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# Sexual discounting among high-risk youth ages 18–24: Implications for sexual and substance use risk behaviors

**Jacinda K. Dariotis, PhD, MAS, MS, MA**[1] and **Matthew W. Johnson, PhD**[2]

[1]Johns Hopkins Bloomberg School of Public Health, Department of Population, Family, and Reproductive Health, Center for Adolescent Health, Hopkins Population Center

[2]Johns Hopkins University School of Medicine, Department of Psychiatry and Behavioral Sciences, Behavioral Pharmacology Research Unit

## Abstract

Youth under 25 show substantial sexual and substance use risk behaviors. One factor associated with risk behaviors is delay discounting, the devaluation of delayed outcomes. This study determined if delay discounting for sexual outcomes is related to sexual risk and substance use among 18–24 year olds. Females (70) and males (56) completed the Sexual Discounting Task, which assessed their likelihood of having unprotected immediate sex vs. waiting for sex with a condom, at various delays, with four hypothetical sexual partners selected from photographs: the person they (1) most wanted to have sex with, (2) least wanted to have sex with, (3) judged most likely to have an STI, and (4) judged least likely to have an STI. They also completed instruments assessing HIV knowledge, sexual behaviors, substance use, risk attitudes, inhibition, impulsivity, and sensation seeking. Condom use likelihood generally decreased with increasing delay. Preference for immediate, unprotected sex was greater for partners whom participants most (vs. least) wanted to have sex with, and judged least (vs. most) likely to have an STI. Preference for immediate, unprotected sex in the 'most want to have sex with' and 'least likely to have an STI' conditions was related to greater lifetime risky sexual partners, lifetime number of unique substances used, disregard of social approval/danger, disinhibition, and sensation/excitement seeking. Males showed greater likelihood of unprotected sex than females when condom use was un-delayed, but delay affected condom use similarly between sexes. Delay discounting should be considered in strategies to minimize youth risk behavior.

### Keywords

Sexual delay discounting; sexual health; substance use; emotional regulation; HIV knowledge; high-risk youth; emerging adults

## Introduction

Sexual and substance abuse risk taking behaviors peak during ages 18 through 24 (Arnett, 1992; SAMHSA, 2012). This developmental period is sometimes referred to as "late adolescence" (Lerner & Galamos, 1997) or "emerging adulthood" (Arnett, 2000) because youth are often not independently engaged in adult responsibilities. As Lerner and Galambos (1997) state, however, this developmental stage is marked by "a transition from high school to the worlds of work, university, or childrearing" (414). Youth aged 15–24 contribute half of all new sexually transmitted infection (STI) cases, yet they constitute only one-quarter of the sexually active U.S. population (Weinstock, Berman, & Cates, 2004). STI rates, especially for Chlamydia and Gonorrhea, continue to increase for this age group (CDC, 2011). Youth ages 18–25 also rank highest in current (past month) alcohol use, binge drinking, illicit drugs, and nonmedical prescription drug use among all age categories (SAMHSA, 2012). Several factors are related to individual differences in risk-taking decisions (Traube, Holloway, & Smith, 2011), including perceived risk of transmission (Pollack, Boyer, & Weinstein, 2013), the perceived severity of HIV/AIDS consequences (e.g., van der Snoek et al., 2006) and social network factors (Ford, Sohn, & Lepkowski, 2002; Laumann & Youm, 1999). These factors, however, are likely not the only ones accounting for differences in sexual risk behavior among young people.

One potential factor influencing risk behavior is delay discounting. Delay discounting refers to reduction in subjective value of a consequence due to delay until the consequence occurs. Organisms typically prefer sooner rewards over delayed rewards (Rachlin, Raineri, & Cross, 1991). Delay decreases the subjective value of a reward such that smaller immediate rewards may be preferred over larger delayed rewards. Increased rates of delay discounting (preference for smaller immediate over larger later rewards) have been associated with a variety of problematic behaviors such as substance abuse and dependence, problem gambling, lack of preventative health care, and sedentary lifestyle (Bradford, 2010; MacKillop et al., 2011; Weller, Cook, Avsar, & Cox, 2008). This research typically assesses discounting of monetary rewards (i.e., choices between smaller immediate vs. larger delayed money). While research assessing the discounting of monetary rewards has proven utility, real life choices affected by discounting involve a variety of outcomes other than monetary. Tasks that examine discounting of other commodities have been developed to examine discounting in domains relevant to clinical behaviors in question. These delay discounting tasks assessing clinically-relevant, non-monetary outcomes have shown stronger associations than monetary delay discount has shown with actual clinical issues (e.g., Johnson & Bruner, 2012; Lawyer & Schoepflin, 2013; Rasmussen et al., 2010; Hendrickson & Rasmussen, 2013).

The Sexual Discounting Task (SDT) assesses the role of delay discounting in sexual risk behavior by examining how delay affects decisions related to condom use (Johnson & Bruner, 2012). On this task, participants rate their likelihood of engaging in immediate unprotected sex vs. delayed sex with a condom with four hypothetical partners. In an initial study involving 62 sexually active (reported sexual intercourse within the past 30 days) cocaine-dependent adults ages 18–65 (Johnson & Bruner, 2012), preference for immediate unprotected sex on the SDT was significantly associated with greater self-reported real-

world sexual risk behavior in three out of the four Sexual Discounting Task partner conditions. No significant relations were found between real-life sexual risk behaviors and discounting of money, suggesting discounting may be domain-specific.

