STI VULNERABILITY IN YOUTH: A BEHAVIORAL ECONOMIC APPROACH

A Dissertation

by

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ABSTRACT

STIs are affecting youth at an alarming rate. The majority of these diagnoses are found in females. Poor decision making has been examined as a mechanism underlying STI risk behavior, but research has been limited. The present study examined the association between discounting and STI risk behavior, including drug use, in youth (N = 155), ages 14-21 years. Further the study included a psychometric examination of the Sexual Discounting Task (SDT) with regard to STI risk behavior. The SDT should be considered a clinically meaningful assessment of STI risk behavior in youth. Sexual discounting had robust associations with STI risk and differences were found across gender. Further, differences in gender, sexual discounting, and STI risk were found across drug users. In addition, STI risk differences were by gender and across drug users. The results highlight discounting as a critical and fairly unrecognized variable for understanding STI engagement, especially in females and drug users, which may benefit current STI intervention and prevention strategies.

DEDICATION

"*If you raise your children to feel that they can accomplish any goal or task they decide upon, you will have succeeded as a parent and you will have given your children the greatest of all blessings*." – Brian Tracy

I dedicate this dissertation to my parents. They have raised me to believe I can accomplish anything, and have sacrificed so much to allow me the opportunity to pursue my dreams. Above all, they have provided me with unconditional love and support every step of the way. And in this moment of accomplishment, I owe it all to them – the two biggest blessings in my life.

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NOMENCLATURE

AIDS	Acquired Immunodeficiency Syndrome
ANOVA	Analysis of covariance
AUC	Area under the curve
B/CS	Bryan/College Station
CDC	Center for Disease Control
DDQ	Delay Discounting Questionnaire
HBRG	Health Behavior Research Group
HBV	Hepatitis B virus
HIV	Human immunodeficiency virus
HPV	Human papillomavirus
HSV-2	Herpes simplex virus-2
IDU	Injection Drug Use
KBIT-2	Kauffman Brief Intelligence Test- Second Edition
LGB	Lesbian, Gay, Bi-sexual
MANCOVA	Multivariate analysis of covariance
MRI	Magnetic resonance imaging
SDT	Sexual Discounting Task
STI	Sexually Transmitted Infections
TAMU	Texas A&M University
UPPS-P	UPPSP Impulsive Behavior Scale
US	United States (of America)

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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

Background

Adolescence is a developmental period integral to the prevention and detection of mental and behavioral health issues and is associated with increased involvement in health risk behaviors, including high risk sexual behavior and substance use, specifically the use of tobacco, alcohol, and illicit drugs (Diclemente, Santelli, Crosby & 2009; Floyd & Latimer, 2009). Specifically, incidence of youth being diagnosed with a Sexually Transmitted Infection (STI) has grown at an alarming rate over the past decade and has reached epidemic proportions. Prevalence estimates typically include only the eight most common STIs which are chlamydia, gonorrhea, hepatitis B virus (HBV), herpes simplex virus type 2 (HSV-2), human immunodeficiency virus (HIV), human papillomavirus (HPV), syphilis, and trichomoniasis and therefore are probably underestimates of the actual rates of STI diagnosis. Information regarding these rates is typically obtained via national surveys, nationally notifiable disease case reports, and data from special projects (CDC, 2011).

A unique set of factors interact to heighten STI vulnerability in youth (CDC, 2013). Such factors include: (1) insufficient screening - as many female youth do not receive comprehensive STI screenings which the CDC recommends, (2) confidentiality concerns - youth are reluctant to disclose risk behavior to their physicians although it may aid in preventative care, (3) biology - female youth are biologically more

susceptible to STIs because of the increased amount of immature ectopic tissue on the endocervix, (4) lack of access to healthcare - including limited clinic hours, lack of insurance and transportation barriers, and (5) multiple sex partners - adolescent sexuality has shifted to more permissive behavior including engaging in sexual behavior with multiple non-committed partners (CDC, 2011; McIllhaney, 2000; DiClemente, Salazar,
& Crosby, 2013).

Prevalence rates

The CDC estimates that there are roughly 19.7 million *new* STI diagnoses in the United States (US) each year, with HPV accounting for the bulk of these cases. Although, youth ages 15-24 comprise only 25% of the entire population and 27% of the sexually active population, they comprise roughly half (50%) of all new STI diagnoses (CDC, 2013). Of the new STI diagnoses, this age group accounts for 20% of syphilis, 26% of HIV, 45% of genital herpes, 49% of HPV, 63% of chlamydia, and 70% of gonorrhea cases. The CDC estimates more than 110 million people being diagnosed with STIs nationwide, with the majority of these diagnoses found in females (CDC, 2013). Of the 1.1 million persons living with HIV in the US in 2012, 6.7% were between the ages of 13-24; and 59.5% of these youth were unaware of their infection (Whitemore et al., 2012). Further, the long latency period before the development of clinical Acquired Immunodeficiency Syndrome (AIDS) suggests HIV/AIDS identified among people in their 30s was acquired during their teen years (Pandey, Dutt, Nair, Subramanyam, & Nagaraj, 2013), and this age group is the only age group to experience a rise in the rate of HIV infection. The direct medical costs of treating STIs places a significant economic strain on the US healthcare system; with treatment of the eight aforementioned, most common STIs costing an estimated $16 billion annually (CDC, 2011).

