

Delayed Reward Discounting in Adolescents with Sexual Offense Convictions

by

Hugo B. Morais

A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
August 1, 2015

Copyright 2015 by Hugo B. Morais

Approved by

Barry R. Burkhart, Chair, Professor of Psychology
Steven K. Shapiro, Associate Professor of Psychology
Jeffrey S. Katz, Professor of Psychology
Alejandro A. Lazarte, Associate Professor of Psychology

Abstract

Current explanatory models of sexual offending have been useful in elucidating the etiology of maladaptive sexual behaviors. Prominent models of sexual offending, however, are based largely on empirical findings regarding the offending patterns and psychological characteristics of adults. Consistent findings indicate that adolescents who engage in sexually inappropriate behaviors differ from adult sexual offenders in important ways including cognitive functioning, offending trajectory and persistence, as well as response to psychological treatments aimed at addressing inappropriate sexual behaviors. Thus, the downward extension of explanatory models based on the adult literature to adolescent sexual offending is not supported by the extant sexual abuse literature. Importantly, current models of sexual offending emphasize the role of poor decision-making, particularly impulsive responding, in the development of sexual offenses. A precise operationalization of decision-making, however, remains absent in virtually all prominent sexual offending models. The current study, therefore, sought to elucidate the role of decision-making styles in the development of adolescent sexual offending. Based on a growing behavioral economics literature, the current study operationalized decision-making via three delayed reward discounting tasks. Participants consisted of 30 detained adolescents with sexual offense convictions in residential sex-offender treatment and 30 non-sex-delinquents in a state juvenile detention center. All participants completed a hypothetical monetary task, an actual reward task, and a hypothetical delayed reward task based on reductions in post-adjudication requirements (i.e., time in a sex-offender registry and probation). Results indicate that

adolescents with sexual offense convictions discounted future rewards significantly less than non-sex-delinquents on all three delayed reward tasks. Personality characteristics, measured by objective clinical scales, indicate participants presenting high delayed reward discounting were more likely to present behavioral impulsivity, unstable interpersonal relationships, and social insensitivity than low-discounters. Patterns of delayed discounting were not significantly related to sexual offense characteristics, including the age and number of sexual abuse victims. The current findings indicate that decision-making styles may be useful in distinguishing adolescents with sexual offenses from non-sex-delinquents; however, delayed reward discounting may be less useful in elucidating specific aspects of adolescent sexual offending. Importantly, however, the current findings indicate that adolescents with sexual offenses may not be characterized as impulsive, and insensitive to future consequences when compared with adolescents who commit non-sexual-offenses.

Table of Contents

Abstract	ii
List of Tables	vi
List of Figures	vii
Introduction	1
Impulsivity, Decision Making, and Maladaptive Behaviors.....	5
Theories of Sexual Offending and the Role of Decision Making.....	12
Adolescent Sexual Offender Laws and Adolescent Decision Making.....	16
Current Study and Hypotheses.....	18
Method	20
Participants.....	20
Procedure.....	20
Measures.....	21
Results.....	27
Statistical and Quantitative Analyses.....	27
Delayed Reward Discounting.....	29
Hypothetical Monetary Task.....	29
Actual Reward Task.....	32
Registry Probation Hypothetical Task.....	34
Delayed Discounting and Sexual Offending.....	37

Discussion	39
Delinquency, Sexual Offending and Delayed Reward Discounting.....	39
Delayed Discounting and Psychopathology.....	40
Delayed discounting and personality characteristics.....	42
Delayed Discounting and Post-detention Requirements.....	44
Sex Offender Registration: A Sisyphean Endeavor.....	45
Delayed discounting and intelligence.....	46
Delayed discounting and adolescent sexual offending.....	48
Conclusions and Future Directions.....	49
References	51

List of Tables

Table 1	28
Table 2	30
Table 3	32
Table 4	33
Table 5	34
Table 6	35
Table 7	37

List of Figures

Figure 1	36
----------------	----

Introduction

Sexual abuse in its many forms comprises a serious and pervasive public health concern (Pereda, Guilera, Forns, & Gómez-Benito, 2009; Stoltenborgh, van Ijzendoorn, Euser, & Bakermans-Kranenburg, 2011). In the United States, the number of reported cases of forcible rape against women approached 84,000 in 2011 (U.S. Department of Justice, Federal Bureau of Investigation, 2012). Finkelhor (1994) examined the prevalence rates of child sexual abuse in 21 epidemiological studies comprising samples from approximately 21 countries, including the United States and Canada. Prevalence rates of child sexual victimization ranged from 7% to 36% for women, and from 3% to 29% for men. In a follow-up study to Finkelhor (1994), Pereda, et al. (2009) examined epidemiological data from 39 prevalence studies comprising samples from 21 countries, and found similar prevalence rates as those reported a decade and-a-half earlier by Finkelhor (1994), with most studies indicating a prevalence of sexual victimization between 20% and 30% for women, and approximately 10% for men. Thus, consistent findings indicate that sexual abuse of adults and children occurs frequently, and that despite legal and social initiatives, sexual abuse continues to represent a serious societal problem. Notably, adolescents are responsible for a large portion of sexual crimes and account for approximately one third of all cases of child sexual abuse and for approximately 16% of all sexually related arrests in the United States (Faniff & Kolko, 2012; Finkelhor, Ormrod, & Chaffin, 2009).

Studies on the etiology of adolescent sexual offending rely predominantly on well-established models of sexual abuse, which are typically based on studies of adult offenders (e.g., Finkelhor, 1984; Hall & Hirschman, 1992; Marshall & Barbaree, 1990; Marshall & Marshall,

2000). Although well-established models guide important aspects of intervention and prevention (e.g., treatment planning, legal initiatives to address public safety), current etiological models, as well as legal initiatives targeted at juvenile offenders, may overlook critical developmental sensitivities that are characteristic of adolescents (Chaffin, 2008; Letourneau & Miner, 2005). Decision-making is perhaps the most important of these overlooked developmental sensitivities. Specifically, biological, social, and psychological factors interact during adolescence to create a developmental context that is often characterized by generally attenuated executive and decision-making abilities, by an increase in externalizing behaviors, and by greater impulsivity when compared to adulthood (Blakemore & Choudhury, 2006; Blakemore & Robbins, 2010; Broidy et al., 2003; Kazdin, 1997; Loerb et al. 2012; Moffitt, 1993; Moffitt, Caspi, Harrington, & Milne, 2002; Nock, Kazdin, Hiripi, & Kessler, 2006;).

Although most models of sexual offending highlight the importance of decision-making as a distal factor, and in some theories as a proximal contributor, of sexual offending (e.g., Marshall & Barbaree, 1996); precise definitions and operationalizations of decision making within well-established models are largely absent (Ward, Plascheck, & Beech, 2006). However, neuropsychological abilities, typically in the domain of executive functioning, have been studied as proxies for decision-making in populations of sexual offenders. Findings from studies assessing neurocognitive abilities, however, are inconsistent and indicate generally that deficits observed in sexual offenders may also be observed in the profiles of non-sex-offenders (Joyal, Balck, & Dassylva, 2007). Thus, the implications of decision-making styles in general, and those characteristic of adolescents in particular, as etiological factors in sexual offending remain unclear.

In addition to scientific efforts, the high incidence of sexual offending has prompted the development of specific legal initiatives. Under the *parens patriae* doctrine, a principally rehabilitative approach, adolescents with sexual offense convictions are subject to a plethora of post-conviction requirements. In an effort to promote public safety by reducing the incidence of recidivism, post-conviction requirements for adolescents with sexual offense convictions stipulate severely punitive and long-lasting consequences realized primarily through social control measures. At the core of these requirements are the assignment of risk levels after incarceration, mandatory registration in publicly accessible databases, and mandatory community notification. The emphasis on such long-term, sometimes life-long, consequences of sexually inappropriate behaviors is illustrative of the juvenile justice systems' reliance on one's ability to be future-focused and to make adaptive, self-serving decisions in its reformative efforts. However, adolescent decision-making has received surprisingly little attention in the clinical sexual abuse literature, particularly in how it may relate to developmental factors as well as important treatment-outcome measures.

In contrast, an expanding body of experimental research has consistently demonstrated that decision-making styles are correlated with myriad psychological disorders and maladaptive behaviors (Bickel et al., 2012; Green & Myerson, 2004; MacKillop et al., 2011; Vuchinich & Heather, 2003). Specifically, a proclivity to choose immediate rewards, and to perceive rewards displaced in time as less appealing even when future rewards are larger than those immediately available, is correlated with substance use disorders (MacKillop et al., 2010; MacKillop, Mattson, MacKillop, Castelda, & Denovick, 2007; Murphy, Correia, Colby, & Vuchinich, 2005; Tucker, Vuchinich, Black, & Rippens, 2006) disordered gambling (Madden, Francisco, Brewer, & Stein, 2011; Ross, Sharp, Vuchinich, & Spurrett, 2008; Stea, Hodgins, & Lambert, 2011)

personality disorders characterized by emotional dysregulation (Bornovalova, Lejuez, Daughters, Rosenthal, & Lynch, 2005), as well as serious and persistent mental illness (Bickel et al., 2012). These findings rely on delayed discounting paradigms, which have elucidated decision making processes in both humans and non-human animals when decisions require the analysis of both quantity and temporal variables (Green & Myerson, 2004). Thus, whereas decision-making has been largely overlooked in conceptual models of sexual offending, delayed reward discounting (DRD) models have been amply useful in elucidating decision-making factors that contribute to the development and maintenance of maladaptive, often appetitive, behaviors (e.g., substance use disorders).

The current study's objective is therefore to elucidate the role of impulsive decision-making in several important aspects of juvenile sexual offending. First, the current study reviews the extant literature on the correlation among delayed discounting and maladaptive behavioral patterns. Secondly, the current study reviews prevalent models of sexual offending and proposes the assessment of the utility of DRD paradigms as operational definitions of currently vaguely defined constructs (e.g., impulsivity, poor decision making, cognitive errors). Third, the current study presents a discussion of current post-conviction requirements and proposes that decision-making styles may provide a greater understanding of the limitations of post-conviction laws centered on consequences displaced in time. Finally, the current study will assess whether impulsive decision-making is associated with offense characteristics, as well as psychological characteristics of adolescents with sexual offense convictions. Specific hypotheses are outlined thereafter.

Impulsivity, decision-making, and maladaptive behavioral patterns

It is traditional in psychological science for studies to focus on underlying mechanisms that drive specific behavioral phenotypes (Loeber et al., 2012). Studies on maladaptive behavioral patterns during adolescence, including juvenile delinquency, consistently indicate that the interaction of impulsivity and environmental factors is an important example of such an underlying mechanism (Loeber et al., 2012; Loeber, Farrington, Stouthamer-Loeber, Moffitt, & Caspi, 1998; Pardini, Obradovic, & Loeber, 2006; Vitulano, Fite, & Rathert, 2010; White et al., 1994).

Behavioral impulsivity has been a predominant focus, for example, of one of the most comprehensive longitudinal studies on disruptive and maladaptive behaviors: the Pittsburgh Youth Study (Loeber et al. 1998). Initiated in 1987, the Pittsburgh Youth Study assessed biopsychosocial factors in inner-city boys attending the first, fourth, and seventh grades in Pittsburgh, Pennsylvania. The study included approximately 20 subsequent assessments, following participants until the age of 28. Results from the Youth Study were compelling in demonstrating that impulsivity was not only a strong correlate of delinquency cross-sectionally (White et al., 1998), but it also predicted future criminal behaviors. For example, future homicide was only correlated with psychiatric diagnoses that included impulsivity as a cardinal criterion, namely conduct disorder, oppositional defiant disorder, and attention-deficit hyperactivity disorder (Loeber et al., 2012). Moreover, the interaction of cognitive impulsivity, as assessed by standardized measures of cognitive functioning, and intelligence elucidated the age-crime curve, which is characterized by an increase in delinquency from late childhood to adolescence, a peak in delinquency in middle to late adolescence, and a decrease in delinquency from late adolescence to adulthood. Specifically, a stronger increase, peak, and decrease in the age-crime

curve was observed for boys with comparatively higher cognitive impulsivity and average intelligence (Loeber et al., 2012).

