarcity, economic instability, unsafe living conditions, and other environments with perceived losses (e.g., Hawkins et al., 2002).

Violence

The present study also allowed comparison of self-reports of past violent behavior with likelihood of future violent behavior. First, youth who reported fighting in the past year on the Kansas Communities that Cares (KCTC) Survey also reported more likelihood of fighting on the Risk-Taking Fighting (RTF) task compared to youth who reported no fighting in the past year on the KCTC. Second, youth who reported past serious attacks on the KCTC survey also reported more likelihood of fighting on the RTF compared to youth with no past serious attacks, although

not statistically significant. Third, youth who had one or more disciplinary referrals also reported more likelihood of fighting on the RTF task compared to youth who had no disciplinary referrals. Thus, this suggests that youth's past reports of past behavior corresponded with their future predictions particularly on behaviors that relate closely, suggesting that the tool measures what it is designed to measure (e.g., construct validity and convergent validity).

Across the RTAs, the likelihood of engaging in problem behavior typically was reported at or below 50% across most groups, with a few notable exceptions. Youth who reported past fighting, past serious attacks, past handgun carrying, or greater community risk factors reported more than 50% likelihood of fighting. These results corroborate the construct and convergent validity of the task. The results also suggest that above "might or might not" is a sensitive enough measure to identify youth who are at risk for violence based on their past behavior.

However, since this is the first time the task has been used, future research is warranted to further examine the tasks' reliability and validity. A few feasible studies to explore convergent and construct validity would be to examine KCTC responses on questions about past marijuana use, to see whether they correspond with RT Marijuana Task scores. Similarly, self-reports of other problem behaviors could be compared with the Risk-Taking tasks, and the Risk-Taking tasks could be adapted to explore other adolescent problem behaviors (e.g., risky sexual behavior, gaming/gambling, etc.).

Correlations between Assessments

Delay discounting AUC was weakly and positively correlated with probability discounting AUC. This is consistent with previously published research with adults (e.g., Olson, Hooper, and Luciana, 2007; Holt, Green & Myerson, 2003, Richards et al., 1999). The reason for the correlation is still debated, with some researchers positing that DD and PD both measure

risk-taking, as delayed rewards inherently involve some form of risk (e.g., Green & Myerson, 1996, as cited by Olson et al., 2007). Others suggest that DD and PD both identify impulsivity; however, if they are both measuring impulsivity, the correlation should be a negative correlation (i.e., impulsive individuals should delay discount more and probability discount less). It is more likely that separate processes explain delay and probability discounting (Olson et al., 2007). The present study also found no correlations between delay discounting AUC and AUC on any of the three Risk-Taking Assessments, further indicating that delay and probability discounting measure different constructs.

In contrast, Probability Discounting AUC was weakly and positively correlated with two of three Risk-Taking Assessments (Risk-Taking Fighting and Risk-Taking Marijuana). This suggests the RTAs may similarly measure risk and also may be useful alternative to PD for exploring risk taking. However, further research is needed given the novelty of the RTAs and the limited research on PD in adolescents.

The AUC on all three RTAs were positively and strongly correlated. This suggests that participants responded similarly across tasks. The RTAs may also uniquely offer a measure of behavior-specific risk. For the most part, the greatest differences between groups were generally observed for those risk-groups where the risk-behavior was topographically like the Risk-Taking task (e.g., youth who reported past fighting reported higher likelihood of future fighting that was statistically significantly different than youth who reported no past fighting).

The behaviors of interest selected for the Risk-Taking tasks (fighting, stealing, and marijuana use) were selected for several reasons. First, assessing and reducing these behaviors were key outcomes from the ThrYve study on youth violence prevention that this study as a part of. Second, Kansas City Kansas Police Department data corroborated that theft, battery/domestic

battery (fighting), and drug use were the in the top-four most frequent reasons for youth arrest between 2016 to 2019 (KCKPD, 2019). Third, Kansas Communities that Care survey data indicate that more youth in KCK report lifetime use and past 30-day use of marijuana; attacking someone (i.e., violence); norms favorable to stealing (e.g., "I don't think it's wrong at all to steal something worth more than $5"; and exposure to adults who engage in stealing, compared to the state average (KCTC, 2018). Finally, informal observations and anecdotal evidence from program staff suggested that ThrYve program youth engaged in these behaviors. Importantly, the task could easily be adapted to explore other behaviors of interest.