Although most STIs do not lead to mortality, many have the potential to cause serious health problems if not diagnosed and treated early (CDC, 2013). Sadly, many infections go undetected and undiagnosed because they are asymptomatic. In addition, female adolescents perceive themselves to be at little or no risk of ever being diagnosed with an STI, even when STI indicators may be present (Ethier, Kershaw, Niccolai, Lewis, & Ickovics, 2003). Unfortunately, it is women who face the most serious, long-term health consequences as a result of undiagnosed and untreated STIs, such as infertility, chronic pain, cervical cancer, and death (DiClemente, Salazar, & Crosby, 2012). Undiagnosed STIs cause 24,000 women to become infertile each year (CDC, 2013).

STI risk behavior

High risk sexual behavior contributing to unintended pregnancy and STIs, including HIV has become one of the leading public health concerns for adolescents in the US, with the CDC listing sexual risk taking as one of the six leading health-risk behaviors (CDC, 2015). High risk sexual behavior is defined here, as sexual behavior that increases the exposure to, and therefore, likelihood of an adolescent acquiring an STI. Such behaviors include early age of sexual initiation, condom use, number of sexual partners, and frequency of sexual encounters. Greater lifetime partners and higher frequency of sexual encounters include "one-night stands," engaging in sexual relations with a non-committed partner, and engaging in sexual behavior with concurrent partners. This is can be referred to as casual sex.

Earlier initiation for sexual intercourse is consistently associated with the likelihood of contracting an STI during adolescence (Kaestle, Halpern, Miller, & Ford, 2005; Coker et al., 1994). Early sexual initiation was found to be associated with greater frequency of sexual intercourse, increased number of sexual partners, lower contraception use, inconsistent condom use, and recent sexual intercourse under the influence of alcohol (Sandfort, Orr, Hirsch, & Santelli,

2008; Miller, Clark, & Moore, 1997; Santelli, Lowry, Brener, & Robin, 2000). Females, especially, who became sexually active between the ages of 10 and 14 years had four times higher the odds of having five or more sexual partners in the past year and three times higher the odds of having sex with bisexual, intravenous drug-using, or HIV-infected men, and twice the higher odds of reporting a history of STIs within the last five years (Greenberg, Magder, & Aral, 1992; Forhan et al., 2009). Regardless of gender, condom use at sexual initiation was found to be habit forming, such that adolescents who used condoms at sexual initiation had a twofold increase in likelihood of condom use during most recent sex, and was additionally associated with a 50% decrease in the likelihood of testing positive for chlamydia or gonorrhea (Shafii, Stovel, Davis, & Holmes, 2004).

Understanding the effectiveness of condoms has become so paramount that, in 2000, the US National Institutes of Health (NIH) organized a review of the scientific evidence on the effectiveness of condoms in preventing STIs (Holmes, Levine, & Weaver, 2004). This examination concluded that consistent condom use was effective in protecting against the transmission of HIV in both men and women, and in reducing the risk of men becoming infected with gonorrhea (Davis & Weller, 1999; Holmes, Levine, & Weaver, 2004). Condoms are 90-95% effective when used consistently, such that consistent condom users were found to be 10 to 20 times less likely to become infected with HIV when exposed to the virus compared to inconsistent and non-condom users (Pinkerton & Abramson, 1997). A later systematic review of epidemiological studies revealed that using a condom reduced the risk of other types of infections, including chlamydial infection, gonorrhea, HSV-2, and syphilis in both men and women (Holmes, Levine, & Weaver, 2004; Warner, Stone, Maculuso, Buehler, & Austin, 2006). More recent studies have also demonstrated that consistent condom use appears to reduce the likelihood of contracting cervical and vulvovaginal HPV, as well (Winer et al., 2006). Females appear to report more

benefits to condom use and costs of unprotected sex (Parsons, Halkitis, Bimbi, & Borkowski, 2000).

Number of lifetime partners is also integral to understanding STI risk. A greater number of sexual partners during adolescence increases the opportunity to engage in sexual behavior with a partner who is infected with and may transmit an STI (Finer, Darroch, & Singh, 1999). These partnerships may be monogamous but sequential or casual (e.g., one night stands, non-committed partners). As mentioned previously, roughly 35% of adolescents report greater sexual encounters with overlapping and concurrent partners (Kelley, Borawski, Flocke, & Keen, 2003). Such encounters are associated with lower condom use, higher regret of having sex related to alcohol use, lower self-efficacy for using contraceptives and the likelihood of reporting having an STI (Kelley, Borawski, Flocke, & Keen, 2003). Unfortunately, only a minority of individuals whose partners had other partners were aware of this, and this was independently associated with STI risk (Drumright, Gorbach, & Holmes, 2004).