Although a compelling explanatory factor in the development of generally delinquent behaviors, studies on the role of impulsivity, predominantly cognitive impulsivity, in the etiology of sexual offenses have not yielded similarly consistent findings. In a comprehensive review of the neuropsychological and neurological literature, Joyal, Black, and Dassylva (2007) highlight that sexual offenders are more likely than other offenders to present deficits in lower-order executive functions, which include inhibition and sustained attention, while retaining intact performance of higher-order executive functions, including reasoning and cognitive flexibility. However, these deficits in neuropsychological functioning, as well as neurological anomalies such as fronto-temporal dysfunctions, are also observed often in the profiles of non-sex-offenders and are reported inconsistently in populations of sexual offenders. Thus, whereas specific anomalies in neurodevelopment and neuropsychological functioning may be associated with an increased risk for sexual offending, particularly pedophilia, inconsistencies in the literature limit further conclusions regarding etiology (Blanchard, Cantor, & Robichaud, 2006, p. 99).

Research on impulsivity, however, has led to the recognition that this construct can be divided into three broad categories: personality based indices, behavioral indices of response inhibition, and indices of decision making (MacKillop et al., 2011; Perry et al., 2005; de Wit, 2005). Current research on the role of impulsivity in the etiology of sexual offending, therefore, has focused almost exclusively on only one of several facets of the construct (i.e., cognitive impulsivity). This is not altogether surprising as psychometrically sound standardized measures of neurocognitive functioning are readily available to clinicians and have served to elucidate

important aspects of antisocial behaviors (Morgan & Lilienfeld, 2000). Alternatively, behavioral economics, an increasingly influential discipline that combines psychological and economic principles, has allowed for the evaluation of decision-making as a critical index of impulsivity, particularly as behavioral economic paradigms aim to elucidate the mechanisms of rational and irrational decision-making (MacKillop et al., 2011; Vuchinich & Heather, 2003).

A specific facet of decision making, delayed reward discounting (DRD), has been widely useful in elucidating impulsive decision-making when both quantity and temporal variables must be evaluated before a decision is made. In most situations, a decisional balance involves the evaluation of only one situational dimension, such as the value of a reward (e.g., buying a cheaper product instead of a more expensive one), or the time one must wait before receiving the reward (e.g., buying groceries before or after work). Problematic decision-making patterns seem to arise, however, when multiple dimensions must be considered before a decision is made (Green & Myerson, 2004; Ross et al., 2008). The prototypical DRD task, therefore, assesses decision making when two outcomes are possible: a smaller reward that is available either immediately or comparatively sooner and a larger reward displaced in time. An example would be choosing between receiving \$100 now or \$120 one month from now, in which case, the modal response may be the former; however, when the options are presented as follows: \$100 one year from now or \$120 in 13 months, the modal response may be the larger reward available later (Green & Myerson, 2004). In this case, when both outcomes are displaced into the future, larger later rewards are more appealing; however, a preference reversal is observed when the range of delay is restricted (e.g., \$100 now versus \$120 one month from now). Green and Myerson (2004) highlight, for example, that a student may prefer to watch a movie Friday night instead of working on a school assignment due the following week that would increase the student's grade

in a course (i.e., preference for a smaller sooner reward). The preference for the immediate reward on Friday night may occur even though the student may have expressed several weeks earlier a strong preference for completing the school assignment (i.e., preference for a larger later reward).

The point at which a change in preference is observed is referred to as the point of preference reversal. According to the DRD framework, preference reversals occur because the subjective value of immediate, smaller rewards increases more than the subjective value of larger later rewards with an equivalent decrease in the delay of the two rewards (Green & Myerson, 2004). For example, \$100 now might be preferable to \$120 in one month (i.e., a 1 month delay); however, \$120 in 13 months might be more appealing than \$100 in one year (i.e., the same 1 month delay). Decision-making patterns based on the discounting framework can be expressed mathematically as the hyperbolic function: $V = A/(1 + kD)$, where V represents the subjective value of a reward, A represents its actual value, D represents the delay until the receipt of the reward, and k represents a discounting parameter that describes the rate of devaluing of the reward displaced in time (Green, Fry, & Myerson, 1994; Green & Myerson, 2004; Kirby & Herrnstein, 1995; Mazur, 1987; MacKillop & Kahler, 2009; MacKillop et al., 2007; Myerson & Green, 1995; Vuchinich & Simpson, 1998). Thus, as k increases, so does one's proclivity to discount future rewards. An alternative and increasingly popular method of quantifying discounting is to calculate the area under the discounting curve (Myerson, Green, & Warusawitharan, 2001; Odum, 2011). The area under the curve (AUC) can be used as an index of discounting as it is negatively correlated with the rate with which the value of a delayed reward is discounted. AUC can be calculated through trapezoidal integration by summing the areas of discrete trapezoids under the discounting curve delineated by X and Y coordinates. Each

discrete trapezoid can be calculated as $X_2 - X_1 [(Y_1 + Y_2)/ 2]$, where X values represent normalized delays, and Y values represent normalized preference reversal amounts.

The delayed discounting framework has been extended to studies of addictive behaviors and psychopathology, with consistent findings indicating that excessive temporal discounting is associated with a variety of behavioral problems. For example, Kirby and Petry (2004) investigated the association between delayed discounting and substance abuse in 145 participants, including 33 who abused alcohol, 41 who abused cocaine, 27 who abused heroine, and 44 control participants without a history of substance abuse. A monetary choice questionnaire (MCQ; see Kirby, Petry, & Bickel, 1999) was used to estimate participants' rate of discounting. The MCQ presents a set of 27 choices between a smaller immediate reward and a larger delayed reward. Results indicated that participants who abused cocaine and those who abused heroin presented higher discounting rates than the control group and that abstinence was correlated with lower rates of discounting for heroin users. Bjork, Hommer, Grant, and Danube (2004) demonstrated that individuals with an alcohol dependence presented higher rates of discounting even after a period of detoxification as inpatients receiving substance abuse treatment. Similarly, Field, Christiansen, Cole, and Goudie (2006) assessed the rate of delay discounting in 90 adolescents with a history of alcohol abuse. Heavy drinkers presented significantly higher rates of delayed discounting, as well as an attentional bias for alcohol-related cues in a modified Stroop task. MacKillop et al. (2011) summarize similar findings in a meta-analysis of the extant addiction literature, highlighting that despite a high heterogeneity of effect sizes, a small effect of DRD on substance addiction was observed generally ($d = .15$); however, when methodology was considered, larger effects were associated with studies utilizing clinical samples ($d = .61$), and studies with a large numbers of self-report items ($d = .58$).

Different classes of psychiatric diagnoses, in addition to substance use disorders, also seem to be associated with excessive rates of future discounting. For example, Gold et al. (2008) evaluated decision making, emotional arousal, and learning in 41 adults diagnosed with schizophrenia and 31 control participants. Participants in the clinical group were stable and receiving pharmacological treatment for schizophrenia; nonetheless, results indicated that participants in the clinical group presented significantly higher rates of delay discounting. Similarly, Heery, Robinson, McMahon, and Gold (2007) evaluated decision making in 31 participants diagnosed with schizophrenia, 11 participants suffering from schizoaffective disorder, and 29 controls without a psychiatric diagnosis. Participants in the clinical group demonstrated a significantly higher rate of delay discounting than the control group; however, clinical participants with higher memory and higher levels of negative symptoms demonstrated discounting rates most similar to the control group. Thus, it appears that memory may impact the relationship between schizophrenia and the evaluation of immediate and delayed rewards.

The role of future discounting has also been considered in the development of disorders characterized by poor emotional regulation, particularly as these disorders are also highly correlated with substance abuse. Bornovalova et al. (2005) highlight that impulsivity and poor emotional regulation are canonical to both borderline personality disorder (BPD) and substance use disorders (SUDs), with the implication that differential rates of DRD may be characteristic of individuals diagnosed with BPD. However, Dougherty et al. (1999) found no significant differences in the rates of delayed discounting between BPD participants and non-BPD controls. Nonetheless, higher discounting has been observed in individuals suffering from depression and social anxiety when compared to non-diagnosed controls (Swam et al., 2002; Yoon et al., 2007). In light of extensive evidence of the association between excessive delayed discounting and

different classes of clinically significant maladaptive behaviors, Bickel et al. (2012) propose that excessive discounting of future rewards comprises a “trans-disease” process thought to manifest across different classes of disorders.

Another important clinical consideration of DRD is that excessive discounting has been demonstrated to predict differential treatment outcomes in several settings. For example, Badger, Saklly, and Dantona (2011) investigated the relationship between DRD and the duration of cocaine abstinence in a sample of outpatients receiving treatment for cocaine dependence. Higher rates of future discounting were associated with shorter intervals between cocaine use and therefore lower abstinence. A relationship between DRD and treatment outcome has also been observed in adolescents receiving substance abuse treatment. Stanger et al. (2012) investigated the relationship between DRD and treatment outcomes for 165 adolescents receiving outpatient treatment for marijuana abuse. Participants completed a hypothetical monetary DRD task and their marijuana use while in treatment was monitored. Participants with higher DRD rates demonstrated the greatest frequency of in-treatment marijuana use. Moreover, DRD predicted in-treatment use beyond the type of treatment administered. Similarly, MacKillop and Kahler (2009) investigated the relationship between DRD and smoking cessation in 57 adult heavy drinkers receiving treatment for nicotine addiction as part of a randomized controlled trial. DRD predicted the amount of time until relapse (i.e., until an individual smoked after a period of abstinence) beyond covariates such as nicotine dependence and sensation seeking. These findings indicate that the rate of future discounting may comprise a significant risk factor in the treatment of addictive and other maladaptive behaviors.

Theories of sexual offending and the role of decision-making

Allusions to the importance of decision-making can be found in most well established models of sexual offending. Marshall and Barbaree's Integrated Theory (Marshall & Barbaree, 1990; Marshall & Marshall 2000) is a multifactor explanatory model of general sexual offending, as well as sexual deviance, that has received adequate empirical support, and is consequently a highly influential model (Ward, Plascheck, & Beech, 2006). The central notion of Marshall and Barbaree's Integrated Theory is that sexual offending results from the combination of developmental vulnerabilities and situational factors. According to the Integrated Theory, early adverse developmental experiences (e.g., physical, emotional, and sexual abuse; neglect) comprise powerful destabilizing events that damage a typical developmental trajectory and lead to predispositions to offend sexually. Specifically, adverse early experiences are thought to hinder the development of appropriate interpersonal skills, to compromise the ability to develop trust and secure attachments, and to contribute to pervasive low self-esteem and poor emotional regulation. The interaction of poor emotional coping, interpersonal ineffectiveness, and a generally maladaptive attachment style, according to the Integrated Model, may result in difficulties with problem solving, decision-making, and impulsivity (Ward, Plascheck, & Beech, 2006, p. 34). Thus, in a developmentally adverse context in which the individual fails to develop a cognitive and behavioral repertoire to elicit support from others, and in which access to social reinforcers necessary for healthy development is low, the probability of maladaptive coping of emotional distress is high. Consequently, Marshall and Barbaree postulate that coping through sexually gratifying acts (e.g., masturbation) becomes a viable alternative to securing externally determined rewards, particularly after early sexualization. In this context, sexualized coping comprises an immediate reward that may be more appealing than engaging in behaviors with

higher response costs, such as adaptive and socially appropriate ways of fulfilling sexual and emotional needs (e.g., dating, developing interpersonal relationships).

In the case of adolescents, the Integrated Theory highlights that puberty sets the stage for several critical developmental tasks. First, a developmentally vulnerable adolescent must negotiate a social environment often lacking interpersonal skills necessary for the establishment of peer and romantic relationships. Secondly, facing a high probability of social rejection, an adolescent with developmental vulnerabilities must cope with negative emotional states in the likely absence of a supportive network, as well as generally poor emotional coping, resulting in a proclivity to engage in immediately gratifying sexual behaviors.

The Integrated Model suggests broadly that sexual offending is a multidetermined phenomenon realized through the confluence of developmental vulnerabilities, social, and biological factors. Nonetheless, the model allows for specific predictions. For example, developmentally vulnerable individuals tend to choose victims deemed as non-threatening (Marshall & Marhsall, 2000), which often includes victims who are younger than the offender. Moreover, according to the model, a possible pathway to sexually aggressive behaviors in adolescence may be the inability to inhibit aggressiveness in the presence of sexual arousal. However, although decision-making and judgment are highlighted as deficient in adolescents with vulnerabilities conducive to sexually offending, the theory does not elaborate on these constructs, and it does not indicate how they may be operationalized. Thus, although conceptually relevant, the definition of decision-making within the context of sexual offenses, according to the Integrated Model, is absent.