Strengths

First, the study extended the generality of behavioral economic measures by exploring discounting with a relatively underrepresented population (i.e., African American and Hispanic/Latinx youth). Given that the present study was largely exploratory, the present research replicated the most common methods for studying delay discounting with adolescents (i.e., computerized, adjusting amount procedure using hypothetical monetary rewards) and used both curve fitting and AUC to examine delay discounting data. All delay discounting data better fit Rachlin's (2006) two-parameter hyperbola formula than Mazur's (1987) formula, consistent with previous research (McKerchar et al., 2009). AUC was effective for exploring PD, consistent with McKerchar and Renda's (2012) recommendations to use AUC when extending behavioral economic measures to examine differences between new populations. Thus, by using existing methods to extend the research to new behaviors and populations of interest, the present study extends the generality of behavioral economic measures.

Second, the topic of the study was socially significant to multiple individuals and groups. Nationally, the Center for Disease Control and Prevention make concerted efforts to study and

promote youth violence prevention, evidenced also by national funding from the Division of Health and Human Services Office of Minority Health. Locally, in Kansas City, Kansas where African American and Hispanic youth are disproportionately affected by violence, preventing youth violence is stated community priority and is critically important to the study participants who were at elevated risk for violence.

This study was the first to examine adolescent delay discounting in relation to several new variables including attendance, disciplinary referrals, fighting, serious attacks, handgun carrying, and community risk score. This study was also among the first to examine several new variables in relation to adolescent probability discounting. Thus, the present study extends our understanding of discounting and adolescent problem behavior.

Direct examination of violence is particularly challenging for the applied behavior analytic researcher due to the severity of the behavior and settings in which it occurs. From a prevention standpoint, it would be better to intervene before a youth presents in the hospital as a victim of violence or in the criminal justice system as a perpetrator of violence. A strength of the present study was that it drew from Prevention Science research to inform the assessment battery and explore risk factors for violence which have not been explored in relation to behavioral economic measures.

Future researchers could further explore other related variables, for example police reports of perpetration or hospital records of victimization. Another idea for future research would be to more deeply explore disciplinary referrals based on the type or reason for disciplinary referral. In the present study, the reasons for disciplinary referrals were unknown and all disciplinary referrals were grouped together; however, future researchers could attempt to

identify the reasons for disciplinary referrals to see whether different types of disciplinary referrals are associated with discounting or risk taking.

The inclusion of the novel risk-taking assessments (RTAs) had several advantages. First, compared to other existing risk-taking tasks (e.g., probability discounting, balloon analog risk task, etc.), the RTA is shorter and more efficient, taking approximately five to ten minutes to complete. It is also quicker and easier to implement than the KCTC survey and showed good correspondence with the KCTC survey. Thus, the RTA could be used more frequently, which would be helpful when assessing an individual's risk for problem behavior, as well as to examine intervention effectiveness in real-time. The RTA also appears sensitive enough to identify differences between groups even at low reported likelihood of problem behavior. It uniquely allowed descriptive analysis of patterns of behavior across groups and could also be used to explore individual-level behavior. Future research could adapt the task to explore other risk behaviors and the effect of intervention on self-reported likelihood of problem behavior.

Given the nascence of applied behavioral economic methods with youth who are at-risk for violence, future attempts to replicate and explore the present research is warranted prior to implementing treatments. However, as noted by Morris (1980), "Applied does not mean the only goal of an approach is treatment or intervention…descriptive analyses of social problems and processes that may not or cannot be intervened into [are equally important]" (p. 133). The present study incorporated several measures (delay discounting, probability discounting, three new Risk-Taking Assessments) each of which yielded some new descriptive insights into the problem of youth violence. Thus, the present study sets the stage for future researchers to continue to explore the relation between risk factors for violence and discounting, ultimately toward the goal of preventing youth violence.

Limitations

The strengths of the findings are tempered based on the limited statistical significance observed in the present study, as statistical analysis is commonly used in behavioral economics to interpret whether differences between groups are likely due to chance. The lack of statistical significance in the present study could have been due to several factors, including the operational definitions used to dichotomize the groups, sample size, parameters of the tasks themselves, or a lack of association between variables.