It is often assumed that those who have a large number of sexual partners are the only individuals central to the transmission and acquisition of STIs. However, individuals who have a large number of sexual encounters per partner and have several, but not necessarily a large number of partners, are also at risk for STIs (Nordvik & Liljeros, 2006). This concept is best defined by sexual networks, which refers to groups of people who can be considered "sexually linked" by sequential or concurrent sexual partners (Healthy People 2020, 2013). Though an adolescent may only have had sexual encounters with one sexual partner or a brief encounter with one sexual partner, if that partner is a member of a risky sexual network, the adolescent is at higher risk for STI acquisition (Healthy People 2020, 2013). Further suggesting that sexual interactions, especially greater sexual encounters, with a social partner, are more likely to result in infection compared to an interaction with a non-social partner (Youm & Laumann, 2002).

Drug use and STI risk behavior

Ample research has articulated the association between drug use and STI risk behavior in the acquisition and transmission of STIs (Fortenberry, 1995). As adolescents age, longitudinal analyses suggest that adolescent drug use significantly predicts sexual risk during emerging adulthood (Guo, Hill, Hawkins, Catalano & Abbott., 2002). Generally, adolescent drug users are more likely to be sexually active than non-users and to choose sexual activity versus abstinence (Floyd & Latimer, 2010; Malow, Dévieux, Jennings, Lucenko, & Kalichman, 2001). Lifetime drug use and age of initiation for drug use were associated with earlier sexual initiation, greater number of lifetime partners, and failure to use a condom (Rosenbaum & Kandel, 1990; Castilla, Barrio, Belza, & de la Fuente, 1999; Santelli, Robin, Brener, & Lowry, 2001).

Nearly a quarter (22.1%) of sexually active adolescents report using drugs prior to engaging in sexual intercourse (CDC, 2015). Unplanned sexual intercourse under the influence of drugs was found to be an independent risk factor for inconsistent condom use and multiple sexual partners (Poulin & Graham, 2001; Hingson, Strunin, Berlin, & Heeren, 1990). Recent drug use and use of drugs at last sexual intercourse were associated with greater number of sexual partners within the past three months (Santelli, Robin, Brener, & Lowry, 2001). Specifically, the adjusted proportion of youth who recently had multiple partners rose as the number of drug-related behaviors increased (Santelli, Brener, Lowry, Bhatt, & Zabin, 1998).

When examining severity, the number of sexual partners steadily increased as drug use intensified from non-use to experimental use to consistent use across all drugs tested for both males and females (Cavazos-Rehg et al., 2011). Related to this finding, adolescents in clinical treatment centers had more sexual partners, used condoms inconsistently, had higher rates of HIV testing, and had more STI diagnoses than sociodemographically comparable, non-abusing

community youth (Tapert, Aarons, Sedlar, & Brown, 2001). The highest rate of STIs was found in drug using, female adolescents (Tapert, Aarons, Sedlar, & Brown, 2001).

Neuro-cognitive factors

Behavioral Choice Theory suggests that drug use and sexual behavior itself can be reinforcing, but even under the best circumstances, there is a delay before an adolescent will see negative consequences, such as the contraction of an STI. And perceived benefits of sexual behavior (e.g., pleasure, pleasing partner) appear to be better determinants of STI risk behavior than perceived costs of healthy behavior (i.e., not contracting an STI; Parsons, Halkitis, Bimbi, & Borkowski, 2000). These findings have been linked to the neurological development of adolescents.

Magnetic resonance imaging (MRI) studies have revealed that the adolescent brain undergoes both progressive and regressive changes (Crews, He, & Hodge, 2007). An inverted U-shape change in gray matter volume occurs in which a pre-adolescent increase is followed by a post-adolescents decrease (Giedd et al., 1999; Giedd, 2004). Changes in gray matter results in an overproduction of axons and synapses during early puberty and rapid pruning in late adolescence (Andersen et al., 2000; Andersen & Teicher, 2004; Giedd et al., 1999). This is paralleled by a remodeling of the dopaminergic system within the socio-emotional network, which this change being more pronounced in males (Steinberg, 2008). Although these changes provide a unique biological basis for neurogenesis and cortical synaptic remodeling needed for adult maturation; this remodeling also makes adolescents more vulnerable to behavioral characteristics including high risk-taking, sensation seeking and high activity (Crews, He, & Hodge, 2006). This affects adolescent reasoning, goal and priority setting, impulse control and the evaluation of long and short term goals (Crews, He, & Hodge, 2006). It is important to note that although previous research has attempted to link hormonal changes to risk behavior, this research has no be fruitful

and research has demonstrated that hormones, even with regard to hormonally driven behavior such as sex, only affect these behaviors under the right context (Steinberg, 2008).

Further this results in differential brain maturation in which the reward sensitivity system, and not the cognitive control system, is more strongly influenced by the hormonal changes of puberty (Smith, Chein, Steinberg, 2013). As a result, situations of intense arousal or affect (e.g., sexual behavior) may act as a trigger that activates the hypersensitive reward processing system, while the cognitive control system is still immature. Consequently, adolescents have higher levels of approach behavior with a lesser inclination towards harm avoidance, which results in poor decision making (e.g., having unprotected sex; Cauffman et al., 2010; van Duijvenvoorde, Jansen, Visser, & Huizenga, 2010). Therefore, adolescents may be subject to a weaker orientation towards the future, have a tendency to make more impulsive, rash decisions, and are unable to inhibit unwanted or impulsive behavior when experiencing emotionally arousing stimuli (Steinberg et al., 2009; Furby & Beyth-Marom, 1992; Nurmi, 1991; Greene, 1986; Smith, Chein, Steinberg, 2013).