An underlying decisional balance is implicit in Marshall and Barbaree's Integrated Theory. In the context of sexualized coping, for instance, immediate gratification through a

reduction in negative emotional states is preferred to the more costly response of seeking socially appropriate ways of meeting sexual and attachment needs, which would be temporally displaced. Similarly, engaging in sexual contact with a non-threatening victim (e.g., children or impaired individuals) may provide an immediate, although potentially less satisfying reward, than a delayed, more satisfying outcome (e.g., developing a romantic relationship). Hence, the decision to offend sexually when situational factors are conducive to an offense (e.g., no supervision, presence of a non-threatening victim) may be conceptually consistent with DRD paradigms, as it represents a proclivity to choose immediate rewards, even when more satisfying and socially appropriate outcomes may be available in the future.

A decisional balance may also be inferred in Finkelhor's Precondition Model (Finkelhor, 1984), a well-established model of child sexual abuse. The Precondition Model is centered on the notion that individuals who engage in child sexual abuse comprise a heterogeneous group, and that a combination of factors, including traits within normal limits of psychological functioning, interact to result in child sexual abuse. Specifically, Finkelhor delineates four necessary preconditions for the sexual abuse of a child, namely the motivation to abuse sexually (i.e., instead of other forms of abuse), the ability to overcome internal inhibitors, the ability to overcome external inhibitors, and the ability to overcome the victim's resistance.

The Precondition Model postulates that motivations to commit child sexual abuse fall generally within 3 categories. First, Finkelhor (1984) suggests that an emotional congruence may exist so that the offender perceives the child as a viable emotional partner who is able to meet adult attachment needs. Moreover, in accordance with Marshall and Barbaree's Integrated Theory, an aversive learning history with age-appropriate interpersonal relationships (e.g., rejection), may contribute to the offender's belief that a child would be a more viable partner

than an adult (e.g., non-threatening, deferent to the adult offender). A second possible motivating factor, according to Finkelhor, is deviant sexual arousal, which in this context is operationalized as pedophilic interest. The precondition model highlights that many developmental pathways can lead to deviant sexual arousal; however, all pathways seem to include the common factor of a vandalized early sexualization, including experiences of sexual abuse either directly or indirectly (e.g., though exposure to pornography). A third possible motivation for targeting children is an inability to meet sexual and emotional needs through age-appropriate relationships, which contributes to the offender's perception of children as "surrogate partners" (Ward, Plascheck, & Beech, 2006, p. 22).

The second precondition in Finkelhor's model is overcoming internal inhibitors, which may occur through myriad means. However, central to the fulfillment of the second precondition is the presence of diminished capacity for self-control, or an inability to manage sexual urges. Following the disinhibiting of internal mechanisms that prevent sexually deviant acts, in the presence of strong motivations to offend, Finkelhor suggests that the offender must overcome external inhibitors, which include barriers to close proximity to a potential victim (e.g., family, supervising adults, laws). Finally, the last precondition in Finkelhor's model is the overcoming of the child's resistance. After motivating factors have been activated, and internal and external inhibitors overcome, the offender may work diligently to reduce the child's resistance, typically in a gradual process including grooming of potential victims, a gradual sexualization (e.g., introduction to pornography), but may also include threats of or actual violence.

As with Marshall and Barbaree's Integrated Theory, the Preconditional Model implies that decision-making is a critical component embedded within multiple factors in the model. In the first precondition, the motivation to sexually offend against a child, the Precondition Model

highlights the adult's proclivity to choose a child as a sexual partner, a potentially immediately gratifying option, over an adult, a more costly response that may require a delayed outcome (e.g., building an age-appropriate romantic relationship). Similarly, in preconditions three and four, the model highlights the critical role of self-regulatory abilities, as well as judgment; however, these constructs are not well defined, and it is unclear, for example, whether behavioral disinhibition is more salient to the model than emotional disinhibition. Thus, a DRD paradigm would also be appropriate in testing hypotheses consistent with the Precondition Model, as it would provide an operational definition for a construct that seems critical to the internal consistency of the model, yet remains poorly defined.

Adolescent sexual offender laws and adolescent decision-making

The implementation of socio-legal interventions is often at odds with empirical evidence regarding the effectiveness and appropriateness of legally imposed post-conviction sanctions against adolescents who commit sexual offenses (Chaffin, 2008; Letourneau & Miner, 2005). Specifically, post-conviction requirements are procrustean and assume that adolescents with sexual offense convictions comprise a homogenous group and that delinquent adolescents can be categorized dichotomously (i.e., those who sexually offend and those who commit only non-sexual offenses). This is evidenced by the fact that most post-conviction requirements do not apply to non-sexual offenders. However, adolescents with sexual offense convictions are a heterogeneous group, not only in psychological profile, but also in the nature of their offenses (Herkov, Gynther, Thomas, & Meyers, 1996; Veneziano & Veneziano, 2002).

The effectiveness of clinical and social interventions, particularly as deterrents of future offenses, relies on the adolescent's understanding of the consequences not only of the offense itself, but also of the future costs incurred as a consequence of post-conviction classifications

(e.g., risk level). For example, The Adam Walsh Act, enacted in 2006, mandates that adolescents adjudicated for sexual offenses must return to court after serving their sentences, at which point they are assigned risk levels based on progress while in treatment, as well as the presiding judge's discretion. The assignment of risk is based on three categories: tier I, tier II, and tier III, with tier III representing the highest level of risk. Each risk level delineates specific social-control requirements. For example, adolescents with sex-offense convictions must register with a national database, and upon release from incarceration, they must appear in person to verify and update information contained in the registry. The frequency with which offenders must verify these data is based on offenders' risk level. Tier II offenders must appear every six months, whereas tier I offenders only appear once per year. Additionally, tier I offenders must register for 15 years post-incarceration, tier II offenders must register for 25 years, and tier III offenders have a life-time registration requirement. Moreover, the jurisdiction where the offenders are registered must maintain the following offender information: physical description, charge, offender's general criminal history, current photograph, a set of fingerprints, a DNA sample, and a copy of the sex offender's driver's license. Although the Federal Bureau of Investigation and the Attorney General's office maintain the database, data from the registry are publicly accessible on the internet via a zip code search.

As the assignment of risk is determined in part by the adolescent's conduct while in treatment, short-term decisions that are largely independent of the actual sexual offense (e.g., to comply with treatment, to follow the rules of the correctional facility) may directly impact the offender's future, perhaps more severely than a discrete period of incarceration. For instance, whereas an adolescent may serve a 12-month sentence, he may be required to remain in the sex offender registry for 25 years post incarceration depending on his charge and level of risk. In

effect, the success of post-conviction requirements as deterrents of future offenses, therefore, hinges on the offender's ability to choose larger-delayed rewards. That is, in order to reduce the likelihood of reoffending, as well as the frequency and intensity of behaviors that compromise the offender's rehabilitation, a decisional balance must favor future consequences over immediate, more tangible rewards. That is, while in treatment, adolescents with sex-offense convictions must demonstrate progress in understanding their offenses, as well as a decreased proclivity to reoffend, which may require an emotionally difficult therapeutic engagement. A hesitation to effectively engage in treatment (i.e., smaller immediate reward) may influence staff's ratings of offenders' risk level and lead to more costly future consequences (e.g., greater post-conviction requirements).

Thus, the ideal response pattern for adolescents in the process of being rehabilitated would be to always choose a future larger reward (e.g., greater freedom after incarceration) over a smaller immediate reward (e.g., disengagement from treatment, noncompliance with institutional rules). A review of the extant DRD literature indicates, however, that persistent maladaptive behaviors tend to be associated precisely with the opposite decision-making style required, at least conceptually, for the effectiveness of future-focused post-conviction requirements.

Current study and hypotheses

The current study examined delayed rewards discounting in adolescents adjudicated for sexual offenses and non-sex-delinquents detained in a state juvenile correction center. Based on the extant delayed reward discounting and sexual offense literatures regarding decision making, cognitive factors, and general antisocial behaviors, the following hypotheses were tested: 1) delayed discounting differentiates adolescents adjudicated for sexual offenses from non-sex-

delinquents; 2) delayed discounting is associated with participants' intellectual functioning, 3) delayed discounting is associated with psychopathic traits, 4) delayed discounting is associated with internalizing psychopathology, 5) delayed discounting is associated with personality characteristics. Moreover, it was hypothesized that delayed discounting would be significantly related to offense characteristics in participants adjudicated for sexual offenses, including age of victims, number of victims, and number of juvenile delinquent commitments. Finally, it was hypothesized that adolescents with sexual offenses would discount future rewards related to sexual offender registration significantly less than non-sex-delinquents discount future rewards regarding probation.

Method

Participants

Participants consisted of 30 male adolescents adjudicated for sexual offenses and 30 male non-sex-delinquents. The average age of participants was 16.8 (± 1.32) years; however, non-sex-delinquents were significantly older than those adjudicated for sexual offenses, $t(46.93) = 3.25$, $p = .002$, ($M = 17.31 \pm 1$ and 16.24 ± 1.4 , respectively). The average length of time in detention at the time of data collection was 113.56 (± 85) days. Participants with sexual offense convictions, however, spent significantly more time in detention (i.e., 138.30 ± 101.35 days) than non-sex-delinquents (i.e., 85 ± 58.03 days), $t(45.27) = 2.23$, $p = .031$. Demographic information indicates that 49.1% of participants identified as White, 43.6 as African American, 3.6 as Hispanic, and 3.6 as other/biracial.

Procedure

With approval from the Institutional Review Boards (IRB) of Auburn University and the facility in which participants were housed, data were collected as participants completed a comprehensive psychological assessment approximately two weeks after their arrival at the detention facility. During each assessment, participants were invited to participate in a study aimed at improving the provision of services to adolescents in the facility. Each participant was informed that although the psychological assessment was a required part of his treatment protocol, participation in the current study was voluntary. Moreover, participants were informed that their decisions to participate or to decline to participate had no bearing on their detention.

As part of comprehensive pre-treatment psychological assessments, participants completed measures of intelligence, personality, psychopathology, attachment, and risk of reoffending. Participants completed three computerized DRD tasks: a hypothetical monetary reward task (Field et al., 2006), an adapted DRD task in which participants had a chance of receiving actual rewards in the form of a points in a token economy established within the correctional facility, and a hypothetical DRD task in which the rewards were presented as time reductions from the post-conviction registration requirements for participants adjudicated for sexual offenses, or probation for non-sex-delinquents. Administration of the three DRD tasks was counterbalanced.

Measures

Semi-structured interview. Clinical data were obtained via a 90-minute semi-structured interview including general demographic information (e.g., date of birth, ethnicity), sexual developmental history (e.g., age of first sexual experiences, age of first masturbation), sexual victimization history (e.g., experience of sexual abuse, relationship to perpetrator, duration of sexual abuse) an assessment of living conditions (e.g., family structure, history of abuse), and a history of delinquency and sexual offending.

Juvenile Sex Offender Assessment Protocol-II (JSOAP-II; Prently & Righthand, 2003). The JSOAP-II is a 28-item systematic checklist designed to assess for risk factors related to sexual and criminal offending in male adolescents aged 12 to 18 years. The JSOAP-II yields four factor scores (Sexual drive/preoccupation, Impulsive/antisocial behavior, Intervention, and Community stability/adjustment), as well as Static (i.e., typically unchanging responses such as family and historical variables), and Dynamic scores. Internal consistency coefficients for the JSOAP-II have been found to be between .64 and .95.

Inventory of Parent and Peer Attachment (IPPA; Armsden & Greenberg, 1987). The IPPA is a 28-item self-report measure of parental (i.e., adolescent to parent) and peer (i.e., adolescent to peer) attachment. All items are assessed via a five-point Likert-scale (1 = *almost always true*, 5 = *almost never true*), and a total score and three subscale scores are derived as the sum of items in each scale, namely: Trust, Communication, and Alienation. Internal consistency on this scale has been found to be between .73 and .93.