Being cocaine dependent individuals, these participants were demographically among the highest risk populations for sexual risk behavior. Despite this fact, participants reported that they would be very likely to use a condom under conditions in which a condom was immediately available. But, adding a relatively short delay to condom availability greatly reduced likelihood of condom use in some partner conditions. This suggests that delay is a critical but underappreciated factor that influences choices to engage in sexually risky behavior, and that the SDT provides a clinically meaningful assessment of this phenomenon. A follow up study in cocaine-dependent participants demonstrated that the SDT has high test-test reliability (Johnson & Bruner, 2013). A recent study comparing 27 opioid dependent women with 33 control women reported that opioid dependent women showed greater discounting of condom protected sex relative to control women with respect to partners they perceived as less risky (least likely to have an STI). The study also found that greater sexual discounting was related to greater self-reported impulsivity (Herrman, Hand, Johnson, Badger, & Heil, 2014).

Two other tasks have shown clinically meaningful relationships with the delay discounting of sexual outcomes (e.g., sexual desire; sexual excitation and inhibition). One study found that preference for a shorter duration of immediate sexual activity over a longer duration of delay sexual activity was associated with increased sexual excitability (Lawyer & Schoepflin; 2013). Another study showed that alcohol dependent individuals showed significantly greater preference for a smaller number of immediate sex occasions over a greater number of delayed sex occasions compared to non-dependent participants (Jarmolowicz, Bickel, & Gatchalian, 2013). Together, these studies suggest that delay discounting for sexual outcomes is relevant to sexual decision making.

Another issue of interest in the study of delay discounting is that of differences between males and females. The preponderance of evidence suggests that there are no substantial differences in the delay discounting of monetary rewards between the two sexes (for a brief review, see Johnson & Bruner, 2013). With respect to sexual discounting, however, an initial study in cocaine dependent older adults (mean age 48.5 years, SD=8.4) found that males discounted significantly more than females in 3 of the 4 partner conditions of the Sexual Discounting Task, with a trend nearly reaching significance (p=.07) in the remaining condition (Johnson & Bruner, 2013). Money discounting did not significantly differ between males and females. A sex difference between the discounting of sexual outcomes - but not the money outcomes - may be consistent with an evolutionary perspective in which men put more effort into short term mating strategies than women because their evolutionary success necessitates relatively less parental investment (Buss & Schmitt, 1993).

The primary aim out the present study is to assess sexual discounting among 18–24 year olds, including its relations to HIV knowledge, self-reported sexual and substance use risk behaviors, and scores on self-reported sensation seeking and impulsivity instruments. Based on previous research with older cocaine-dependent participants, we hypothesize that

participants will discount their likelihood of condom use as a function of delay, with greater decreases (i.e., greater sexual discounting) for more desirable partners and partners judged least likely to have an STI. Also based on this previous research we hypothesize that greater sexual discounting will be associated with greater self-report sexual risk behavior, and greater sexual discounting will be observed in men than women. Moreover, we test novel hypotheses based in this emerging adult population. Specifically, we hypothesize that greater sexual discounting is related to (a) lower HIV risk knowledge, (b) greater substance use, (c) more positive attitudes toward risk-taking, (d) higher scores on standard self-report impulsivity scale, (e) greater self-report disinhibition, and (f) greater self-report sensation seeking.

## Method

### Sample and Participant Selection

All study protocols, measures, and materials were approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board. All participants provided written consent prior to participating. Data for this study come from a convenience sample of 126 HIV-negative, never married 18–24 year old (Mean age= 21.3, SD = 1.9) women and men who provided informed consent living within an urban city characterized by high STI and HIV prevalence rates, drug use, and crime as well as surrounding counties marked by fewer risk outcomes. More females (n=70) than males (n=56) were enrolled to provide an oversample in the event of pregnancy at a later visit.[1] Quota sampling was used to balance the distribution across age, biological sex, and race categories, and produce a heterogeneous sample. Inclusion criteria include being between ages 18 and 24 inclusive, never married, HIV negative, English reading and writing proficiency, and not currently pregnant (females only). Recruitment strategies included local newspaper and online social media advertisements, public flyers, and peer referrals from enrolled participants. During the in-person screening visit, participants underwent an HIV rapid test by a trained test administrator to verify self-reported negative HIV status. All participants tested negative. Demographics are presented in Table 1. Sexual and substance use risk-taking behaviors are presented in Table 2.

### Data Collection Procedures

During the visit, participants completed an Audio Computer Assisted Self-Interview (ACASI) survey using headphones and the computerized SDT. Urine specimens were collected and tested to assess for 12 substances. Participants were given a reloadable cash card at the end of the visit. They were compensated $15 for both the ACASI and computerized tasks including the SDT and $10 for providing a urine specimen.

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[1]These data come from the baseline visit of a larger, longitudinal parent study that involved biological assessments contraindicated for pregnant women. In anticipation that 18–24 year old females may become pregnant over the course of the parent study, females were oversampled at baseline compared to males.

## Measures Used for the Present Study

**Sexual Discounting Task (SDT)—**The Sexual Discounting Task (Johnson & Bruner, 2012) presents participants with 60 photos of individuals (half female). Of the 60 photos used with adult samples, 13 were replaced with photos of younger people to increase sample relevance.

At task onset participants were instructed the following:

> For this task, we will ask you hypothetical (pretend) questions about your willingness to have sex in various situations. For the purpose of this task, please pretend that you are not currently in a committed sexual relationship if you are. In other words, please pretend that you are single and available, and that you are not cheating on anybody if you indicate you would have sex with somebody in this task. In the following window you will see a lot of pictures of people. For each person, I would like you to think about how attractive that person is. Based on physical appearance alone, please think about whether each person is someone that you would consider having sex with in the right environment and if you liked the person's personality.