The definitions used to divide youth into low- and high-risk categories for data analysis might have affected the study findings. The study groupings were determined based on actual distribution of data, and sample size limited the groupings available for exploration. For example, despite oversampling high-risk youth, few youths reported handgun carrying in general. This required the groups to be analyzed dichotomously as "never" carrying versus carrying "once or more." Future research with larger samples could explore whether more robust results would have been obtained if the groups were divided differently (e.g., never fighting vs. fighting 35+ times). Alternatively, future researchers could first group the youth based on responses and then attempt to identify the risk factors that are associated with the patterns of responding. For example, youth who reported over 80% likelihood of engaging in problem behavior on the RTA could be grouped and then compared with youth who reported less than 20% likelihood of engaging in problem behavior to identify differences in risk factors between groups. Exploring data this way might offer a more objective method for identifying appropriate risk groups.

The need for larger sample sizes was especially important once differences between groups based on gender were identified. The sample was initially evenly distributed between

male and female youth. However, the present study findings were divided into smaller groups of high- and low-risk male youth based on the observed distributions of risk factors and differences in delay discounting between male and female youth. Dividing the sample in this way sometimes yielded very small sample sizes which limited the interpretations particularly for the delay discounting and the Risk-Taking Assessments.

As mentioned, prior research on probability discounting with adolescents is limited. The present study applied a relatively novel assessment to a novel behavior and a novel population; thus, limited differences between groups are challenging to interpret. One explanation is that the PD assessment lacks sufficient ecological validity to youth who may have limited exposure to choosing between probabilistic monetary rewards. In contrast, the RTAs asked youth to predict the likelihood of behaviors they might commonly engage in. Both assessments require further exploration and validation.

Conclusion

The present study was multidisciplinary, applying Behavioral Economic methods to examine adolescent risk and protective factors identified from Prevention Science research to address youth violence. The present study added to the literature on adolescent problem behavior and discounting by extending the research not only to new behaviors of social significance, but with a population (i.e., African American and Hispanic/Latinx) who experiences elevated risk for violence and is relatively underrepresented in the literature.

The study findings contribute to existing literature suggesting that delay discounting is a trans-disease process which occurs across a range of problem behaviors (Bickel et al., 2012). Youth exposed to greater risk factors, for example living in environments where they perceive fighting, crime and drug selling to be common, may be more inclined to engage in self-protective

measures including violence. Similarly, delay discounting and risk taking may be adaptive (e.g., strategic) in these types of environments, where reinforcement is lean or variable (e.g., Hirsh et al., 2008; da Matta et al., 2012). Youth with higher community risk factor scores reported higher likelihood of stealing, fighting, and marijuana use. Associations between delay discounting and violence were observed in the present study, although further research is needed.

In the case of delay discounting and Risk-Taking Assessments, the necessary step for future researchers would be to replicate and validate the present study findings using larger samples, particularly matched for gender. In the case of probability discounting, future research exploring dimensions of the task and its applicability with youth are necessary given the sparsity literature on probability discounting with adolescents in general. The present study occasions the opportunity for future researchers to further examine risk and protective factors toward the goal of preventing adolescent problem behavior including violence.

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Appendix A

Table 19

Risk Factors for Adolescent Problem Behaviors (Reproduced from Hawkins & Catalano, 1992)

Domain	Risk Factor	Substance Abuse	Delin-quency	Teen Pregnancy	School Drop Out	Violence
Individual	Early and persistent antisocial behavior	X	X	X	X	X
	Alienation and Rebelliousness	X	X		X	
	Friends who engage in the problem behavior	X	X	X	X	X
	Gang involvement	X	X			X
	Favorable attitudes toward the problem behavior	X	X	X	X	
	Early initiation of the problem behavior	X	X	X	X	X
	Constitutional factors	X	X			X
Family	Family history of the problem behavior	X	X	X	X	X
	Family management problems	X	X	X	X	X
	Family conflict	X	X	X	X	X
	Favorable parental attitudes and involvement in the problem behavior	X	X			X

School	Academic failure beginning in late elementary school	X	X	X	X	X
	Lack of commitment to school	X	X	X	X	X
Community	Availability of drugs	X				X
	Availability of firearms		X			X
	Community laws/norms favorable to drug use, firearms, crime	X	X			X
	Media portrayals of violence					X
	Transitions and mobility	X	X		X	
	Low neighborhood attachment and community disorganization	X	X			X
	Extreme economic deprivation	X	X	X	X	X

Source: Hawkins, J.D., Catalano, R.F., & Miller, J.Y. (1992). *Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention.* Psychological Bulletin 112, 64-105.