The *Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime version* (K-SADS-PL; Kaufman, Birmaher, Brent, Rao, & Ryan, 1996). The K-SADS-PL is a semi-structured interview used in the assessment of current and past symptoms of psychological disorders. The K-SADS-PL can be administered by interviewing parents, the child, or both. The present study interviewed participants alone, and only current scores were included as they can be corroborated via other sources of data (e.g., MACI scores, medical and psychological history). Interrater reliability for the K-SADS-PL is high, and test-retest reliability has been found to be between .50 and .70.

Personality and Psychopathology: The Millon Adolescent Clinical Inventory (MACI; Millon, Browne, 1993) is a self-report measure widely used in the assessment of juvenile delinquents. It consists of 160 true-false items that assess personality features (i.e., 12 personality pattern scales), psychopathology based on DSM nosology (i.e., seven clinical syndrome scales), and psychological functioning (i.e., eight expressed concerns scales). Internal consistency and test-retest reliability are adequate and range from .61 to .91 and .63 to .92 respectively.

Intelligence: The Wechsler Abbreviated Scale of Intelligence (WASI; Psychological Corporation, 1999) is a short form of the Wechsler scales intended to assess intellectual functioning in individuals between the ages of six and 89 years. As an abbreviated measure, the

WASI was selected in an attempt to mitigate fatigue during a long, comprehensive assessment including measures of academic achievement, psychopathology, personality, and risk-level. The WASI is comprised of four subtests: Vocabulary, Similarities, Matrix Reasoning, and Block Design. It provides a general measure of intellectual functioning (i.e., Full Scale IQ), as well as two domain specific indexes (i.e., Verbal and Performance IQ). All IQ indexes have a mean of 100 and a standard deviation of 15. Subtest scores are presented as *T* scores, with a mean of 50 and a standard deviation of 10. Split-half reliability coefficients range from .92 to .98 for the IQ indexes, and from .84 to .98 for subtest scores. Test-retest reliability coefficients range from .79 to .90 for subtest scores, and from .87 to .92 for IQ indexes. The average standard error of measurement ranges from 2.38 to 3.13. Correlations between the WASI and the WAIS-III are high, ranging from .66 to .88 for subtest scores, and from .84 to .92 for IQ indexes.

Hypothetical Monetary Task: An adaptation of Field et al. (2006) (also see Giordano et al., 2001) was used to assess the rate of delayed discounting. Items were presented via an online survey in which participants were asked to choose between an immediate and a future hypothetical monetary reward. The delayed reward remained constant at \$1000, whereas immediate rewards began at 100% of the delayed reward and then decreased in the following order: 99%, 96%, 92%, 85%, 80%, 75%, 70%, 65%, 60%, 55%, 50%, 45%, 40%, 35%, 30%, 25%, 20%, 15%, 10%, 8%, 6%, 4%, 2%. The following 7 delays were presented: 1 week, 2 weeks, 1 month, 6 months, 1 year, 5 years, and 25 years (e.g., “Would you rather have \$1000 now or \$800 in 1 week?”). The last immediate amount participants choose before switching to the delayed reward constituted the point of preference reversal. Once preference reversal was reached for a specific delay, participants advanced to the next delay in ascending order (i.e., from 1 week to 25 years). Participants received the following instructions before beginning this task:

“You are about to participate in a study. The purpose of this study is to see how you make decisions about different amounts of money. Please answer each question as if the money were real. Two amounts of money will appear at a time. Your job is to choose which of the two amounts you like best. Please do not try to plan ahead. Just choose your answer based on what you like best.”

Actual Reward Task: A DRD measure in which participants may receive an actual reward was included to assess whether discounting rates in a task with a familiar referent, and a smaller reward, will differ from the discounting rates of a hypothetical monetary task. Participants received the following instructions: “You are about to participate in a study. The purpose of this study is to see how you make decisions about different amounts of DYS Dollars. Two amounts of DYS Dollars will appear at a time. Your job is to choose which of the two amounts you like best. Please do not try to plan ahead. Just choose your answers based on what you like best. Please answer each question as if the money were real because at the end of the study you will participate in a drawing. If you win the drawing, you will receive a reward based on one of your answers. For example, if the two choices you see are ‘10 DYS Dollars today or 11 DYS Dollars in one week’ and you choose 10 DYS Dollars today, then if you win the drawing you may get 10 DYS Dollars today.”

Based on the parameters of the token economy established in the correctional facility, participants could earn a maximum of 12 DYS Dollars each day. DYS Dollars can be exchanged for items such as candy, body wash, and items of clothing (e.g., socks, underwear) that range in price from 50 DYS Dollars (i.e., a small bag of Skittles) to 180 DYS Dollars (i.e., new earphones). As the token economy is designed to both induce engagement (e.g., compliance with institutional rules) and to educate students about maintaining a budget, the delayed reward in the

current task consisted of 60 DYS Dollars, which represents a maximum “week’s pay” for participants.

Participants chose between a constant delayed reward of 60 DYS Dollars and an immediate reward which began at 100% of the delayed reward and then decreased in the following order: 95%, 90%, 85%, 80%, 75%, 70%, 65%, 60%, 55%, 50%, 45%, 40%, 35%, 30%, 25%, 20%, 15%, 10%, and 5%. The following delays were presented: 1 week, 2 weeks, 1 month, 3 months, 4 months, 5 months, and 6 months. The last immediate amount participants chose before switching to the delayed reward constituted the point of preference reversal. Once preference reversal was reached for a specific delay, participants advanced to the next delay in ascending order. After completing this task, each participant participated, individually, in a drawing in which each participant had a 1 in 5 chances of winning. Those who won the drawing received a reward based on their responses in the 1 week delay condition.

Registry/Probation Task: To assess delay discounting rates within the context of incarceration and post-conviction requirements, participants completed a DRD task in which rewards were presented as time deductions from a 15-year sex offender registration requirement, or probation, instead of monetary amounts. The following script was presented to participants adjudicated for a sexual offense: “Before leaving Mt. Meigs, you will attend a hearing in which the Court will determine your risk level. For this study, please imagine that you are at your final hearing, and you have been assigned a risk level that requires that you register as a sex-offender for 15 years. However, the judge has given you the option of leaving Mt. Meigs now with the 15-year registration requirement, or staying in treatment longer in order to reduce the time of that requirement. Now, you will be given several options of how much longer you can stay and how much your registration requirement will be reduced. Please choose the option you like best.”

Alternatively, non-sex-delinquent participants received the following instructions: “Before leaving Mt. Meigs, you will attend a hearing in which the Court will determine how long you will be required to be on probation. For this study, please imagine that you are at your final probation hearing, and you have been assigned 15 years of probation. However, the judge has given you the option of leaving Mt. Meigs now with the 15-year probation requirement, or staying longer in order to reduce the time of that requirement. Now you will be given several options of how much longer you can stay and how much your probation requirement will be reduced. Please choose the option you like best.”

In both conditions, delayed rewards remained constant, whereas immediate rewards decreased in the same following pattern: 96%, 90%, 83%, 76%, 70%, 66%, 60%, 53%, 46%, 40%, 33%, 26%, 20%, 13%, 10%, and 6%. The following delays were used: 2 weeks, 1 month, 4 months, 6 months, 1 year, 5 years. The last immediate amount participants choose before switching to the delayed reward will constitute the point of preference reversal. Once preference reversal is reached for a specific delay, participants advanced to the next delay in ascending order.

Results

Statistical and quantitative analyses

First, area under the curve (AUC) was calculated through trapezoidal integration for each of the three delayed discounting tasks following procedures outlined in Myerson, Green, and Warusawitharana (2001). To assess whether the three discounting tasks represent a unified discounting construct, internal consistency was estimated using Cronbach's coefficient alpha. To test the hypothesis that delayed discounting differentiates adolescents adjudicated for sexual offenses from non-sex-delinquents, binary logistic regressions were run with delinquent group membership as the outcome variable and a median split (i.e., lower 50% versus upper 50%) of AUC scores as the predictor for each of the three discounting tasks. A series of multivariate and binary logistic regressions were then run with AUC scores, or median split, as the outcome variable and intelligence, psychopathy, personality traits, psychopathology, and time in detention as predictors. Finally, a series of multiple regressions were run to test the hypothesis that delayed discounting is associated with specific aspects of sexual offending, namely sexual offending risk, victim age, number of juvenile delinquent commitments, and number of sexual offense victims. A Bonferroni correction was used given the high number of comparisons and full model results are considered statistically significant at the .01 alpha level. Table 1 below describes between-group comparisons.

Table 1. Comparisons between adolescents with sexual offense convictions (ASOC) and non-sex delinquents (NSD)

	ASOC		NSD		<i>F</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Arrests	2.48	2.5	5.82	3.8	14.44**
Commitment ¹	1.6	1.4	2.57	1.2	5.86*
PCL-YV Total	14.31	7.67	17.68	9.24	2.48
PCL-YV 1A	1.66	2.07	2.65	2.61	2.77
PCL-YV 2A	4.19	2.05	5.42	2.87	.403
PCL-YV 1B	3.28	2.23	2.94	2.21	.380
PCL-YV 2B	3.81	2.78	4.55	2.45	.403
Full Scale IQ	87.55	13.9	88.44	11.79	.065
Performance IQ	89.42	15.12	91.56	11.94	.33
Verbal IQ	87.55	13.43	87.04	11.60	.01
CD	50%		78%		$X^2 (1) = 8.16^*$
ODD	37.5%		50%		$X^2 (1) = .95$
GAD	46.42%		40.6%		$X^2 (1) = .205$
Depression	50%		21.4%		$X^2 (1) = 5.25^*$
ADHD	62.5%		64.3%		$X^2 (1) = .021$
CSA	29.6%		7.1%		$X^2 (1) = 4.67^*$
CPA	40.7%		21.4%		$X^2 (1) = 2.14$

SD: Standard Deviation; PCL-YV: Psychopathy Checklist Youth Version; CD = Conduct Disorder; ODD = Oppositional Defiant Disorder; GAD = Generalized Anxiety Disorder; ADHD = Attention Deficit-Hyperactivity Disorder; CSA: Childhood Sexual Abuse; CPA: Childhood Physical Abuse;

¹Number of Juvenile Delinquent Commitments; ** = $p < .001$; * = $p < .05$

Delayed reward discounting

Internal consistency. An internal consistency analysis including scores on the three delayed discounting tasks indicated an acceptable level of reliability (Cronbach's alpha = .664). The reliability coefficient, however, increased to .834 with the removal of the Registry/Probation item.

Hypothetical Monetary Task

Group membership. Results of a binary logistic regression testing a full model against a constant-only model was statistically significant indicating that AUC scores in the Hypothetical Monetary Task reliably distinguished between adolescents adjudicated for sexual offenses and non-sex-delinquents, $\chi^2(1) = 10.21, p < .001$; Nagelkerke's $R^2 = .20$. The overall prediction success was 70% (68% for participants with sexual offenses and 71% for non-sex-delinquents). The full model's $\text{EXP}(\beta)$ value indicates that participants with AUC scores above the median were 5.4 times more likely than those with scores below the median to have been adjudicated for sexual offenses. Table 2 presents descriptive data regarding AUC and subjective values according to delays.

Table 2.

	ASOC		NSD	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<i>AUC</i>	.35	.28	.15	.23
<i>Subjective value</i>				
1 week delay	955.93	163.63	908.71	144.17
2 weeks delay	930.00	177.94	805.80	195.82
4 weeks delay	839.44	262.42	662.26	251.33
24 weeks delay	702.41	338.25	404.48	331.12
52 weeks delay	606.75	368.62	247.64	311.31
260 weeks delay	429.78	336.50	174.19	293.40
1300 weeks delay	206.90	244.84	109.32	231.40

Note: Constant reward = \$1,000.00; AUC = area under the curve.

Intelligence. Results of a multiple regression did not indicate a statistically significant relationship among Full Scale IQ, Verbal IQ, Performance IQ, and AUC scores on the Hypothetical Monetary Task, $F(3, 56) = .13, p = .9$.

Psychopathy. Results indicate, however, that psychopathy scores were significantly correlated with AUC scores, $F(4,56) = 3.72, p = .009, R^2 = .20$. Specifically, Factor 2A (Impulsive Lifestyle) was positively correlated with AUC scores, $\beta = .42, t(59) = 2.5, p = .016$, whereas Factor 2B (Antisocial Behavior) scores were negatively correlated with AUC scores, $\beta = -.5, t(59) = 3.31, p = .002$.