Participants looked at each photo in turn and answered 'yes' or 'no' about whether they would have sex with the person depicted in the photo. Then, across all the photos to which they said 'yes,' they were asked to identify one photo for each of four conditions: the person (1) s/he *most* wanted to have *sex* with, (2) s/he *least* wanted to have *sex* with, (3) *most* likely had an *STI*, and (4) *least* likely had an *STI*. These categories will be termed 'most want to have sex with,' 'least want to have sex with,' 'most likely to have an STI,' and 'least likely to have an STI' partners. Participants could choose the same photo for more than one category. The category presentation order was randomized across participants. Participants were asked eight questions in reference to each of these 4 partners. If only one photo was chosen, participants answered a single set of items in reference to that photo (items were not specific to any of the four conditions). Only one question was presented on the screen at a time along with the reference photo. Participants were informed that they should answer the questions assuming pregnancy was not possible. The first question for each category asked participants to report their likelihood of using an immediately available condom when having sex with this person now. This zero-delay item is considered a measure of condom preference regardless of delay. Participants responded using a computer mouse to move the slider on a visual analog scale ranging from 0 to 100 percent with 0 indicating "I will definitely have sex with this person now without a condom" and 100 indicating "I will definitely have sex with this person now with a condom." Before the SDT task participants were trained to respond on visual analog scales.

After the zero-delay question, seven additional questions followed for each photo, asking the participant's likelihood of waiting a specific amount of time for protected sex with a condom vs. having immediate unprotected sex. Visual analog scales ranged from 0 indicating "I will definitely have sex with this person now without a condom" to 100 indicating "I will definitely wait [delay] to have sex with this person with a condom." Delays were presented in ascending order: 1 hour, 3 hours, 6 hours, 1 day, 1 week, 1 month,

and 3 months. All percent likelihood values were converted to proportions by dividing values by 100. Each proportion will be refer to as an "indifference point." Participants who choose no photos have no indifference point data and are not included in these analyses.

**HIV sexual risk-taking behaviors—**Participants were asked about their lifetime sexual behaviors via items used in national surveys on sexual behaviors (e.g., National Survey of Adolescent Males – NSAM; National Survey of Family Growth – NSFG). A composite variable of lifetime risky sexual partners was calculated by summing "yes" responses across the following items: (1) ever having sex with another male, (2) ever have sex with a prostitute or ever received money/drugs/ something else in exchange for sex, (3) ever have sex with an intravenous drug user, (4) ever have sex with someone who is HIV+, and (5) ever have sex with someone only once (one-time partners). Values range from 0 to 5.

**Substance use behaviors and clinical assessments—**Via ACASI participants reported about lifetime, recent (last 12 months), and current (last month) substance use including tobacco, alcohol, inhalants, non-prescribed prescription drugs, and illicit drugs (e.g., marijuana, opiates, bath salts, hallucinogens, stimulants, downers). Participants also provided a urine sample that was tested for the presence of 12 substances. Positive urine drug results were added to self-reported measures to create a composite variable of the total number of unique substances ever used. Values range from 0 to 10.

**HIV knowledge—**Participants completed the 45-item HIV Knowledge Questionnaire (HIV-K-Q; Carey, Morrison-Beedy, & Johnson, 1997). Any 'do not know' responses were treated as incorrect. The total scores were calculated by summing the number of correct items, dividing the sum by 45, and multiplying by 100. Higher scores denote more accurate HIV knowledge. Internal consistency was high (Cronbach's alpha = 0.85).

**Risk-taking attitudes—**Risk-taking attitudes were assessed using the 34-item Attitudes Toward Risk Scale (Franken, Gibson, & Rowland, 1992). Using a five-point Likert scale, participants indicated whether the description presented in each item was "like me" or "not like me." Internal consistency was very high (alpha = 0.94). The scale contains two subscales with 10 items each: regard for social approval (alpha = 0.91) and regard for danger (alpha = 0.89). Higher scores on each subscale denote less favorable attitudes toward risk.

**Sensation seeking—**The 40-item Sensation Seeking Scale V (Zuckerman, Eysenck, & Eysenck, 1978) consists of four subscales (10 items each) that measured boredom susceptibility (alpha = 0.72), thrill and adventure seeking (alpha = 0.77), experience seeking (alpha = 0.69), and disinhibition (alpha = 0.70). For each item participants rated whether the statement was 'true', for a maximum score of 10 on each subscale and 40 for the total scale. Higher values on each subscale denote greater level of the characteristic measured. The total scale had high reliability in this sample (alpha = 0.86).

**Self-report impulsivity—**The 59-item UPPS-P Impulsive Behavior Scale (Cyders, Smith, Spillane, Fischer, Annus, & Peterson, 2007) was used as a metric of self-reported impulsivity. This scale adds a personality subscale - positive urgency – to the original UPPS scale (Whiteside SP & Lynam, 2001). For each statement, participants indicated their level

of agreement using a four-point scale ("agree strongly" to "disagree strongly"). Five subscales make up the total scale: negative urgency (12 items; alpha = 0.88), lack of premeditation (11 items; alpha = 0.79), lack of perseverance (10 items; alpha = 0.77), sensation seeking (12 items; alpha = 0.83), and positive urgency (14 items; alpha = 0.94). Higher values denote more of the characteristic. The total scale had high reliability (Cronbach's alpha = 0.93).

## Analytic Strategy

**Data orderliness**—An established algorithm (Johnson & Bickel, 2008) that has been implemented in multiple delay-discounting studies (e.g., Johnson & Bruner, 2012, 2013; J), was used to assess orderliness of unstandardized data in the current study. This method determines if data for each discounting function (or curve) meets the most basic assumption of delay discounting data: that the value of the preferred option will either remain stable or decrease (not increase) if a delay is imposed. Data orderliness is assessed by initially flagging discounting functions (or curves) if any indifference point (starting with the 1 hour delay) was greater than the preceding indifference point by a magnitude greater than 0.2. If a participant's curve had only one flagged nonsystematic point, the average of the two adjacent points [(preceding + subsequent points)/2] was imputed. If a participant's curve had two or more points identified as nonsystematic, that condition for that individual was excluded from subsequent analyses.