These changes render adolescents more vulnerable to the influences of environmental factors such as drug use. Drug use has been shown to effect executive functioning processes in a way that increases impulsivity (Crews & Boettiger, 2009). The high proportion of drug abusers who are positive for STIs may reflect an underlying dysfunction in neuro-cognitive processes that may be common to drug use as well as the acquisition of STIs (i.e., sexual risk behavior). For example, chronic alcohol use results in cortical degeneration, with adolescents especially sensitive to alcohol induced neuro-toxicity. This degeneration can alter perceptions, planning ability, and evaluation of rewards and risk (i.e., greater impulsivity; Crews & Boettiger, 2009). Given that the adolescent brain is still developing and sensitive to drug related neuro-toxicity, the additional effects of drug use can result in an extreme bias in executive functioning processes towards other

risk behavior, including high risk sexual behavior, indirectly increasing the likelihood of acquiring an STI.

Delay discounting

Delay discounting refers to the tendency of a reward presented after a delay to be perceived as less valuable, or discounted (Reynolds, Penfold, Patak, 2008). The association between delay discounting and drug use has been consistently demonstrated in adolescents (Field, Christiansen, Cole, & Goudie, 2007; Reynolds & Fields, 2012; Stanger et al., 2012, 2013). Moreover, a study of drug use status found differences in discounting among types of users such that adolescents smokers displayed greater discounting than non-smokers and triers discounted more than non-smokers, but smokers and triers did not significantly differ in discounting (Reynolds & Fields, 2012).

Recent research, albeit limited, has moved towards domain or commodity specific delay discounting, such as sexual discounting and has suggested that the discounting of sexual outcomes represents an important behavioral process that underlies sexual risk behavior (Dariotis & Johnson, 2015; Johnson & Bruner, 2012; Lawyer and Schoepflin, 2013). Further, the discounting of a sexual commodity has been found to be more pronounced than monetary discounting (Jarmolowicz, Bickel, & Gatchalian, 2013; Jarmolowicz et al., 2014; Lawyer and Schoepflin, 2013). Sexual discounting refers to the devaluation of a delayed sexual commodity for immediate gratification (e.g., less sexual acts versus a greater number of sexual acts or unprotected sex versus access to a condom).

Emerging adults were found to discount delayed access to longer durations of erotic film and longer durations of sexual activity (Lawyer, 2008; Lawyer, Williams, Prihodova, Rollins, & Lester, 2010). Individuals were also found to discount having sex with a desired partner at a delayed time for sex with a less desirable partner sooner (Jarmolowicz, Lemley, Asmussen, &

Reed, 2015). Males have also consistently demonstrated a higher rate of sexual discounting than females (Dariotis & Johnson, 2015; Johnson & Bruner, 2012; Jarmolowicz, Lemley, Asmussen, & Reed, 2015).

Drug users were found to discount delayed sexual rewards and at higher rate than money (Jarmolowicz et al., 2014; Johnson & Bruner, 2012). Female drug users, particularly, discounted sexual commodities more than non-drug using counterparts (Herrmann, Hand, Johnson, Badger, & Heil, 2014). When examining the discounting of delayed sexual behavior across drug use status, it was determined that drug-dependent individuals discount sexual rewards more significantly than non-dependent controls (Herrmann et al., 2014; Jarmolowicz, Bickel, & Gatchalian, 2013; Koffarnus et al., 2015). Thus, similar to previous studies, rather than examine delay discounting via a monetary commodity only, it may be informative to examine drug use within the context of a more salient domain specific or relatable commodity such a sexual behavior in youth.

Only three studies to date have examined the association between sexual discounting and STI risk (Dariotis & Johnson, 2015; Herrmann, Hand, Johnson, Badger, & Heil, 2014; Johnson & Bruner, 2012). These studies utilized a novel task called the Sexual Discounting Task (SDT) which framed delay discounting or decision making within the clinical context of HIV sexual risk behavior. This task requires participants to decide between sexual activities with and without a condom (i.e., immediate sex without a condom vs. delayed sex with a condom). An initial validation study demonstrated that the task showed sensitivity to factors that may influence real world decisions (e.g., partner desirability and perception of disease risk; Johnson & Bruner, 2012). Unfortunately, none of these studies examined sexual discounting exclusively in youth, which may shed valuable insight into the epidemic plaguing this group.