Length of Detention. Results of a linear regression did not indicate a statistically significant relationship between time spent in detention and AUC scores on the Hypothetical Monetary Task, $F(1,58) = .9, p = .35$.

Psychopathology. Results of a binary logistic regression with AUC scores (i.e., upper 50% versus lower 50%) and K-SADS Depression, Anxiety, Attention Deficit-Hyperactivity Disorder, Conduct Disorder, and Oppositional-Defiant Disorder scales (all dichotomous yes/no) did not indicate a statistically significant relationship between scores on the Hypothetical Monetary Task and indices of psychopathology, $\chi^2(5) = 3.23, p = .65$.

Personality Characteristics. Results of a backward regression with MACI scales as predictors and AUC scores as the outcome variable indicated a statistically significant relationship among personality characteristics and scores on the Hypothetical Monetary Task, $F(12,47) = 4.20, p < .001, R^2 = .52$. Table 3 below describes the full model.

Table 3.

MACI Scales	Standardized β	t	p
Desirability	.562	3.35	.002
Debasement	-.663	-2.84	.007
Egotistic	-1.253	-3.901	<.001
Unruly	.909	3.319	.002
Borderline	.594	3.004	.004
Devaluation	-.775	-2.367	.022
Body Disapproval	.849	4.396	<.001
Social Insensitivity	.615	2.707	.009
Impulsivity	-1.119	-4.473	<.001

Note: Full regression model with MACI scales as predictors and AUC scores on the Hypothetical Monetary Task as the outcome variable.

Actual Reward Task

Group membership. Results of a binary logistic regression testing a full model against a constant-only model was statistically significant indicating that AUC scores in the Actual Reward Task reliably distinguished between adolescents adjudicated for sexual offenses and non-sex-delinquents, $\chi^2(1) = 13.9, p < .001$; Nagelkerke's $R^2 = .26$. The overall prediction success was 73% (74% for participants with sexual offenses and 72% for non-sex-delinquents). The full model's $\text{EXP}(\beta)$ value indicates that participants with AUC scores in the Actual Reward Task above the medium were 7.35 times more likely than those with scores below the medium to have be in the adolescents with sexual offenses group. Table 4 below describes AUC and subjective value data based on each delay.

Table 4.

	ASOC		NSD	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<i>AUC</i>	.56	.27	.30	.25
<i>Subjective value</i>				
1 week delay	48.63	15.48	45.75	16.87
2 weeks delay	45.00	16.13	34.20	19.85
4 weeks delay	38.60	18.64	24.90	19.54
12 weeks delay	35.60	18.74	18.70	17.70
16 weeks delay	29.70	18.04	14.70	15.66
20 weeks delay	25.20	19.45	11.80	13.78
24 weeks delay	21.70	18.85	10.00	12.26

Note: Constant reward = 60 DYS Dollars; AUC = area under the curve.

Intelligence. Results of a multiple regression did not indicate a statistically significant relationship among Full Scale IQ, Verbal IQ, Performance IQ, and AUC scores on the Actual Reward Task, $F(3, 57) = 2.31, p = .09$.

Psychopathy. Results indicate that psychopathy scores were not significantly correlated with AUC scores on the Actual Reward Task, $F(4,56) = .813, p = .52$.

Length of Detention. Results of a linear regression did not indicate a statistically significant relationship between time spent in detention and AUC scores on the Actual Reward Task, $F(1,58) = .5, p = .49$.

Psychopathology. Results of a binary logistic regression with AUC split medium scores (i.e., upper 50% versus lower 50%) on the Actual Reward Task and K-SADS Depression,

Anxiety, Attention Deficit-Hyperactivity Disorder, Conduct Disorder, and Oppositional-Defiant Disorder scales (i.e., all dichotomous yes/no) did not indicate a statistically significant relationship, $\chi^2(5) = 4, p = .55$.

Personality Characteristics. Results of a backward regression with MACI scales as predictors and AUC scores on the Actual Reward Task as the outcome variable indicated a statistically significant relationship among personality characteristics and delayed discounting, $F(10,49) = 3.6, p = .001, R^2 = .42$. Table 5 below describes the full model.

Table 5.

MACI Scales	Standardized β	t	p
Desirability	.659	3.424	.001
Debasement	-.551	-2.205	.032
Submissive	-.515	-2.946	.005
Egotistic	-1.280	-4.066	<.001
Borderline	.736	3.433	.001
Devaluation	-.814	-2.378	.021
Impulsivity	-.726	-3.499	.001

Note: Full regression model with MACI scales as predictors and AUC scores on the Actual Reward Task as the outcome variable.

Registry/Probation Hypothetical Task

Group membership. Results of a binary logistic regression testing a full model against a constant-only model was statistically significant indicating that AUC scores in the Registry/ Probation Task reliably distinguished between adolescents adjudicated for sexual offenses and non-sex-delinquents, $\chi^2(1) = 4.2, p = .042$; Nagelkerke's $R^2 = .08$. This model, however, was not statistically significant given the corrected alpha level of .01. The model's overall prediction success of was 62.9% (62.5% for participants with sexual offenses and 63.3% for non-sex-

delinquents). The full model's $EXP(\beta)$ value indicates that participants with AUC scores above the medium were 2.89 times more likely than those with scores below the medium to have been adjudicated for sexual offenses. Table 6 presents AUC and subjective value data based on delays.

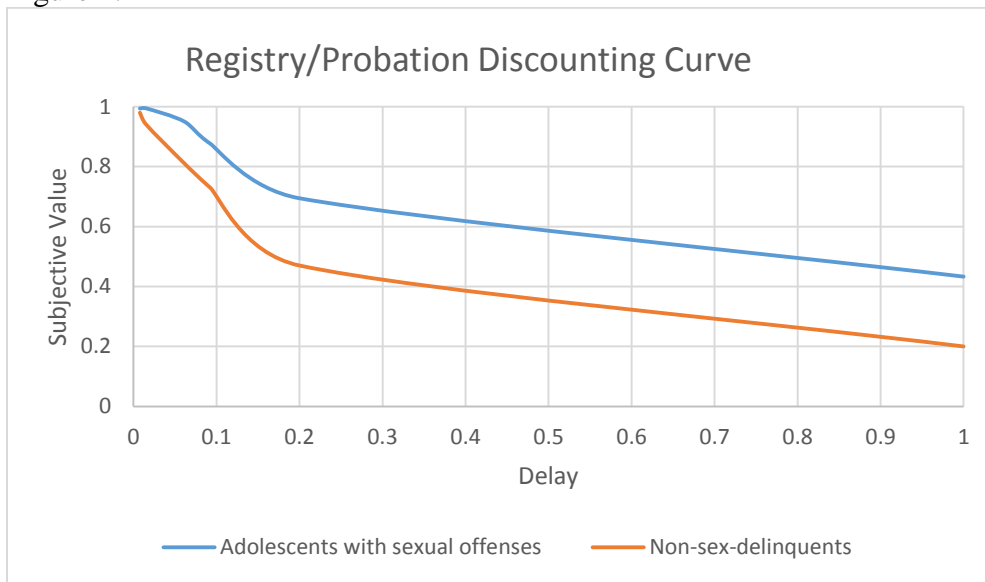
Table 6.

<i>Subjective value</i>	ASOC		NSD	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
2 weeks delay	179.60	1.45	170.00	4.92
4 weeks delay	179.09	2.65	170.4	14.6
14 weeks delay	171.09	30.41	146.4	50.78
24 weeks delay	158.91	44.97	132.6	53.12
52 weeks delay	125.45	64.87	86.0	68.43
260 weeks delay	78.27	64.74	36.4	49.40

Note: Constant reward = 180-month reduction in either probation or registration requirements; AUC = area under the curve.

Registry versus Probation. Participants with sexual offense convictions had significantly higher AUC scores ($M = .60 \pm .29$) in the Registry condition than non-sex-delinquents ($M = .42 \pm .29$) in the Probation condition, $t(59) = 2.35, p = .022$. Figure 1 below displays the discounting curve for each group.

Figure 1.



Note: AUC scores are inversely correlated with delayed discounting.

Intelligence. Results of a multiple regression did not indicate a statistically significant relationship among Full Scale IQ, Verbal IQ, Performance IQ, and AUC scores on the Registry/Probation Task, $F(3, 56) = .85, p = .47$.

Psychopathy. Results indicate that psychopathy scores were not significantly correlated with AUC scores on the Registry/Probation Task, $F(4,56) = 1.6, p = .19$.

Length of Detention. Results of a linear regression did not indicate a statistically significant relationship between time spent in detention and AUC scores in the Registry/Probation Task, $F(1,58) = .29, p = .60$.

Psychopathology. Results of a binary logistic regression with AUC split medium scores (i.e., upper 50% versus lower 50%) on the Registry/Probation Task and K-SADS Depression, Anxiety, Attention Deficit-Hyperactivity Disorder, Conduct Disorder, and Oppositional-Defiant Disorder scales (all dichotomous yes/no) did not indicate a statistically significant relationship, $\chi^2(5) = 1.78, p = .88$.

Personality Characteristics. Results of a backward regression with MACI scales as predictors and AUC scores on the Registry/Probation Task as the outcome variable indicated a statistically significant relationship among personality characteristics and delayed discounting, $F(4,54) = 10.07, p < .001, R^2 = .42$. Table 7 describes the full model.

Table 7.

MACI Scales	Standardized β	t	p
Doleful	-.439	-2.776	.008
Borderline	.586	3.512	.001
Sexual Abuse	.558	4.662	<.001
Family Conflict	.392	3.233	.002

Full regression model with MACI scales as predictors and AUC scores on the Registry/Probation Task.

Delayed discounting and sexual offending

Hypothetical Monetary Task. Results of a multiple regression with AUC scores on the Hypothetical Monetary Task as the outcome and J-SOAP-II Factor scores (i.e., 1 through 4) did not indicate a significant relationship between delayed discounting and risk of sexual offending in adolescents with sexual offense convictions, $F(4,25) = 1.16, p = .350$. Similarly, results of another multiple regression with AUC scores on the Hypothetical Monetary Task as the outcome variable and victim-age, number of sexual offense victims, and number of delinquent commitments did not indicate a statistically significant relationship between delayed discounting and sexual offense characteristics, $F(3,26) = 1.04, p = .40$.

Actual Reward Task. Results of a multiple regression with AUC scores on the Actual Reward Task as the outcome and the 4 J-SOAP-II Factor scores did not indicate a significant

relationship between delayed discounting on this measure and risk of sexual offending in adolescents with sexual offense convictions, $F(4,25) = .23, p = .582$. Similarly, results of another multiple regression with AUC scores on the Actual Reward Task as the outcome variable and victim-age, number of victims, and number of delinquent commitments did not indicate a statistically significant relationship between delayed discounting on this task and sexual offense characteristics, $F(3,26) = 1.32, p = .30$.

Registry/Probation Task. Finally, results of a multiple regression with AUC scores on the Registry/Probation Task as the outcome variable and the 4 J-SOAP-II Factor scores as predictors did not indicate a statistically significant relationship between delayed discounting on this measure and risk of sexual offending in adolescents with sexual offense convictions, $F(4,25) = .80, p = .52$. Results of another multiple regression with AUC scores on the Registry/Probation Task as the outcome variable and victim-age, number of sexual offense victims, and number of delinquent commitments also failed to indicate a statistically significant relationship between delayed discounting and sexual offense characteristics, $F(3,26) = 1.4, p = .29$.

Discussion

The current findings comprise the first study on delayed reward discounting in adolescents with sexual offense convictions. The primary objective of the current study was to test the hypothesis that the delayed reward discounting patterns of adolescents adjudicated for sexual offenses differ significantly from the discounting patterns of non-sex-delinquents. The current study also sought to elucidate the relationship among delayed discounting and factors related to adolescent sexual offending and general delinquency. A third objective was to determine whether participants with sexual offenses discounted delayed rewards regarding reductions in registration requirements differently from non-sex-delinquents evaluating delayed rewards regarding reductions in the length of probation.