Appendix B

CDC Risk and Protective Factors for Violence (2020)

Individual Risk Factors

- History of violent victimization
- Attention deficits, hyperactivity, or learning disorders
- History of early aggressive behavior
- Involvement with drugs, alcohol, or tobacco
- Low IQ
- Poor behavioral control
- Deficits in social cognitive or information-processing abilities
- High emotional distress
- History of treatment for emotional problems
- Antisocial beliefs and attitudes
- Exposure to violence and conflict in the family

Family Risk Factors

- Authoritarian childrearing attitudes
- Harsh, lax, or inconsistent disciplinary practices
- Low parental involvement
- Low emotional attachment to parents or caregivers
- Low parental education and income
- Parental substance abuse or criminality
- Poor family functioning
- Poor monitoring and supervision of children

Peer and Social Risk Factors

- Association with delinquent peers
- Involvement in gangs
- Social rejection by peers
- Lack of involvement in conventional activities
- Poor academic performance
- Low commitment to school and school failure

Community Risk Factors

- Diminished economic opportunities
- High concentrations of poor residents
- High level of transiency
- High level of family disruption
- Low levels of community participation
- Socially disorganized neighborhoods

Individual Protective Factors

- Intolerant attitude toward deviance
- High IQ
- High grade point average (as an indicator of high academic achievement)

- High educational aspirations
- Positive social orientation
- Popularity acknowledged by peers
- Highly developed social skills/competencies
- Highly developed skills for realistic planning
- Religious beliefs

Family Protective Factors

- Connectedness to family or adults outside the family
- Ability to discuss problems with parents
- Perceived parental expectations about school performance are high
- Frequent shared activities with parents
- Consistent presence of parent during at least one of the following: when awakening, when arriving home from school, at evening mealtime, or when going to bed
- Involvement in social activities
- Parental/family use of constructive strategies for coping with problems (provision of models of constructive coping)

Peer and Social Protective Factors

- Possession of affective relationships with those at school that are strong, close, and prosocially oriented
- Commitment to school (an investment in school and in doing well at school)
- Close relationships with non-deviant peers
- Membership in peer groups that do not condone antisocial behavior
- Involvement in prosocial activities
- Exposure to school climates with the following characteristics:
- Intensive supervision
- Clear behavior rules
- Firm disciplinary methods
- Engagement of parents and teachers

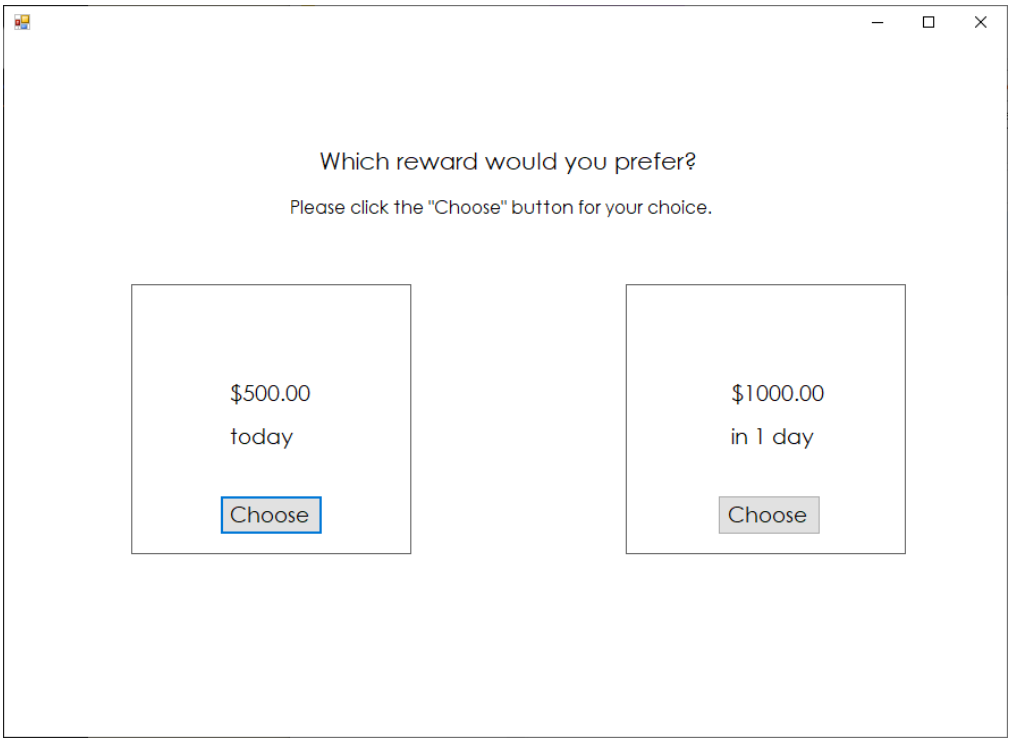
Centers for Disease Control and Prevention (2020, March 2). *Violence Prevention: Risk and Protective Factors.* https://www.cdc.gov/violenceprevention/youthviolence/riskprotectivefactors.html