**Raw (unstandardized) delay-discounting data**—Raw delay-discounting data includes the participant's response to the zero-delay question as well as responses to subsequent questions assessing the effect of various delays. Area under the curve (AUC) was determined for all individual discounting curves using procedures for delay discounting previously described (Myerson, Green, & Warusawitharana, 2001). Smaller AUC values denote greater preference for immediate sex without a condom. Because it is based on zero-delay as well as delay data, raw delay-discounting AUC expresses one's overall likelihood of using a condom, due to non-delay factors as well as delay.

**Standardized delay-discounting data**—To isolate the effect of delay in decreasing condom use likelihood, each delay value after the zero-delay item (i.e., 7 items) was divided by the zero-delay value to generate standardized values. This shows the degree to which delay affected condom use likelihood above and beyond any differences in condom use in the zero-delay condition. From these standardized data, AUC was calculated as described above.

**Non-linear regression**—For visual descriptive purposes, nonlinear regression was used to fit discounting functions to the group median data for each condition for standardized discounting data. Group median data were fit to a 2-parameter hyperbolic found to describe delay discounting functions (Green, Fry, & Myerson, 1994).

**Comparing discounting across conditions**—Paired t-tests compared each of two condition pairs - (1) 'most want to have sex with' and 'least want to have sex with', and (2)

'most likely to have an STI,' and 'least likely to have an STI' conditions, using zero-delay values and standardized and raw AUC means.

**Relating discounting data to survey measures—**Correlations of sexual discounting to survey measures used standardized discounting data because we were specifically interested in the pure effect of delay discounting (controlling for zero-delay propensity to use a condom) in relation to these other variables. Using standardized data, Pearson correlations were conducted between each of the four SDT condition AUCs and (1) the number of photos chosen, (2) HIV knowledge questionnaire scores, (3) lifetime risky sexual behavior reports, (4) lifetime unique substances used, (5) attitudes toward risk, (6) sensation-seeking total and subscale scores, and (7) UPPS-P total and subscale scores.

**Sex differences—**The number of photos chosen for the SDT, zero-delay time condition, and raw and standardized AUCs for the four SDT conditions were directly tested for sex differences. Subsequent models used biological sex as a covariate only for SDT conditions where sex differences were statistically significant.

## Results

### Sample Demographics and Risk-Taking Behaviors

This sample is heterogeneous with respect to childhood disadvantages, educational attainment, and risk-taking behaviors, yet generally more disadvantaged and showing greater risk relative to national estimates. With respect to childhood socioeconomic and poverty status, over half of the sample (54%) was eligible for or received reduced or free lunch under age 18 (compared to 42 – 47.5% national estimates for 2005–2011 among school-aged youth; US Department of Education, 2012), less than half lived with both biological parents at age 14 (47.6%) with 29 percent living in single-parent only households, 32 percent were born to mothers who were teenagers at first motherhood (compared to 30.3% of 15–19 year olds, nationally; Martinez, Copen, & Amba, 2011), and 38 percent of the sample reported being born to parents who never cohabitated or married (compared to 17% for the national average among 15–44 year olds; Martinez, Daniels, & Chandra, 2012). These comparisons suggest the sample is more disadvantaged relative to national averages.

With respect to educational attainment, this sample represents both enrolled and non-enrolled (41.3%) youth. Youth varied with respect to highest degree earned [GED (9.5%), high school diploma (61.9%), associate's degree (7.1%), four-year college degree (14.3%)] and educational attainment [less than high school (9.1%); high school only (40.5%); some college attendance (38.1%); four-year college degree (14.3%)]. National averages reported for 2009 suggest this sample is disadvantaged with respect to educational attainment [national averages: high school completion including GED (29.3%), some college (36.3%), associate's degree (5.1%), four-year college degree or higher (19.0%)]. According to national averages, 65.6 percent of 18–24 year olds in 2009 earned a high school degree or equivalent but no higher degree and 19.0 percent earned a four-year college degree or higher (Aud, KewalRamani, & Frohlich, 2011) compared to 71.4 and 14.3 percent, respectively, for the current study sample. This speaks to the educational attainment disadvantage of the current sample. In terms of arrests and jail time, 25 percent of the sample reported being

arrested at least once in their lifetime and 24 percent spent time in jail. In 2009, the national average for arrest was 104 per 1,000 young adults (10.4%; Aud et al., 2011). The current sample reports over twice as many arrests, speaking to elevated delinquency risk.

This study sample spans risk-avoidance and risk-seeking youth in terms of sexual and substance use risk behaviors. Of the 126 female and male youth, 36 (28.6%) youth reported ever being pregnant or impregnating a female and 21 of the 36 (16.7% of the total sample) reported becoming a parent via live birth. The average age at first pregnancy for this sample was 17.7 (SD=2.3) years old. A total of 76 pregnancies were reported (17 youth reported multiple pregnancies). Nearly one-third (32.9%; 23 of 70) of female study participants reported ever being pregnant compared to national estimates of 7.9 percent (79 births per 1000) of unmarried 20–24 year old females (Aud et al., 2011).