Delinquency, sexual offending and delayed reward discounting

The current findings support the hypothesis that adolescents adjudicated for sexual offenses discount delayed rewards significantly differently than generally delinquent adolescents. Results from all three delayed reward discounting tasks indicate that non-sex-delinquents discounted hypothetical monetary rewards, actual rewards, and hypothetical reductions in the length of conditional release significantly more steeply than participants adjudicated for sexual offenses. In this regard, the current results indicate that delayed reward discounting may be useful in differentiating detained adolescents based on type of offense. Specifically, participants scoring above the median of the Hypothetical Monetary Task were over five times more likely to be in the sexual offenses group. Similarly, participants scoring above the median of the Actual

Reward Task were over seven times more likely to be in the sexual offenses group. Although non-sex-delinquents discounted delayed rewards regarding length of post-detention probation significantly more steeply than participants with sexual offenses discounted length of registration requirements; this task was not as useful in differentiating between the two groups. Patterns of delayed discounting reported in the behavioral economics literature as well as the current results may be useful in interpreting this discrepancy. First, although patterns of delayed discounting are stable over time (Simpson & Vuchinich, 2000; Odum, 2011), reward characteristics seem to affect the rate of future discounting. For instance, individuals with cocaine dependence discount future amounts of cocaine more steeply than other types of rewards (Hoffman et al., 2008). Thus, it is possible that monetary rewards represent a significantly different type of stimuli than hypothetical reductions in the length of conditional release, and are therefore discounted differently. This is consistent with the finding that the internal consistency of the delayed discounting tasks increased from .66 to .83 with the removal of the Registry/Probation Task, which may indicate that this task represents a different facet of delayed discounting than the two monetary tasks. It is also possible that non-sex-delinquents and participants with sexual offenses may differ on the degree to which they prefer smaller immediate monetary rewards, yet their preferences are comparatively more aligned regarding registration and probation. Nonetheless, it is important to note that non-sex-delinquents discounted reductions in the length of probation, on average, significantly more steeply.

Delayed discounting and psychopathology

Consistent findings across studies and methodologies indicate that delayed reward discounting is associated with mental health difficulties (Bickel, Jarmolowicz, Mueller, Koffarnus, & Gatchalian, 2012). The current findings, however, do not indicate a significant

relationship among patterns of delayed discounting and clinical diagnoses in detained adolescents. The high rate of clinically significant mental health concerns in both adolescents adjudicated for sexual offenses and non-sex-delinquents may be helpful in interpreting this finding. Studies highlighting a correlation between excessive delayed discounting and mental illness focus predominantly on between-group differences in healthy participants and clinical populations. This is an important consideration as neither participants with sexual offenses nor non-sex-delinquents may be considered a healthy group. The developmental histories of adolescents detained in the juvenile justice system are often characterized by exposure to both physical and sexual abuse, as well as community violence (Huner & Figueredo, 2000; Miner et al., 2010), which contribute to elevated rates of mental health problems when compared to the general adolescent population. Thus, it remains possible that whereas substantial differences in patterns of delayed discounting exist between clinical populations and healthy controls, within-group differences in clinical samples may be attenuated. Future studies comparing detained adolescents to similarly aged, non-detained adolescents would help to further elucidate this possibility.

The lack of significant differences based on clinical diagnoses is, however, intriguing as non-sex-delinquents were significantly more likely than adolescents adjudicated for sexual offenses to present with externalizing problems (e.g., conduct disorder), and those with sexual offenses were more likely to present with a diagnosis of Major Depression. Moreover, delayed reward discounting has been found to be positively correlated with personality and mental health problems characterized by poor impulse control and poor emotional regulation (Bornovalova, Lejuez, Daughters, Rosenthal, & Lynch, 2005). It is important to note that psychopathology was assessed as a dichotomous variable in the current analyses, which may have prevented the

assessment of the impact of severity of clinical symptoms in the relationship between mental health problems and delayed discounting. Findings from a continuous personality and clinical measure discussed below shed some light on this possibility.

Delayed discounting and personality characteristics

Indices of personality traits comprised the strongest predictors of delayed discounting in all three tasks. Notably, constructs closely related to delinquency were strongly and negatively correlated with AUC scores, whereas scales indicating the presence of unstable interpersonal patterns and emotional distress were strongly and positively correlated with AUC (note that AUC is inversely related to discounting). On the Hypothetical Monetary Task, indices of behavioral impulsivity (i.e., MACI Impulsivity scale), grandiose sense of self (i.e., MACI Egotistic scale), and exaggerated responding or feigning (i.e., MACI Debasement scale) characterized the personality profiles of participants who presented high levels of discounting. It is important to note that high Debasement scores may indicate the presence of significant psychopathology; however, high scores on this scale may also indicate negative impression management. In contrast, indices of poor emotional regulation (i.e., MACI Borderline scale), unstable interpersonal relationships (i.e., MACI Borderline, Unruly, and Social Insensitivity scales), and general distress (i.e., Body Disapproval scales) characterized the profiles of participants with comparatively lower levels of discounting.

Consistently with MACI scores, psychopathic traits related to antisocial behaviors (i.e., Factor 2B) were negatively correlated with AUC scores on the Hypothetical Monetary Task (i.e., indicating higher discounting). However, AUC scores on this task were positively correlated with scores on the impulsive lifestyle factor (i.e., Factor 2A). These findings indicate that the psychopathy dimension related to rule breaking and the violation of the rights of others

characterized the profiles of participants with comparatively higher levels of discounting on the Hypothetical Monetary Task, whereas those with comparatively lower levels of discounting were likely to engage in socially and interpersonally irresponsible behaviors; however, these participants are less likely to engage in antisocial behaviors than those presenting higher levels of discounting.

The personality dimensions correlated with scores on the Actual Reward Task were similar to those correlated with scores on the Hypothetical Monetary Task. MACI scales indicating behavioral impulsivity (i.e., MACI Impulsivity scale) and grandiose sense of self (i.e., MACI Egotistic scale) presented the strongest negative correlations with scores on the Actual Reward Task. In contrast, MACI scales indicating unstable interpersonal relationships and poor emotional regulation (i.e., MACI Borderline scale), as well as positive impression management (i.e., Desirability) were positively correlated with AUC scores on this task. However, psychopathy scores were not correlated with scores on the Actual Reward Task. This finding may be interpreted in the context of psychopaths' insensitivity to negative consequences and intact responsivity to rewards (Foulkes, McCrory, Neumann, & Viding, 2014). In the current design, participants suffered no particular loss for choosing smaller immediate hypothetical rewards over larger rewards displaced in time. In the Actual Reward Task, however, participants stood to experience an actual reduction in the amount of token money by selecting immediate rewards excessively. Thus, whereas the Hypothetical Monetary Task presented neither an actual punishment nor an actual reward, the Actual Reward Task presented a real loss of reinforcement in the case of excessive discounting. Therefore, it is possible that participants with comparatively higher levels of psychopathic traits did not attend to the potential rewards of choosing larger amounts of money displaced in time in the hypothetical condition; yet, they were able to do so

when presented with the possibility of real rewards. In contrast, participants with comparatively lower levels of psychopathy may have been more likely to appreciate both the negative consequences of excessive delayed discounting *and* the reinforcing aspect of larger rewards displaced in time. It is important to note that although psychopathic traits are generally correlated with delinquency, the current sample did not present high psychopathy scores, with both group means falling well below the recommended cutoff for a psychopathic classification (i.e., total PCL-YV score of 30 or above).

Delayed discounting and post-detention requirements

The current study tested the hypothesis that participants with sexual offense convictions would present an insensitivity to consequences displaced in time. This hypothesis was based on consistent findings indicating a proclivity toward both behavioral and cognitive impulsivity in adolescence (e.g., Blakemore & Robbins, 2012). The finding that adolescents adjudicated for sexual offenses did not seem to discount future reductions in registration requirements excessively was somewhat unexpected. The fact that these participants discounted registration-related rewards less steeply than non-sex-delinquents discounted probation-related rewards was also unexpected. For instance, the subjective value of the constant reward in the five-year interval condition (i.e., maximum delay) was, on average, only 50% less than its actual value for participants with sexual offenses. In contrast, the subjective value of the constant reward dropped, on average, 80% for non-sex-delinquents in the five-year delay interval. Thus, these findings seem inconsistent with the notion that adolescents with sexual offenses are too present-focused to appreciate the impact of post-detention consequences displaced far into the future. Moreover, the current findings seem to indicate that non-sex-delinquents may be far less inclined

to stay in detention to reduce the length of probation than participants with sexual offenses regarding reductions in registration requirements.

Personality and clinical dimensions associated with scores on the Registry/Probation Task differed significantly from the dimensions associated with the two monetary task conditions. Specifically, personality characteristics often associated with delinquency, including impulsivity and social insensitivity, were not significantly correlated with scores on this tasks. In contrast, lower discounting on the Registry/Probation Task was positively correlated with positive impression management. Moreover, participants who reported experiencing childhood sexual abuse and a high level of family conflict also presented comparatively lower levels of discounting. These findings are consistent with the fact that participants with sexual offenses presented, on average, lower levels of discounting across all three tasks. It is also consistent with the finding that participants with sexual offenses are more likely than non-sex-delinquents to have experienced childhood sexual abuse (Seto & Lalumiere, 2010).

Sex offender registration: A Sisyphean endeavor

A comparison of the patterns of delayed discounting of participants with sexual offenses to those of non-sex-delinquents, therefore, indicates that non-sex-delinquents may in effect be less responsive to the punishing consequences of probation than participants with sexual offenses are to post-detention registration. These findings are consistent with the positive outcomes of the residential sex offender treatment program from which these data were derived. Participants with sexual offenses were mandated by state law, in compliance with the Adam Walsh Act of 2006, to undergo psychological treatment. Thus, these participants received evidence-based individual and group interventions aimed at addressing the predicates for their offenses, as well as reducing recidivism. A key component of the treatment program was psychoeducation regarding healthy

relationships and academic instruction regarding sex offender laws. As part of didactic training on sex-offender laws, participants received extensive instruction on post-detention requirements, including registration and notification. All participants with sexual offenses were recruited for the current study after having begun these interventions. Hence, the current findings most likely reflect these participants' responsivity to a rehabilitative paradigm, which is a key underlying assumption of most evidence-based sex offender treatments (Ward & Beech, 2006).

In contrast, non-sex-delinquents are not required by law to receive psychological treatment, they typically receive shorter dispositions, as well as far shorter post-detention requirements. However, as the current results indicate, non-sex-delinquents have, on average, a greater frequency of arrests and juvenile delinquent commitments, and are therefore more likely to be recidivists. Thus, whereas adolescents adjudicated for sexual offenses may face the prospect of life-time registration and are heavily monitored once released from detention, their likelihood to reoffend is unrelated to these social control measures (Caldwell & Dickinson, 2009; Caldwell, Ziemke, & Vitacco, 2008). An emerging body of research, however, indicates that in addition to low utility in predicting and reducing recidivism, registration and notification requirements lead to a plethora of unintended consequences, including social ostracism and living conditions that preclude a return to normative developmental experiences after detention (Letourneau, Levenson, Bandyopadhyay, Armstrong, & Debajyoti, 2010; Letourneau & Miner, 2005).

Delayed discounting and intelligence

Although participants with sexual offenses and non-sex-delinquents presented significantly different patterns of delayed discounting, these differences were not significantly related to any facet of general intellectual functioning assessed in the current study. This is an

unexpected finding as intelligence, particularly verbal IQ, is highly correlated with delinquency-related factors. However, the absence of a relationship between intellectual functioning and delayed discounting may indicate that the proclivity to choose immediate rewards is more closely related to personality dimensions than to cognitive functioning.

Recent findings in the sex offender literature support this interpretation. First, although both non-sex-delinquents and adolescents with sexual behavior problems present lower than average IQ; the cognitive functioning of these two groups of delinquents do not differ significantly. For instance, in an exhaustive meta-analysis, Seto and Lalumiere (2010) found that adolescents with sexual offense convictions did not differ from non-sex-delinquents on IQ. Similarly, Morais, Joyal, Alexander, Fix and Burkhart (2014) found that non-sex-delinquents and adolescents detained for sexual offenses presented similar executive functioning profiles; however, those who sexually offended against children presented higher scores on measures of higher-order executive functioning than non-sex-delinquents. Thus, whereas these two groups of detained adolescents may not differ on measures of cognitive functioning, they seem to present significantly different patterns of delayed discounting. Another possibility, however, is that personality traits interact with cognitive functioning to predict delayed discounting. For instance, Hirsh, Morisano, and Peterson (2008) found that extraversion predicted higher rates of delayed discounting in participants falling in the lower end of the intellectual functioning distribution, whereas emotional stability predicted lower rates of delayed discounting in higher functioning individuals. This possibility warrants further research on the interactions among personality and delayed discounting in detained adolescents.