Appendix C

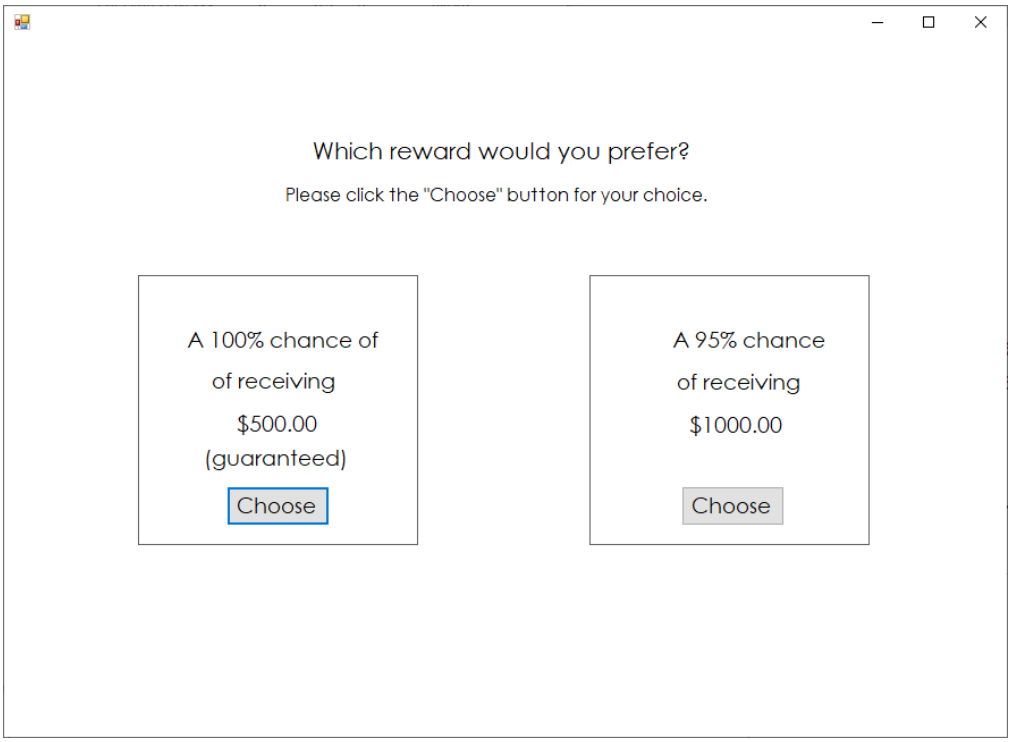
The first screen of the decision-making assessment includes a textbox to type the participant ID. To reduce the likelihood of losing data due to incorrectly typed participant IDs, the participant ID question included data-validation. First, the experimenter types the participant ID. Then, the experimenter is prompted via on-screen text to "Please re-enter the participant number." If the IDs are not identical, a dialog box will pop up that says, "Please enter matching participant codes." Once matching participant IDs are entered, the participant can select "Begin" to begin the assessment.

The initial instructions screen says, "Now you will answer some questions. Your answers are completely confidential. Your answers will not affect you in any way. Only KU staff will see your answers. No one else will see your answers. Please click okay when you are ready to begin." When the participant selects okay, the specific instructions for the subsequent assessment will be presented on screen.