With respect to substance use, youth self-reported about lifetime and current (last 12 month) use of numerous substances (including tobacco, alcohol, inhalants, non-prescribed prescription drugs, and illicit drugs such as marijuana, opiates, bath salts, hallucinogens, stimulants, sedatives) and provided a urine specimen to test for 12 substances. One-third of the sample tested positive for at least one substance in their urine. Over 68 percent reported using drugs at least once in their lifetime (excluding alcohol and nicotine). Furthermore, 85% ever used alcohol, 62% ever used cannabis, 48% ever used nicotine, 25% ever used opioids, 22% ever used ecstasy, 19% ever used sedatives, 18% ever used hallucinogens, and 17% ever used stimulants (including cocaine). Last 12 month frequency reports show that the greatest daily use occurs for nicotine (37%), cannabis use (21%), and alcohol (6%) use. When weekly use is added, one-third to one-half of youth who ever used these substances continue to use them at least weekly (47% for nicotine; 44% for alcohol; 38% for cannabis). According to national averages for 18 to 25 year olds reported for 2009, any substance use in the last month was 21.2 percent across all illicit drugs, 18.1 percent for marijuana, 41.7 percent for alcohol binging, and 35.8 percent for tobacco (Aud, KewalRamani, & Frohlich, 2011). Weekly use of marijuana and alcohol among this sample is higher than monthly use at the national level, suggesting this sample engages in greater substance use.

### Photo Selection

The number of photos selected by participants ranged from 0 to 41. Of the 126 participants, 5 (4.0%) did not choose any photos and 4 (3.2%) chose only one photo. Among participants who selected at least one photo, the mean number of photos selected was 14.5 (SD=8.8) for the total sample and male participants chose significantly more photos relative to females (M=17.5 vs. 12.1, t=3.68, p < 0.001). This was the only statistically significant sex difference found across all the analyses.

### Data Orderliness

Across the 472 sexual discounting functions, 74 (15.7%) were flagged as having at least one nonsystematic point (i.e., with a data point greater than 0.2 from the previous point), with the vast majority (N=62) having only one such nonsystematic point. The 12 functions with two or more nonsystematic time points were removed from further analyses of these

functions. This left 460 functions remaining (111 'most want to have sex with,' 117 'least want to have sex with,' 117 'most likely to have an STI,' 115 'least likely to have an STI').

## Sexual Discounting across Conditions

When only one photo was chosen, data could be analyzed by condition and were dropped from analyses (N=4). The following results are based on data from 117 participants.

**Raw delay discounting data—**The 'least want to have sex with' condition had a statistically significantly greater AUC (M=0.77, SD=0.34) relative to the 'most want to have sex with' condition (M=0.55; SD=0.40), [t(116)=6.43, p < 0.001]. Similar patterns were found for the 'most likely to have an STI' and 'least likely to have an STI' conditions. The AUC for the 'most likely to have an STI' condition (M=0.81; SD=0.32) is statistically significantly higher than for the 'least likely to have an STI' condition (M=0.55; SD=0.41), [t(116)=7.18, p < 0.001]. With respect to sex differences, males discounted more than females for two conditions: 'most want to have sex with' (M = 0.42 vs. 0.67 respectively, t = −3.67, p < 0.001) and 'least likely to have an STI' (M = 0.41 vs. 0.68 respectively, t = −3.87, p < 0.001) conditions. Although differences were in the hypothesized direction, no sex differences reached significance for the 'least want to have sex with' and 'most likely to have an STI' conditions.

**Zero-delay likelihood of using a condom—**Comparing condom use preferences during the zero-delay time point across conditions gives a baseline measure of a person's proclivity to using condoms when no delay is involved. Under the 'most want to have sex with' condition, participants reported a lower preference for condom use (M=0.85, SD=0.29) relative to the 'least want to have sex with' condition (M=0.90, SD=0.23) [t(116) −2.03, p < 0.05]. Similarly, participants reported lower condom preference for 'least likely to have an STI' (M=0.79, SD = 0.23) compared to 'most likely to have an STI' (M=0.93, SD=0.21) partners, [t(116) = −4.42, p < 0.001]. With respect to sex differences for zero-delay, males discounted significantly more than females for the 'most want to have sex with' (M = 0.73 vs. 0.94 respectively, t = −4.03, p < 0.001) and 'least likely to have an STI' (M = 0.70 vs. 0.87 respectively, t = −2.88, p < 0.01) conditions.

**Standardized delay discounting data—**For each of the four the SDT conditions, median indifferences points and associated non-linear regression curves standardized with respect to baseline zero-delay condom use proclivity are presented in Figure 1. Median data pertaining to the 'most want to have sex with' and 'least want to have sex with' are presented in the top panel. Both curves are monotonically decreasing with a sharp decrease from zero to one hour delay followed by a slowing decrease from one to 2190 hours (3 months). The AUC for 'least want to have sex with' partners (M=0.87, SD=0.54) is significantly higher relative to 'most want to have sex with' partners (M=0.64, SD=0.46) [t(110)=4.67, p < 0.001]. AUC was significantly higher for 'most likely to have an STI' partners (M=0.90, SD=0.50) compared to 'least likely to have an STI' partners (M=0.70, SD=0.68), [t(106)= 2.63, p < 0.01]. No sex differences in any of the four conditions reached statistical significance for the standardized data therefore biological sex was not included as a covariate in subsequence models using standardized data.

### Relating Discounting Data to Survey Measures

AUC (standardized) for the four SDT partner conditions were significantly correlated with several measures including the chosen number of photos, number of lifetime risky sexual partners, number of unique lifetime substances used, HIV knowledge, attitudes toward risk, sensation seeking, and impulsivity measures (Table 2). *Negative* coefficients are interpreted as the characteristic of interest being related to *greater* sexual discounting (preference for immediate unprotected sex) whereas *positive* coefficients denote *less* sexual discounting (preference for delayed sex with a condom). Findings were not significant for the 'least want to have sex with' and 'most likely to have an STI' partner conditions and are not referenced.