Delayed discounting and adolescent sexual offending

The current study tested the hypothesis that delayed discounting is significantly related to specific aspects of sexual offending. Specifically, predominant explanatory models regarding the etiology of sexual offending provide poor operational definitions of constructs such as decision making, impulsivity, and self-control. Thus, if supported, the hypothesis that delayed discounting is significantly related to sexual offending would imply that delayed discounting paradigms may provide useful behavioral referents for poorly defined constructs in theories of sexual offending.

The current findings, however, do not indicate a significant relationship among patterns of delayed discounting and specific aspects of sexual offending in adolescents. Although delayed discounting patterns were useful in differentiating adolescents with sexual offenses from non-sex-delinquents; scores on the three discounting tasks were not significantly related to number of sexual offense victims, number of delinquent commitments, or age of sexual offense victims. Moreover, delayed discounting scores were not significantly related to any facet of a measure of risk of sexually offending.

These findings may indicate that although the measures of delayed reward discounting may be sensitive enough to differentiate detained adolescents based on offense type, these measures may not be specific enough to detect distinct sexual offense characteristics. Another possibility, however, is that delayed reward discounting may not be part of the nomological net of cognitive factors related to the etiology of adolescent sexual offending. This interpretation is supported by current findings indicating that personality dimensions were the strongest predictors of delayed discounting, and also, that intellectual functioning was not significantly related to patterns of discounting. Thus, the current findings do not seem to support the utility of delayed discounting paradigms as a way of delineating behavioral referents for poorly defined

constructs in models of sexual offending. Rather, the current findings seem to indicate that delayed discounting may relate to delinquent and antisocial factors far more strongly than to specific aspects of sexual behavior problems.

Conclusions and future directions

The current study comprises a first attempt to elucidate the role of a behavioral-economic construct in adolescent sexual offending. The current findings indicate that a proclivity to choose immediate rewards, even if smaller than delayed rewards, is associated with type of delinquent behaviors. Adolescents with sexual offenses were significantly less likely to discount delayed rewards than non-sex-delinquents. Notably, delayed discounting patterns were strongly related to personality dimensions, and not significantly related to intellectual functioning. The current findings support the notion that delayed discounting may be a useful construct in understanding delinquent behaviors; however, its utility in elucidating the etiology of sexual offenses committed by adolescents may be limited. However, the current findings provide a very useful illustration of the detrimental effects of current social control measures aimed at addressing illegal sexual behaviors. Specifically, participants with sexual offenses were far more likely to avoid registration requirements than non-sex-offenders were to avoid probation. Despite the aversive nature of post-conviction requirements, an emerging body of research indicates that they are ineffective in reducing recidivism. Thus, the current findings provide an indication that although adolescents adjudicated for sexual offenses understand the burden of registration and notification well, they continue to be subject to ineffective and personally costly social control measures.

The current findings revealed several areas that warrant further research. First, it remains possible that the impact of delayed reward discounting in sexual behavior problems may be

characterized by an interaction between personality and cognitive factors. Thus, future studies including normative aspects of personality functioning, as well more nuanced measures of cognitive functioning, would be very useful in elucidating this possibility. Secondly, delayed reward discounting seems to be more strongly related to personality than to cognitive factors. Future studies on this relationship would be useful in determining whether constructs regarding impulsive behaviors that remain poorly defined in current models of sexual offending would be best operationalized as personality dimensions, rather than cognitive abilities.

References

- Armsden, G. C., & Greenberg, M. T. (1987). The Inventory of Parent and Peer Attachment: relationships to well-being in adolescence. *Journal of Youth and Adolescence, 16*, 427-454.
- Balodis, I. M., Kober, H., Worhunsky, P. D., Stevens, M. C., Pearson, G. D., & Potenza, M. N. (2012). Diminished frontostriatal activity during processing of monetary rewards and losses in pathological gambling. *Biological Psychiatry, 71*, 749-757.
- Bickel, W. K., Jarmolowicz, D. P., Mueller, E. T., & Gatchalian, K. M. (2011). The Behavioral Economics and Neuroeconomics of Reinforcer Pathologies: Implications for Etiology and Treatment of Addiction. *Current Psychiatry Reports, 13*, 406-415.
- Bickel, W. K., Jarmolowicz, D. P., Mueller, E. T., Koffarnus, M. N., & Gatchalian, K. M. (2012). Excessive discounting of delayed reinforcers as a trans-disease process contributing to addiction and other disease-related vulnerabilities: Emerging evidence. *Pharmacology & Therapeutics, 134*, 287-297.
- Blakemore, S.J., & Robbins, T. W. (2012). Decision-making in the adolescent brain. *Nature Neuroscience, 15*, 1184-1191.
- Blanchard, R., Cantor, J. M., & Robichaud, L. K. (2006). Biological Factors in the Development of Sexual Deviance and Aggression in Males. In H. E. Barbaree & W. L. Marshall (Eds.), *The juvenile sex offender (2nd ed.)*. (pp. 77-104). New York, NY US: Guilford Press.
- Bjork, J. M., Hommer, D. W., Grant, S. J., & Danube, C. (2004). Impulsivity in abstinent alcohol-

- dependent patients: Relation to control subjects and type 1-/type 2-like traits. *Alcohol*, 34, 133-150.
- Bornovalova, M. A., Lejuez, C. W., Daughters, S. B., Rosenthal, M. Z., & Lynch, T. R. (2005). Impulsivity as a common process across borderline personality and substance use disorders. *Clinical Psychology Review*, 25, 790-812.
- Broidy, L. M., Nagin, D. S., Tremblay, R. E., Bates, J. E., Brame, B., Dodge, K. A., et al. (2003). Developmental trajectories of childhood disruptive behaviors and adolescent delinquency: A six-site, cross-national study. *Developmental Psychology*, 39, 222-245.
- Buss, D. M., & Duntley, J. D. (2008). Adaptations for exploitation. *Group Dynamics: Theory, Research, and Practice*, 12, 53-62. Caldwell, M. F., Ziemke, M. H., & Vitacco, M. J. (2008). An examination of the Sex Offender Registration and Notification Act as applied to juveniles: Evaluating the ability to predict sexual recidivism. *Psychology, Public Policy, and Law*, 14, 89.
- Chaffin, M. (2008). Our minds are made up—don't confuse us with the facts: Commentary on policies concerning children with sexual behavior problems and juvenile sex offenders. *Child Maltreatment*, 13, 110-121.
- Dougherty, D. M., Bjork, J. M., Huckabee, H. C. G., Moeller, F. G., & Swann, A. C. (1999). Laboratory measures of aggression and impulsivity in women with borderline personality disorder. *Psychiatry Research*, 85, 315-326.
- Fanniff, A. M., & Kolko, D. J. (2012). Victim age-based subtypes of juveniles adjudicated for sexual offenses: Comparisons across domains in an outpatient sample. *Sexual Abuse: Journal of Research and Treatment*, 24, 224-264.
- Fields, S., Collins, C., Leraas, K., & Reynolds, B. (2009). Dimensions of impulsive behavior in adolescent smokers and nonsmokers. *Experimental and Clinical Psychopharmacology*, 17, 302-

311.

- Field, M., Christiansen, P., Cole, J., & Goudie, A. (2007). Delay discounting and the alcohol Stroop in heavy drinking adolescents. *Addiction, 102*, 579-586.
- Finkelhor, D. (1984). *Child sexual abuse: New theory and research*. New York: Free Press.
- Finkelhor, D. (1994). The international epidemiology of child sexual abuse. *Child Abuse & Neglect, 18*, 409-417.
- Finkelhor, D., Ormrod, R., & Chaffin, M. (2009). *Juveniles who commit sexual offenses against minors*. Washington, D.C.: Office of Juvenile and Delinquency Prevention.
- Foulkes, L., McCrory, E. J., Neumann, C. S., & Viding, E. (2014). Inverted social reward: Associations between psychopathic traits and self-report and experimental measures of social reward. *PLoS ONE, 9*, e106000. doi: 10.1371/journal.pone.0106000
- Gold, J. M., Waltz, J. A., Prentice, K. J., Morris, S. E., & Heerey, E. A. (2008). Reward processing in schizophrenia: A deficit in the representation of value. *Schizophrenia Bulletin, 34*, 835-847.
- Goto, R., Takahashi, Y., Nishimura, S., & Ida, T. (2009). A cohort study to examine whether time and risk preference is related to smoking cessation success. *Addiction, 104*, 1018-1024.
- Green, L., & Myerson, J. (2004). A Discounting Framework for Choice with Delayed and Probabilistic Rewards. *Psychological Bulletin, 130*, 769-792.
- Goudriaan, A. E., Grekin, E. R., & Sher, K. J. (2011). Decision making and response inhibition as predictors of heavy alcohol use: A prospective study. *Alcoholism: Clinical and Experimental Research, 35*, 1050-1057.
- Hanoch, Y., & Gummerum, M. (2011). A comparison of the risk-taking behaviors of prisoners and non-prisoners. *Journal of Behavioral Decision Making, 24*, 431-442.

- Hall, G.C.N., & Hirschman, R. (1992). Sexual aggression against children: a conceptual perspective of etiology. *Criminal Justice and Behavior*, *19*, 8-23.
- Heerey, E. A., Robinson, B. M., McMahon, R. R., & Gold, J. M. (2007). Delay discounting in schizophrenia. *Cognitive Neuropsychiatry*, *12*, 213-221.
- Heil, S. H., Johnson, M. W., Higgins, S. T., & Bickel, W. K. (2006). Delay discounting in currently using and currently abstinent cocaine-dependent outpatients and non-drug-using matched controls. *Addictive Behaviors*, *31*, 1290-1294.
- Hoffman, W., Schwartz, D., Huckans, M., McFarland, B., Meiri, G., Stevens, A., et al. (2008). Cortical activation during delay discounting in abstinent methamphetamine dependent individuals. *Psychopharmacology*, *201*, 183-193.
- Hoffman, W. F., Moore, M., Templin, R., McFarland, B., Hitzemann, R. J., & Mitchell, S. H. (2006). Neuropsychological function and delay discounting in methamphetamine- dependent individuals. *Psychopharmacology*, *188*, 162-170.
- Ida, T., Goto, R., Takahashi, Y., & Nishimura, S. (2011). Can economic-psychological parameters predict successful smoking cessation? *The Journal of Socio-Economics*, *40*, 285-295.
- Hirsh, J. B., Morisano, D., & Peterson, J. B. (2008). Delay discounting: Interactions between personality and cognitive ability. *Journal of Research in Personality*, *42*, 1646-1650.
- Kazdin, A. E. (1997). Conduct disorder across the life-span. In S. S. Luthar, J. A. Burack, D. Cicchetti & J. R. Weisz (Eds.), *Developmental psychopathology: Perspectives on adjustment, risk, and disorder*. (pp. 248-272). New York, NY US: Cambridge University Press.
- Kaufman, J., Birmaher, B., Brent, D., Rao, U., Flynn, C., Moreci, P., Williamson, D., & Ryan, N. (1997). *Journal of the American Academy of Child Psychiatry*, *36*, 980-988.