Present study

Research investigating delay discounting and STI risk in youth is limited. The present paper addresses several gaps in the literature. Previous research has examined sexual discounting in adults with regard to STI risk behavior, but no studies to date have included adolescents. Further no prior research has explored drug use status in the progression of STI risk. Finally, although sexual discounting appears important in understanding STI risk in youth, no study to date has examined its relationship to both drug use and sexual risk behavior. The objectives of the dissertation are:

1 Assess the validity of the SDT task in a sample of youth
2 Explore the association between discounting and STI risk behavior
3 Examine gender and discounting differences across drug use status
4 Determine if sexual discounting mediates the relationship between drug use and sexual risk behavior

Our hypotheses are as follows:

H_1 The SDT will be a valid assessment of sexual discounting in youth
H_2 Sexual discounting will have robust associations with STI risk behavior, especially in females
H_3 Gender and discounting differences will be found across drug use status, with males and drug users discounting the most
H_4 Sexual discounting will mediate the relationship between drug use and sexual risk behavior

CHAPTER II

MATERIALS AND METHODS

Participants

Participants consisted of youth (n = 155) who received either (1) monetary compensation between $25 and $35, with the specific amount earned dependent on task performance (n = 28) or (2) course credit for their participation (n = 127). The two groups did not differ by gender, age, or romantic status but did significantly differ by ethnicity. Tasks performed for monetary compensation included the Delay Discounting Questionnaire (DDQ; see *Measures* below) and tasks not immediately relevant to the present study. Slightly more than half of the participants were female (n = 96, 61.94%). The majority of participants reported a Euro-American ethnicity (n = 105, 67.74%), while others reported African-American (n = 9; 5.81%), Asian (n = 5; 3.22%), Hispanic (n = 26; 16.77%), and Other/Bi-racial (n =10; 6.45%) ethnicities (see Table 1). Youth were between the ages 14-21 years (m_{age} = 19.36, *S.D.* = 1.39). The present study considers adolescence to include those up to age 21 to remain consistent with The Council on Child and Adolescent Health (1988) who issued a statement defining the age limits of pediatrics to include commitments prior to birth until the developmental process is completed, which was delegated to be age 21.

Measures

Demographics. The following demographics were gathered from those meeting inclusion criteria: age, gender, sexual orientation, current romantic status, and ethnicity. Participants identified as either male or female. Response choices for sexual orientation included heterosexual, homosexual, bi-sexual or other. Participants also identified their romantic status as single- not seeking a partner, dating casually, in a monogamous relationship, engaged, married, or divorced.

Participants were asked to self-identify their ethnic origin. Ethnicity included the following categories: White, Black or African American, American Indian or Alaskan Native, Middle Eastern, Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Other Asian, Native Hawaiian, Guamanian or Chamorro, Samoan, Other Pacific Islander, Mexican or Mexican American, Puerto Rican, Cuban, Other Spanish/Hispanic/Latino as listed in the 2000 U.S. Census. Other, Unknown, Refused, and "mixed race" answer choices were also provided. Ethnicity was then recoded into four broad groups: African American, Asian, Euro-American, Hispanic and Other for statistical analysis.

Sexual Discounting Task (SDT). (SDT) In this computerized task, delay discounting for sexual rewards was assessed in reference to specific photographed hypothetical sexual partners whom the participant would be willing to have casual sex with based on physical appearance alone (*modified from* Johnson & Bruner, 2012). This task assesses decisions "between immediate unprotected sex and delayed sex with a condom" across various parameters. Parameters include a real world scenario with inclusion of risk to obtain a sexually transmitted infection (STI) and to become pregnant, a STI only parameter, and a pregnancy only parameter. Participants rate the likelihood of using a condom (0%-100%) given varying delays (i.e., no delay, 1 hour, 3 hours, 6 hours, 24 hours) with a most and least attractive person in mind, as well as a person most and least likely to have an STI. A 0-100 certainty scale instead of a 0-10 scale similar to that of the DDQ procedure was used due to ease of interpretation by participants and saliency with "certainty" (i.e., "I am 100% certain I will use a condom"). The participant chooses these persons from a group of 100 pictures (50 male and 50 female) of individuals with varying genders, ethnicities, weight and other physical attributes. The authors gauged sexual interest not only through participants' romantic status but also through the number of photographs selected. A mean of 13.14 (*S.D.* = 9.53, range = 1-43) photographs were selected. Participants could select as few or as many

photographs of their choice, meaning that they could have chosen 0 photographs; however none did so, reflecting some degree of sexual interest. Parameters and hypothetical partner selections were randomized between subjects. Hyperbolic curves are plotted with likelihood of using a condom against delay of obtaining a condom, to calculate area under the curve (AUC).