Number of lifetime risky partners was significantly negatively related to discounting in the 'most want to have sex with' partner condition. With respect to the number of lifetime unique substances used, the greater the number of substances used was significantly negatively related to both the 'most want to have sex with' and 'least likely to have an STI' conditions.

HIV knowledge was significantly negatively related to AUC for the 'least likely to have an STI' partner condition. In other words, youth who reported the most accurate knowledge about HIV risk also reported higher preference for immediate, unprotected sex with partners whom they perceived to be least at risk of having an STI. Overall, less favorable attitudes toward risk were related to greater postponement of immediate unprotected sex under two conditions: 'most want to have sex with' and 'least likely to have an STI' partners. Greater regard for social approval had stronger positive associations with postponed unprotected sex in both the 'most want to have sex with' and 'least likely to have an STI' partner relative to regard for danger.

Participants showing greater overall sensation seeking also report greater preference for more immediate unprotected sex in the 'most want to have sex with' and 'least likely to have an STI' partner conditions. These findings were similar for three of the four subscales (the exception being boredom susceptibility). As hypothesized, greater disinhibition and thrill and experience seeking were associated with greater discounting. Specifically, disinhibition as well as thrill and adventure seeking were associated with more immediate sex in the 'least likely to have an STI' and 'most want to have sex' conditions, and adventure seeking was associated with greater discounting in the 'least likely to have an STI' condition. The hypothesized relationship between self-report impulsivity and sexual discounting was supported only for one subscale: a lack of perseverance was related to more immediate sex for the 'most want to have sex with' partner.

## Discussion

The results of the study can be classified into several major categories. First, as hypothesized, these findings replicate the largely systematic pattern of decreasing value for the delayed condom use option with increasingly longer delays, as observed in older and cocaine-dependent samples (means ~49 years old; Johnson & Bruner, 2012, 2013). In both age populations, the task has shown internal validity (e.g., orderly effects of delay; the same within-subject effects of partner desirability and perceived STI likelihood) and external

validity (significant relations to real world risk behavior). This suggests for the first time that delay discounting of condom protected sex may be a risk factor for HIV among youth. A major implication of these data is that condoms should be made as available to youth as possible. It is remarkable that youth, a group known for high rates of risk taking, typically indicated they would use a condom if one were available. Adding even a relatively short delay to condom availability, however, drastically reduced their typical likelihood of using a condom in some conditions. This means having a condom available (e.g., in one's backpack or purse) might tip the scales from unprotected to protected sex. Condoms might be made freely available in schools and other settings, in locations that reduce social embarrassment (e.g., restrooms). Such programs should not be limited to youth attending school, as youth with a high disregard for social approval may be more likely to have dropped out or been expelled from school. Programs may be integrated in non-academic settings young people may frequent such as community recreation centers, employment training centers, GED program sites, rehabilitation centers, community health clinics.

Second, consistent with these previous studies, sexual discounting differed as a function of partner characteristics. Youth discounted significantly more with partners they 'most want to have sex with' and partners whom they thought were 'least likely to have an STI.' These findings hold after controlling for individual differences in condom use when no delay was involved (i.e., using standardized discounting). This has implications for understanding condom nonuse among youth. Youth are more likely to have immediate unprotected sex and forego waiting for a condom when the partner is perceived as more attractive and less likely to have an STI. Perceived low-risk partners do not equate to no-risk (Dariotis et al., 2008). If partners whom youth find quite attractive or misperceive as least likely to have an STI actually have STIs, the risk of transmission is exacerbated by the increase in discounting. Decisions regarding STI likelihood were based on partner appearance alone and may be perpetuated by the "beauty is healthy" misconception (Scheib, Gangestad, & Thornhill, 1999; Zaidel, Aarde, & Baig, 2005). These findings imply sexual education courses might place increased emphasis on the notion that all partners might entail risk, regardless of attractiveness or one's judgment of the partner's risk.

Third, when condoms were not delayed (zero-delay), males were less likely than females to use condoms with the 'most want to have sex with' and 'least likely to have an STI' partners. When controlling the zero-delay condition (isolating the effect of delay), however, there were no sex differences. In a previous study of older adult cocaine-dependent participants, males showed less condom use than females on the Sexual Discounting Task in multiple partner conditions (Johnson and Bruner, 2013). Unlike the present study, that study did not isolate overall sexual discounting task results into zero-delay and standardized sexual discounting components. For comparison with the present study, we conducted sex comparisons of zero-delay and standardized sexual discounting AUC for the previous study (using the sex analyses described for unstandardized AUC in Johnson & Bruner, 2013). Males showed significantly lower condom use likelihood than females in the zero delay condition in all four partner conditions (all ps .05). When standardized with respect to zero-delay condom use, however, only the 'least want to have sex with" partner condition showed a significant sex difference (male AUC < female AUC). Therefore, both studies showed sex differences in condom use likelihood when no delay was involved, but more

restricted (or no) sex differences in delay discount of condom use when controlling for zero-delay differences. Future studies on how zero-delay condom preferences influence sex differences in discounting would be informative.

Last, greater number of unique lifetime substances used and greater number of lifetime risky partners sexual discounting were each associated with greater sexual discounting in some partner conditions (particularly more favorable partners). Taken together, these data suggest that sexual discounting has some trait-like characteristics. That is, the same risk factors may tend to put someone at increased risk for drug use, sex with risky partners, and immediate unprotected sex. These factors may include a more favorable attitude toward risk (disregard for social approval and danger), greater sensation seeking preferences, or less inhibition. Risk attitudes, sensation seeking preferences, and disinhibition characteristics may help identify youth who would benefit from interventions promoting delayed gratification or alternative activities through which to fulfill sensation seeking desires (e.g., sports, academics). Addressing these characteristics generally among children before they reach adolescence may translate into decreased discounting and sexual risk behaviors at later ages. Programs aimed at reducing STI risk might be especially focused on youth with these characteristics and history of sexual risk and substance use behaviors.