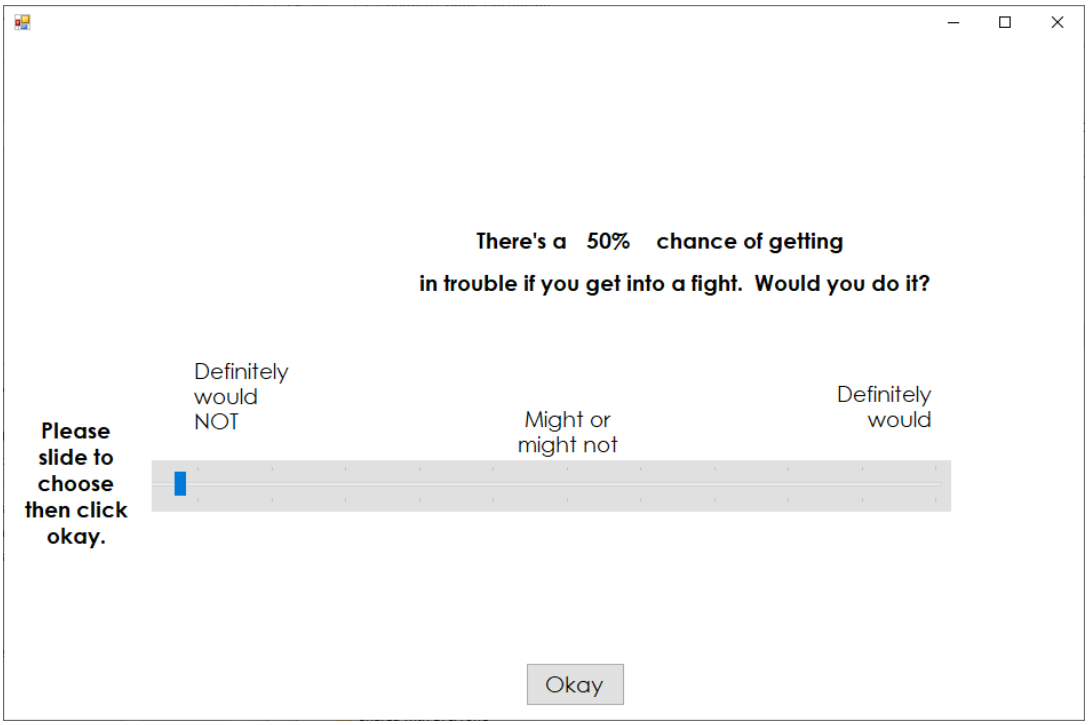
The delay discounting assessment will begin with the instructions, "Now you will answer some questions. The numbers change each time you make a choice. When a number changes, it will flash blue to help you see it." When the participant then clicks "Okay" the next screen says, "Now you will answer some questions about money. For each question, please select the amount you prefer: A) the smaller amount TODAY or B) the larger amount LATER. You will not get the amount you choose but pretend you will really get this amount. Please answer honestly." When the participant clicks "Okay" the delay discounting assessment begins.



Screen shot of Delay Discounting assessment first screen.



Screen shot of Probability Discounting assessment first screen.



Screen shot of Novel Risk-Taking survey first screen.

Demographic questions included in Decision-Making Assessment:

1) In what program are you participating
   (ThrYve, Second Chance, Aim4Peace, Tabernacle Community Development Center, Other, N/A)
2) How long have you participated in this program? __ months, __ years
3) What is your zip code?
4) What is your gender?
   (male, female, transgender)
5) What is your birthday?
   (mm//dd/yy)
6) What is your race/ethnicity?
   (African American/black, Hispanic/Latino, Native American, Asian/Pacific Islander, Caucasian/White, Other)
7) How many children do you have?
8) What is your height?
   (__ feet __ inches)
9) What is your weight?
   (__ pounds)
10) How many hours do you spend playing video games (including on a phone or computer)?
11) What is the highest level of education your parents/guardians have completed?
    (Grade 8 or lower, grade 9, grade 10, grade 11, high school graduate, GED, some college, associate's degree, bachelor's degree, post college)

Appendix D

Teacher Script:

Read aloud the following instructions (most of which are on the first page of the survey) and invite questions:

- Thank you for agreeing to participate in this survey. The purpose of this survey is to learn how students in our schools feel about their school, friends, community and family. Your answers and opinions are important. In order for this survey to be helpful, it is important that you answer each question as honestly as possible. All of your answers will be kept strictly confidential and will never be seen by anyone at your school.
- **The survey is completely voluntary and anonymous. No names or ID numbers are collected on this survey.**
- This is not a test, so there are no right or wrong answers. We would like you to work quickly so you can finish, but it is still important that you read and answer each question.
- All of the questions should be answered by clicking one of the responses. If you do not find an answer that fits exactly, use the one that comes closest. If any question does not apply to you, or you are not sure what it means, just leave it blank. You can skip any question that you are uncomfortable answering.
- You may assume you have not used a particular drug if you do not know what it is.
- You should not consider communion when answering questions about alcohol consumption.
- Electronic cigarettes (e-cigarettes) are sometimes referred to as hooka pens, e-hookas, vape pens, vaping pens, or vape pipes.

- Feel free to go back to a previous page or review your answers by clicking the "Next" and "Back" buttons at the bottom of the page. While you may always change an answer by simply clicking a different response, once any response has been selected, that question must then be answered before proceeding to the next question.
- You will have the entire class period to complete the survey. If you are unable to finish the entire survey, that's okay. There are some questions that are required to be answered. These are the first four demographic questions found on the board: district, building, county and region, plus questions #1 (age), #2 (grade) and #3 (gender), and the last question on the last page. You will receive an error message if you try to move past these questions without answering them.
- I will let you know when time is almost up. At that time, if you are not finished, you should use the "Next" button to skip ahead to the last question of the survey, answer it, then click the "SUBMIT" button. *You will receive a "Thank You" message after you click "SUBMIT". If you do not click "SUBMIT," **NONE** of your responses will be recorded.*

Source: Kansas Communities that Care Survey 2019 Administration Instructions

Appendix E

Distribution of Independent Variables

Table 20

Distribution of Independent Variables: Grade Point Average

Grade Point Average	Number of Youth
0.00-.99	0
1.00-1.99	12
2.00-2.99	16
3.00-4.00	23
Missing GPA	14

Mean: 2.71
Median: 2.8

Table 21

Distribution of Independent Variables: Disciplinary Referrals

Number and Type of Disciplinary Referrals	Number of Youth
0 DR	45
1 DR	5
1 DR, 1 ISS	1
1 STS	1
10 DR	1
2 DR	2
2 DR, 1 STS	1
26 DR, 2 ISS, 2 STS	1
3 DR	2
3 DR, 1 STS	1
3 DR, 3 STS	1
6 DR, 5 STS	1
6, 1 STS	1
7 DR, 1 ISS	1
Missing disciplinary record	1

Table 22

Distribution of Independent Variables: KCTC Individual Level

Response Option	Number of Youth Reporting		
	Fighting*	Serious attack*	Handgun carrying*
Never (0)	34	34	39
1 or 2 times	5	7	0
3-5 times	1	1	0
6-9 times	1	2	0
10-19 times	2	0	1
20-29 times	1	0	0
30-39 times	0	0	0
40+ times	0	0	0
No response	21	21	24

*In the last 12 months

Table 23

Distribution of Independent Variables: KCTC Community Level

Sum of CRF Score (Range, 0-42)	Number of Youth
8	1
11	1
12	3
13	1
14	2
15	2
16	2
17	3
18	4
19	3
20	2
21	6
22	4
24	1
25	2
39	2
31	1
No response to 1 or more questions	25

Table 24

Distribution of Independent Variables: Attendance

Days Missed	Number of Youth
0	2
0.1	1
0.3	1
0.4	1
1	4
1.1	1
1.3	1
1.5	1
1.6	2
2	3
2.1	1
2.2	1
2.5	1
2.6	1
2.7	1
3.1	1
3.6	1
3.7	1
3.98	1
4.5	1
5.3	1
5.6	1
6.5	1
7	1
7.5	2
7.9	1
8	1
8.4	1
9	1
10	1
10.4	1
11.5	1
11.7	1
11.8	1
12	2
12.2	2
12.5	1
13.1	1

13.5	1
13.8	1
14	2
14.2	1
15	1
16.8	1
17	1
18.2	1
21.5	1
23.4	1
27.1	1
29.5	1
31.3	1
32	1
37.2	1
Missing attendance record	1

Mean: 9.21
Median: 7.5