Delay Discounting Questionnaire (DDQ). (DDQ; Richards, Zhang, Mitchell, & de Wit, 1999; Madden, Petry, Badger, & Bickel, 1997). The delay discounting questionnaire requires individuals to decide between delayed or immediate monies. The computerized task presents participants with choices between $10 available after a specified delay (1,2,30,180, or 365 days) and a smaller amount available immediately (i.e., 'would you rather have $10 in 30 days or $2 now?'). The $10 hypothetical quantity was used rather than $100 or $1000 to remain consistent with prior adolescent studies that have employed this task and found differences in drug use status (*see* Reynolds, Penfold, & Patak, 2008; Reynolds & Fields, 2012). Smaller amounts chosen immediately represent greater discounting by delay. This computerized task uses an adjusting amount procedure to derive indifference values. Indifference values were used to calculate discounting curves and analyzed with an area under the curve (AUC) method (Myerson, Green, & Warusawitharana, 2001), with smaller area values indicating greater monetary discounting. Area values were used to characterize discounting data, as opposed to a hyperbolic decay function (see Green & Myerson, 2004), because area analyses avoid certain systematic errors that often result from hyperbolic functions (see Myerson, Green & Warusawitharana, 2001). Those participants earning monetary compensation for their participation were told that their answers to this task were important because upon task completion one question would be randomly selected and their answer honored (*see* Reynolds, Karracker, Horn, & Richards, 2003 for participant instructions) -- resulting in either immediate or delayed monies. Participants earned between $0 and $10 from this task. Although some participants received a hypothetical commodity -- previous research has

demonstrated that with a monetary commodity, hypothetical versus real rewards demonstrated similar results (Johnson & Bickel, 2002; Baker, Johnson, & Bickel, 2003; Johnson et al., 2007; Lagorio & Madden, 2005; Madden et al., 2003, 2004) as well as neurobiological responses (Bickel et al., 2009).

UPPS-P Behavior Scale. The UPPS-P is designed to assess impulsivity, including decision making across the dimensions of the Five Factor Model of personality (Whiteside & Lynam, 2001; Lynam, Smith, Cyders, Fischer, & Whiteside, 2007). In prior studies positive affect was shown to be related to thoughts of sexual intercourse in adolescents (Shrier, Shih, & Beardslee, 2005). And, in a sample of adolescent offenders there was an association between negative affect, greater number of sexual partners and ever having unprotected sex thereby increasing their susceptibility to STIs (Lucenko et al., 2008; Mezzich et al., 1997). Negative affective decision making was calculated using the n*egative urgency* subscale which queried the tendency to experience strong impulses under conditions of negative affect while positive decision making was derived from the p*ositive urgency* subscale which queried the tendency toward rash action in response to a very positive mood. In addition, *lack of premeditation* (the tendency to fail to think and reflect on the consequences of an act before engaging in the act; 11 items) was also utilized. The scoring system consists of a 4-point Likert scale, with 1 representing "agree strongly" and 4 representing "disagree strongly." Greater cumulative scores reflected poor affective decision making.

Sexual History Questionnaire. An author constructed measure was used to gather sexual risk information. The measure was computer administered to enhance the privacy of participant responses. The SHQ queries sexual risk information including age of sexual initiation, number of lifetime partners, condom use frequency, ever having unprotected sexual contact, use of drugs before sex, ever being tested for an STI, and beliefs regarding casual sex. Responses obtained on

these items were totaled to create a *STI risk composite score,* in which the higher the composite score the greater the STI risk. This value was used for mediation analyses.

Response choices for *age of sexual initiation* included “Not Applicable” and varying ages (i.e., 8 years old or younger, 12, 13,…, 24) and were queried with regard to kissing, French kissing, touch breasts, touch penis, touch vagina, oral sex, sexual intercourse anal sex, and sexting. *Condom use frequency* during oral, vaginal and anal sex was assessed via a 5 point frequency scale ranging from “never”, “rarely”, “sometimes”, “frequently”, to “always.” *Ever had unprotected* oral, vaginal or anal sex included the responses, "Yes," "No" and "Never engaged." However, the response "Never engaged" was recoded to “No”. *Number of lifetime* oral, vaginal and anal sex partners were queried using free response format in which participants reported a number inputted into a text box. Questions regarding casual sex reflected a willingness or past engagement in sexual behavior with a recently-met partner, engaging in sexual behavior with a non-committed partner, and engaging in sexual behavior with multiple partners concurrently. Sexual behavior queried within casual sex questions referenced oral, vaginal and anal sex. These questions in addition to the question assessing the *use of drugs before sex,* and *ever being tested* included the dichotomous response choice of “Yes” or “No."

A total of 29 high risk behaviors were assessed. The engagement in these sexual risk behaviors, except for the initiation of sexting and use of drugs before sex which was only completed by a subset of participants, was used to calculate a STI risk behavior composite score; with higher scores reflecting greater engagement in risk behavior.

Drug Use History Questionnaire. An author constructed measure was used to gather information on the three most commonly used drugs in youth: alcohol, cigarette and marijuana use (e.g., age of initiation and frequency of use in the past six months). The present study chose to focus on the three most common drugs used and abused by youth. Frequency of use was measured

using a six point frequency scale, ranging from "never," “tried it,” “1-2x a month,” “1x a week,” “2-4x a week,” and “5x or more a week.” Alcohol use was re-coded to be consistent with standards published by the National Institute on Alcohol Abuse and Alcoholism (NIAA; Dafour, 1999) to abstainers (i.e., never used and tried alcohol), light drinkers (i.e., drinking once to twice per monthor1 drink per week), and moderate drinkers (i.e., drinking 2-4 times per week or greater than 5 times week). However, it should be noted that these guidelines were based on adult alcohol consumption and not youth – thus these categories are likely underestimates of alcohol status in youth. Cigarette and marijuana use status were modeled after Reynolds and Fields (2012) to include non-users (i.e., never smoked), triers (i.e., reported an age of onset but not subsequent use), and users (i.e., use of cigarettes and/or marijuana at least once per month).