Two hypotheses were not supported. First, these data did not support our hypothesis that greater self-reported impulsivity would predict greater sexual discounting. This finding is generally consistent with previous studies which have shown mixed evidence for associations between self-report impulsivity measures and delay discounting measures (Coffey et al., 2003). Second, contrary to our hypothesis, we found that higher HIV risk knowledge was related to greater sexual discounting under the 'least likely to have an STI' condition. This may be an unintended consequence of understanding how low the likelihood is of contracting HIV when someone perceives a partner to be of particularly low risk (least likely to have an STI).

### Limitations

Limitations should be considered. First, the task involves hypothetical rather than real sexual decisions. Experimentally studying real-life sexual decisions poses ethical concerns. However, we found a significant correlation between self-reported real-world risk, similar to a previous study (Johnson & Bruner, 2012), suggesting task validity. Also, hypothetical choices have shown validity in monetary delay discounting tasks (e.g., Johnson & Bickel, 2002; Baker, Johnson, & Bickel, 2003; and Johnson, Bickel, & Baker, 2007). Second, this study relies on retrospective reports about sexual behaviors and drug use (the addition of urine specimens for recent drug use is a strength). Although recall is a source of error, the period from first sexual debut to data collection was relatively short given the young sample age. Furthermore, our sexual risk items assess sexual activities with more salient partners (e.g., prostitutes, intravenous drug users, men who have sex with men), thereby increasing reporting accuracy (Catania, Gibson, Chitwood, & Coates, 1990).

### Strengths

This study has several strengths. First, the sample is heterogeneous in terms of sociodemographic characteristics and includes hard-to-reach urban youth who have not been well represented in the literature due to reliance on middle-class, White, college-enrolled students. To our knowledge this is the first study to examine the delay discounting of condom use among such a demographically heterogeneous sample of youth. Hard-to-reach youth are at particular risk for negative sexual and reproductive health outcomes. This study enables generalization of previous and current findings on the discounting of delayed safer sexual practices (sexual discounting) to youth with broader sociodemographic characteristics. Second, the replication of results for the SDT demonstrates reliability with a younger and more heterogeneous sample suggesting its utility in studying sexual risk among youth. Third, this study draws upon multiple standardized scales to inform how a sexual discounting task relates to sexual behaviors, HIV knowledge, sensation-seeking, and self-report impulsivity. And, this study utilizes both self-reports and biological assessments of substance use.

### Future Directions

The findings are encouraging and suggest several future research directions. Qualitatively exploring why youth make the discounting choices they do may provide insights into intervention and prevention strategies. And, understanding the biological basis for these decisions in youth may also inform intervention efforts. Research may examine whether youth are engaging in cost-benefit analyses (conscious or subconscious) and identify motivations for postponing sexual activity until condom availability. Clearly, youth can postpone sexual activity as shown in the 'most likely to have an STI' condition. But, when they consider the partner most attractive ('most want to have sex with' and 'least likely to have an STI.'), discounting increases. Future research should investigate both strategies for increasing condom availability and increasing the likelihood that youth will wait to obtain a condom if one is not available.

## Acknowledgments

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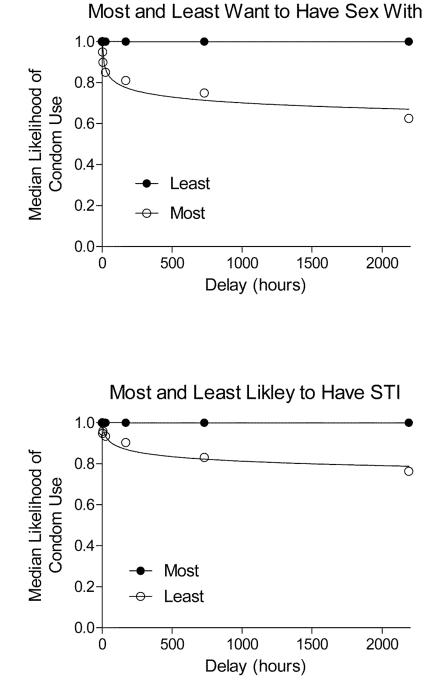
## Most and Least Want to Have Sex With



## Most and Least Likley to Have STI



**Figure 1.**
Sexual discounting group median data with fest-fit hyperbolic curves. Median values and curves are based upon data in which all individuals values have been standardized by (divided by) the individual's value for condom use in the zero delay condition. The resulting values and curves represent the degree to which condom use likelihood decreases as a result of delay, controlling for differences in likelihood of condom use when no delay is involved.

The top panel presents data from the 'most' and 'least' likely to have an STI conditions. The bottom panel presents data from the 'most' and 'least' want to have sex with conditions.