- Kirby, K. N., & Herrnstein, R. J. (1995). Preference reversals due to myopic discounting of delayed reward. *Psychological Science, 6*, 83-89.
- Kirby, K. N., Petry, N. M., & Bickel, W. K. (1999). Heroin addicts have higher discount rates for delayed rewards than non-drug-using controls. *Journal of Experimental Psychology: General, 128*, 78-87.
- Kirby, K. N., & Petry, N. M. (2004). Heroin and cocaine abusers have higher discount rates for delayed rewards than alcoholics or non-drug-using controls. *Addiction, 99*, 461-471.
- Letourneau, E. J., & Miner, M. H. (2005). Juvenile sex offenders: A case against the legal and clinical status quo. *Sexual Abuse: Journal of Research and Treatment, 17*, 293-312.
- Loeber, R., Farrington, D. P., Stouthamer-Loeber, M., Moffitt, T. E., & Caspi, A. (1998). The development of male offending: Key findings from the first decade of the Pittsburgh Youth Study. *Studies on Crime & Crime Prevention, 7*, 141-171.
- Loeber, R., Menting, B., Lynam, D. R., Moffitt, T. E., Stouthamer-Loeber, M., Stallings, R., et al. (2012). Findings from the Pittsburgh Youth Study: Cognitive impulsivity and intelligence as predictors of the age-crime curve. *Journal of the American Academy of Child & Adolescent Psychiatry, 51*, 1136-1149.
- Luo, S., Ainslie, G., Giragosian, L., & Monterosso, J. R. (2009). Behavioral and Neural Evidence of Incentive Bias for Immediate Rewards Relative to Preference-Matched Delayed Rewards. *Journal of Neuroscience, 29*, 14820-14827.
- Luo, S., Ainslie, G., Giragosian, L., & Monterosso, J. R. (2011). Striatal hyposensitivity to delayed rewards among cigarette smokers. *Drug and Alcohol Dependence, 116*, 18- 23.
- Luo, S., Ainslie, G., Pollini, D., Giragosian, L., & Monterosso, J. R. (2012). Moderators of the

- association between brain activation and farsighted choice. *Neuroimage*, 59, 1469-1477.
- Marshall, W. L., & Barbaree, H. E. (1990). An integrated theory of etiology of sexual offending. In W. L. Marshall, D. R. Laws, & H. E. Barbaree (Eds), *Handbook of sexual assault: Issues, theories, and treatment of the offender* (pp. 257-279). New York: Plenum Press.
- Marshall, W. L., & Marshall, L. E. (2000). The origins of sexual offending. *Trauma, Violence, and Abuse*, 1, 250 – 263.
- MacKillop, J., Amlung, M. T., Few, L. R., Ray, L. A., Sweet, L. H., & Munafò, M. R. (2011). Delayed reward discounting and addictive behavior: A meta-analysis. *Psychopharmacology*, 216, 305-321.
- MacKillop, J., & Kahler, C. W. (2008). Delay discounting predicts treatment response for heavy drinkers receiving smoking cessation treatment. *Alcoholism-Clinical and Experimental Research*, 32, 195A-195A.
- MacKillop, J., & Kahler, C. W. (2009). Delayed reward discounting predicts treatment response for heavy drinkers receiving smoking cessation treatment. *Drug and Alcohol Dependence*, 104, 197-203.
- MacKillop, J., Mattson, R. E., MacKillop, E. J. A., Castelda, B. A., & Donovan, P. J. (2007). Multidimensional assessment of impulsivity in undergraduate hazardous drinkers and controls. *Journal of Studies on Alcohol and Drugs*, 68, 785-788.
- MacKillop, J., Miranda, R., Monti, P. M., Ray, L. A., Murphy, J. G., Rohsenow, D. J., et al. (2010). Alcohol Demand, Delayed Reward Discounting, and Craving in Relation to Drinking and Alcohol Use Disorders. *Journal of Abnormal Psychology*, 119, 106-114.
- Madden, G. J., Francisco, M. T., Brewer, A. T., & Stein, J. S. (2011). Delay discounting and gambling. *Behavioural Processes*, 87, 43-49.

- Mazur, J. E. (1987). An adjusting procedure for studying delayed reinforcement. In M. L. Commons, J. E. Mazur, J. A. Nevin & H. Rachlin (Eds.), *The effect of delay and of intervening events on reinforcement value*. (pp. 55-73). Hillsdale, NJ England: Lawrence Erlbaum Associates, Inc.
- Manwaring, J. L., Green, L., Myerson, J., Strube, M. J., & Wilfley, D. E. (2011). Discounting of various types of rewards by women with and without binge eating disorder: Evidence for general rather than specific differences. *The Psychological Record, 61*, 561-582.
- Melanko, S., Leraas, K., Collins, C., Fields, S., & Reynolds, B. (2009). Characteristics of psychopathy in adolescent nonsmokers and smokers: Relations to delay discounting and self reported impulsivity. *Experimental and Clinical Psychopharmacology, 17*, 258-265.
- Moffitt, T. E. (1993). Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Review, 100*, 674-701.
- Moffitt, T. E., Caspi, A., Harrington, H., & Milne, B. J. (2002). Males on the life-course-persistent and adolescence-limited antisocial pathways: Follow-up at age 26 years. *Development and Psychopathology, 14*, 179-207.
- Morais, H.B., Joyal, C.C., Alexander, A.A., Fix, R.L., Burkhart, B.R. (in press). The neuropsychology of adolescent sexual offending: Testing an executive dysfunction hypothesis. *Sexual Abuse: A Journal of Research and Treatment*.
- Morgan, A. B., & Lilienfeld, S. O. (2000). A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. *Clinical Psychology Review, 20*, 113-156.

- Murphy, J. G., Correia, C. J., Colby, S. M., & Vuchinich, R. E. (2005). Using Behavioral Theories of Choice to Predict Drinking Outcomes Following a Brief Intervention. *Experimental and Clinical Psychopharmacology, 13*, 93-101.
- Murphy, J. G., Vuchinich, R. E., & Simpson, C. A. (2001). Delayed reward and cost discounting. *Psychological Record, 51*, 571-588.
- Myerson, J., & Green, L. (1995). Discounting of delayed rewards: Models of individual choice. *Journal of the Experimental Analysis of Behavior, 64*, 263- 276.
- Myerson, J., Green, L., & Warusawitharana, M. (2001). Area under the curve as a measure of discounting. *Journal of the Experimental Analysis of Behavior, 76*, 235-243.
- Nock, M. K., Kazdin, A. E., Hiripi, E., & Kessler, R. C. (2006). Prevalence, subtypes, and correlates of DSM-IV conduct disorder in the National Comorbidity Survey Replication. *Psychological Medicine, 36*, 699-710.
- Odum, A. L. (2011). Delay discounting: I'm a K, you're a K. *Journal of the Experimental Analysis of Behavior, 96*, 427-439.
- Pereda, N., Guilera, G., Forns, M., & Gómez-Benito, J. (2009). The international epidemiology of child sexual abuse: A continuation of Finkelhor (1994). *Child Abuse & Neglect, 33*, 331-342.
- Patterson, G. R., & Yoerger, K. (2002). A developmental model for early- and late-onset delinquency. In J. B. Reid, G. R. Patterson & J. Snyder (Eds.), *Antisocial behavior in children and adolescents: A developmental analysis and model for intervention*. (pp. 147-172). Washington, DC US: American Psychological Association.

- Perry, J. L., Larson, E. B., German, J. P., Madden, G. J., & Carroll, M. E. (2005). Impulsivity (delay discounting) as a predictor of acquisition of IV cocaine self-administration in female rats. *Psychopharmacology, 178*, 193-201.
- Perry, J. L., Nelson, S. E., Anderson, M. M., Morgan, A. D., & Carroll, M. E. (2007). Impulsivity (delay discounting) for food and cocaine in male and female rats selectively bred for high and low saccharin intake. *Pharmacology Biochemistry and Behavior, 86*, 822-837.
- Perry, J. L., Nelson, S. E., & Carroll, M. E. (2008). Impulsive choice as a predictor of acquisition of IV cocaine self-administration and reinstatement of cocaine-seeking behavior in male and female rats. *Experimental and Clinical Psychopharmacology, 16*, 165-177.
- Redish, A. D., Jensen, S., & Johnson, A. (2008). Addiction as vulnerabilities in the decision process. *Behavioral and Brain Sciences, 31*, 461-487.
- Reynolds, B., & Fields, S. (2012). Delay discounting by adolescents experimenting with cigarette smoking. *Addiction, 107*, 417-424.
- Reynolds, B., Patak, M., Shroff, P., Penfold, R. B., Melanko, S., & Duhig, A. M. (2007). Laboratory and self-report assessments of impulsive behavior in adolescent daily smokers and nonsmokers. *Experimental and Clinical Psychopharmacology, 15*, 264- 271.
- Reynolds, B., Penfold, R. B., & Patak, M. (2008). Dimensions of impulsive behavior in adolescents: Laboratory behavioral assessments. *Experimental and Clinical Psychopharmacology, 16*, 124-131.
- Robles, E., Huang, B. E., Simpson, P. M., & McMillan, D. E. (2011). Delay discounting, impulsiveness, and addiction severity in opioid-dependent patients. *Journal of Substance Abuse Treatment, 41*, 354-362.

- Ross, D. (2008). Timing models of reward learning and core addictive processes in the brain. *Behavioral and Brain Sciences*, *31*, 457-458.
- Ross, D., Sharp, C., Vuchinich, R. E., & Spurrett, D. (2008). *Midbrain mutiny: The picoeconomics and neuroeconomics of disordered gambling: Economic theory and cognitive science*. Cambridge, MA US: MIT Press.
- Simpson, C. A., & Vuchinich, R. E. (2000). Reliability of a measure of temporal discounting. *Psychological Record*, *50*, 3-16.
- Stanger, C., Ryan, S. R., Fu, H., Landes, R. D., Jones, B. A., Bickel, W. K., et al. (2012). Delay discounting predicts adolescent substance abuse treatment outcome. *Experimental and Clinical Psychopharmacology*, *20*, 205-212.
- Stea, J. N., Hodgins, D. C., & Lambert, M. J. (2011). Relations between delay discounting and low to moderate gambling, cannabis, and alcohol problems among university students. *Behavioural Processes*, *88*, 202-205.
- Stoltenborgh, M., van Ijzendoorn, M. H., Euser, E. M., & Bakermans-Kranenburg, M. J. (2011). A global perspective on child sexual abuse: Meta-analysis of prevalence around the world. *Child Maltreatment*, *16*, 79-101.
- Tucker, J. A., Roth, D. L., Vignolo, M. J., & Westfall, A. O. (2009). A behavioral economic reward index predicts drinking resolutions: Moderation revisited and compared with other outcomes. *Journal of Consulting and Clinical Psychology*, *77*, 219-228.
- Tucker, J. A., Vuchinich, R. E., Black, B. C., & Rippens, P. D. (2006). Significance of a behavioral economic index of reward value in predicting drinking problem resolution. *Journal of Consulting and Clinical Psychology*, *74*, 317-326.

- United States Department of Justice, Federal Bureau of Investigation. (September 2012). *Crime in the United States, 2011*.
- Veneziano, C., & Veneziano, L. (2002). Adolescent sex offenders: A review of the literature. *Trauma, Violence, & Abuse, 3*, 247-260.
- Vitulano, M. L., Fite, P. J., & Rathert, J. L. (2010). Delinquent peer influence on childhood delinquency: The moderating effect of impulsivity. *Journal of Psychopathology and Behavioral Assessment, 32*, 315-322.
- Vuchinich, R. E., & Heather, N. (2003). *Choice, behavioural economics and addiction*. Amsterdam Netherlands: Pergamon/Elsevier Science Inc.
- Vuchinich, R. E., & Simpson, C. A. (1998). Hyperbolic temporal discounting in social drinkers and problem drinkers. *Experimental and Clinical Psychopharmacology, 6*, 292-305.
- Ward, T., Polaschek, D., & Beech, A. R. (2006). *Theories of sexual offending*. Wiley.
- Washio, Y., Higgins, S. T., Heil, S. H., McKerchar, T. L., Badger, G. J., Skelly, J. M., et al. (2011). Delay discounting is associated with treatment response among cocaine-dependent outpatients. *Experimental and Clinical Psychopharmacology, 19*, 243-248.
- White, J. L., Moffitt, T. E., Caspi, A., Bartusch, D. J., Needles, D. J., & Stouthamer-Loeber, M. (1994). Measuring impulsivity and examining its relationship to delinquency. *Journal of Abnormal Psychology, 103*, 192-205.
- Wilson, M., & Daly, M. (2006). Are Juvenile Offenders Extreme Future Discounters? *Psychological Science, 17*, 989-994.
- Yoon, K. L., Fitzgerald, D. A., Angstadt, M., McCarron, R. A., & Phan, K. L. (2007). Amygdala reactivity to emotional faces at high and low intensity in generalized social phobia: A 4 Tesla functional MRI study. *Psychiatry Research: Neuroimaging, 154*, 93-98.