Procedure

Participants were recruited using fliers distributed throughout the community and through undergraduate psychology courses. After recruiting from the university, recruitment was expanded to the community to include more adolescents under age 18. To add, study recruitment oversampled for drug users. Interested persons either signed up for the study using an online platform maintained by the university which provided study details or voluntarily called the study hotline to be provided with a brief description of the study and screened for exclusion. Participants were excluded if they were not between the ages of 14-21 or were taking ADHD medication. The exclusion criteria were imposed because the present study was focused on adolescents and the medications used in the treatment of ADHD have been shown to reduce impulsive behavior as measured by the behavioral assessments included in the study (Tannock, Schachar, Carr, Chajczyk, & Logan, 1989 Participants meeting inclusion, or anyone under the age of 21 not currently on ADHD medication, were invited to the laboratory where they were consented using

previously approved documents by the Institutional Review Board, and participated in the testing session.

Once consented, participants completed the provided demographic information, completed the sexual history and drug use measure, the SDT, DDQ, and the UPPS-P. Participants were also administered the Kauffman Brief Intelligence Test, Second Edition (K-BIT 2). The K-BIT 2 contains three sections- verbal, mathematics, and riddles and takes approximately 30 minutes for completion. The present study is cross-sectional and all assessments were administered in one session. In addition, task order was randomized for individual participants, to limit interference of task order on results. Total time for completing the study was about 90 minutes.

After completing the tasks, participants were compensated for their participation and received course credit or between $25 and $35, the specific amount to be determined by task performance. Participants recruited via psychology courses were then provided course credit for their time, whereas those recruited via the community were provided monetary compensation. Any delayed monies earned with the delay-discounting task (i.e., to be received in days, weeks or months) was mailed to the participant at the time of the specified delay. All participants chose to complete the study after invitation.

Analytical approach

Data orderliness. To assess orderliness of monetary discounting data, the Johnson and Bickel (2008) algorithm was used. This algorithm has been successfully utilized across a multitude of studies because it provides an objective metric of delay discounting data orderliness (Dariotis & Johnson, 2015; Lawyer, Williams, Prihodova, Rollins, & Lester, 2010; Rasmussen, Lawyer, & Reilly, 2010). Discounting functions were identified as nonsystematic if any delay rating was at least 0.2 greater than the delay rating preceding it or if the last indifference point is not 0.1 less than the first. To assess he orderliness of sexual discounting data the Johnson & Bruner (2012)

algorithm was used which identified any discounting functions as non-systematic only if any delay rating was a least 0.2 greater than the delay rating preceding it. Raw data from the Premeditation scale of the UPPS-P were $\log_{10}$ transformed to correct for skew and kurtosis (i.e., Fisher's skew statistics with absolute values >2).

SDT validation. Data analyses were conducted with SPSS 17.0. For the validation of the SDT raw delay-discounting, data consisted of 6 sets of indifference points (1 monetary discounting and 5 sexual discounting). Indifference points were defined as a proportion of the larger, later reward for money discounting and as the likelihood of using a condom at each delay. AUC was determined for each set of indifference points using a previously described method (Reynolds, Penfold, & Patak, 2008). Paired *t*-tests were conducted to compare group mean AUC of sexual discounting between the "most want to have sex with" and "least want to have sex with" conditions, and between the "most likely to have an STI" and "least likely to have an STI" conditions. Paired *t*-tests were also used to compare the relative value of condom use when one was immediately available (0-delay trial) between the two pairs of conditions as an index of the reinforcing value of condom use when no delay was involved. The analysis of SDT data described above possibly allows for differences in condom use regardless of delay (i.e., relative reinforcing efficacy of condom use) across individuals to drive results, rather than the effects of delay on condom use (delay discounting) *per se*. To address this concern, SDT data were also analyzed after indifference points were normalized relative to the reported likelihood of using a condom when one was immediately available (i.e., delay value were divided by the 0-delay trial). The number of photos selected, zero-delay time condition, and raw and normalized AUCs for the four SDT conditions were tested for gender differences.

The association between discounting and STI risk behaviors. Bivariate associations with gender, age, romantic status, ethnicity and STI risk behaviors were done by conducting a

Pearson's product-moment *r*-test to determine which demographic variables should be included as covariates in the partial correlation and mediation analyses. The covariates included are listed in the respective data analytic sections. A partial correlation was conducted to determine the relationship between discounting and STI risk behavior. Age, gender, ethnicity, and romantic status were included as covariates in these analyses, except when analyzed by gender.