**Table 1**

Sample Demographics

| Demogaphic Variables | N | % | Mean | SD |
|---|---|---|---|---|
| Age (in years) | | | 21.34 | 1.88 |
| 18 | 18 | 14.29 | | |
| 19 | 16 | 12.70 | | |
| 20 | 25 | 19.84 | | |
| 21 | 20 | 15.87 | | |
| 22 | 15 | 11.90 | | |
| 23 | 20 | 15.87 | | |
| 24 | 12 | 9.52 | | |
| Female | 70 | 55.60 | | |
| Race | | | | |
| American Indian/ Alaska Native | 1 | 0.80 | | |
| Asian | 6 | 4.80 | | |
| Black/ African American | 66 | 52.38 | | |
| White | 52 | 41.27 | | |
| Other Specified/ Indigenous Siberian | 1 | 0.79 | | |
| Hispanic | 5 | 3.97 | | |
| Current School Enrollment | | | | |
| Full-time student | 58 | 46.03 | | |
| Part-time student | 16 | 12.7 | | |
| Not currently enrolled | 52 | 41.27 | | |
| Current Highest Degree | | | | |
| No Degree/ Less than High School | 9 | 7.14 | | |
| GED | 12 | 9.52 | | |
| High School Diploma | 78 | 61.9 | | |
| Associate's Degree | 9 | 7.14 | | |
| Bachelor's Degree | 18 | 14.29 | | |
| Biological Parents were Married at Time of Birth | 67 | 53.17 | | |
| Received Free or Reduced Lunch as a minor | 68 | 53.97 | | |

| Demogaphic Variables | N | % | Mean | SD |
|---|---|---|---|---|
| Lived with at age 14 | | | | |
| Two biological or adoptive parents | 60 | 47.62 | | |
| Single mother | 35 | 27.78 | | |
| Single father | 2 | 1.59 | | |
| Biological parent and step parent | 15 | 11.9 | | |
| Grandparents or other family members (no parents) | 7 | 5.56 | | |
| Biological Parents' Age at First Parenthood | | | | |
| Biological Mother's Age | 117 | na | 23.68 | 6.57 |
| Biological Mother was a Teen Mother (< age 20) | 37 | 31.62 | | |
| Biological Mother was not a Teen Mother (>= age 20) | 80 | 63.49 | | |
| Missing | 9 | 7.14 | | |
| Biological Father's Age | 98 | na | 25.53 | 6.28 |
| Biological Father was a Teen Mother (< age 20) | 25 | 25.51 | | |
| Biological Father was not a Teen Father (>= age 20) | 73 | 57.94 | | |
| Missing | 28 | 22.22 | | |

**Table 2**

Correlations among AUC (standardized) for each Sexual Discounting Task Condition, HIV Knowledge, Sexual Behaviors, Attitudes, Sensation Seeking, and Impulsivity

| Construct | Most STI (N=114) | | Least STI (N=110) | | Most Sex (N=113) | | Least Sex (N=115) | |
|---|---|---|---|---|---|---|---|---|
| | r | p-value | r | p-value | r | p-value | r | p-value |
| Total Number of Photos Chosen | −0.15 | 0.10 | −0.05 | 0.64 | 0.00 | 0.96 | −0.17 | 0.07 |
| Lifetime Risky Partners | −0.03 | 0.79 | −0.15 | 0.12 | −0.19 | 0.04 * | 0.02 | 0.79 |
| Lifetime Unique Substances Used | 0.05 | 0.58 | −0.23 | 0.02 * | −0.22 | 0.02 * | −0.16 | 0.09 |
| HIV Knowledge Score | −0.08 | 0.41 | −0.20 | 0.04 * | −0.14 | 0.13 | −0.08 | 0.37 |
| Attitudes Toward Risk Scale (total sum) ~ | 0.00 | 1.00 | 0.19 | 0.05 * | 0.33 | 0.00 *** | 0.09 | 0.33 |
| High Regard for Social Approval | 0.04 | 0.66 | 0.18 | 0.06 | 0.35 | 0.00 *** | 0.14 | 0.13 |
| High Regard for Danger | −0.05 | 0.60 | 0.16 | 0.10 | 0.27 | 0.00 ** | −0.01 | 0.91 |
| Sensation Seeking Scale (total sum) | 0.06 | 0.51 | −0.30 | 0.00 ** | −0.28 | 0.00 ** | −0.01 | 0.88 |
| Boredom Susceptibility | 0.07 | 0.47 | −0.12 | 0.20 | −0.14 | 0.13 | 0.06 | 0.50 |
| Thrill and Adventure Seeking | 0.03 | 0.77 | −0.24 | 0.01 * | −0.22 | 0.02 * | −0.02 | 0.86 |
| Disinhibition | 0.00 | 0.99 | −0.23 | 0.02 * | −0.28 | 0.00 ** | −0.08 | 0.39 |
| Experience Seeking | 0.09 | 0.34 | −0.27 | 0.00 ** | −0.16 | 0.10 | −0.01 | 0.91 |
| UPPS-P Impulsive Behavior Scale | 0.09 | 0.36 | 0.00 | 0.99 | −0.11 | 0.26 | 0.00 | 0.97 |
| Negative Urgency | 0.13 | 0.16 | 0.00 | 0.98 | −0.07 | 0.43 | 0.03 | 0.74 |
| Lack of Premeditation | −0.01 | 0.93 | 0.05 | 0.57 | −0.03 | 0.74 | 0.14 | 0.15 |
| Lack of Perseverance | −0.10 | 0.31 | −0.08 | 0.43 | −0.20 | 0.03 * | −0.17 | 0.07 |
| Sensation Seeking | 0.03 | 0.78 | −0.08 | 0.43 | −0.13 | 0.18 | 0.03 | 0.76 |
| Positive Urgency | 0.12 | 0.20 | 0.06 | 0.53 | 0.00 | 0.98 | −0.03 | 0.78 |

NOTE: positive coefficients denote more of the characteristic is related to greater postponement of sex (less discounting).

NOTE: negative coefficients denote more of the characteristic is related to more immediate sex (greater discounting).

~ higher values denote less favorable attitudes toward risk

\* p 0.05,

\*\* p 0.01,

\*\*\* p 0.001