Group differences. To compare participant demographics data across gender and drug use status a one-way analysis of variance (ANOVA) was used for continuous variables and a chi-squared test was used for dichotomous variables. A chi-square test of independence was performed to examine the relation between gender and drug use status as well as to examine the relation between both gender and drug use status with the following STI risk behavior: frequency of condom use, ever having unprotected sexual behavior, use of drugs before sex, casual sex, and ever been tested. A univariate analysis of variance (ANOVA) was used to determine the differences in monetary across drug use status. A multivariate analysis of covariance (MANCOVA) was used to determine differences in discounting and STI risk behaviors -- sexual initiation, lifetime sexual partners, and number of photographs selected in the SDT task -- across gender and/or drug use status. To test the simple effects of drug use status a Tukey's post-hoc analyses were conducted. Age and gender were included as covariates when examining differences across drug use status, and romantic status was included as a covariate when examining differences across gender.

Mediation analyses. Mediation analyses were conducted using the four step approach outlined in Baron and Kenny (1986) to understand the relational dynamics of sexual discounting and HIV risk behavior. Regressions conducted within the mediation model included drug use frequency, sexual discounting and the STI risk behavior composite score. Romantic status was included as a covariate because it was associated with the sexual risk composite. To test the

mediation model (Figure 1), ordered regressions were used to test a, b, ab, c, and c´ pathways. Mediation occurred if the effect of the "c" pathway decreased in the "c´" pathway. Models were run for alcohol, cigarette and marijuana status use.

The “a” pathway represented non-standardized beta from the OLS regression of drug use on the proposed mediator: sexual discounting. The “b” pathway represented the ordered regression of the mediator, sexual discounting, on the dependent variable, STI risk behavior. The “c” pathway represents the ordered regression of the drug use on STI risk behavior without the sexual discounting in the model. The “c′” pathway represents the ordered logistic regression of drug use on STI risk behavior with the effects of sexual discounting controlled. The “c′” pathway is also called the direct effect of drug use on STI risk behavior as it represents the effects of drug use on sexual risk behavior independent of sexual discounting. To test the significance of the indirect effect of drug use on STI risk behavior via sexual discounting, Preacher and Hayes (2004) SPSS INDIRECT bootstrapping macro was used. Indirect effects do not meet statistical assumptions for normality, thus bootstrapping was used to estimate the significance of the indirect effect. Corrected confidence intervals were computed using 5,000 bootstrapped re-samples for each indirect point estimate. Confidence intervals not containing zero indicate a significant indirect effect. Models were run for alcohol, cigarettes and marijuana.

CHAPTER III

RESULTS

Descriptive data

With regard to orderliness of data, 26 (4.2%) of the sexual discounting functions and 16 (0.3%) of all monetary discounting functions were found to be non-systematic. However in 28 cases only a single data point of the five indifference points was aberrant. To determine internal consistency for discounting responses, a Cronbach's α was calculated for the DDQ, the SDT, the UPPS-P which were found to be within the acceptable range (α = 0.82 - 0.98). In addition, the means and standard deviations of these tasks were comparable to similar samples (Fields, Sabet, & Reynolds, 2013; Dariotis & Johnson, 2015). Data were also examined for normality of distribution and to determine if regression analyses could be conducted. To determine a linear relationship, the authors used a scatter plot and calculated Mahalanobis distance to detect any outliers, for which none were found. Skewness (-0.68 - 0.30) and kurtosis (-1.22 - -1.07) values were also calculated. All values were in the acceptable range. Multicollinearity between gender and sexual discounting (r = 0.33, p < 0.001), but not monetary discounting (r = -0.05, p = 0.52) was found. Means and standard deviations are presented in Table 2.

Validation of the Sexual Discounting Task

Figure 2 shows SDT group mean data for the four partner conditions. Individual sexual discounting functions were typically monotonically decreasing or flat (i.e., little or no change across delays). The “least want to have sex with” condition had greater AUC (M = 8.46, $S.D.$ = 2.93) than the “most want to have sex with” condition [M = 7.59, $S.D.$ = 3.38, t(155) = -4.55, p < 0.001]. Similarly, the “most likely to have an STI” condition had greater AUC (M = 9.13, $S.D.$ =

2.21; i.e., had a greater likelihood of waiting until a condom was available) than the "least likely to have an STI" condition [M = 6.46, $S.D.$ = 3.96), $t(155) = 9.69$, $p < 0.001$].

There were significant differences found between conditions for condom use when delay was not involved (in the 0-delay trial). Participants rated that they would be more likely to use a condom for the person they deemed "least likely to have sex with" (M = 94.25, $S.D.$ = 19.42) suggested participants are more likely to use a condom if one is readily available than with the person they "most want to have sex with;" however this was not significantly different [M = 91.46, $S.D.$ = 22.15; $t(155) = -1.83$, $p = 0.07$]. Participants also rated that they would be much more likely to use a condom for the person they deemed "most likely to have an STI" (M = 96.05, $S.D.$ = 16.12) than the person they rated "least likely to have an STI" [M = 78.57, $S.D.$ = 36.47); $t(155) = 6.78$, $p < 0.001$].

Figure 3 shows group mean data for the SDT that were normalized relative to likelihood of using a condom in the 0-delay trial. Participants had significantly greater AUC in the "least want to have sex with" condition (M = 8.36, $S.D.$ = 3.08) than the "most want to have sex with" condition [M = 7.74, $S.D.$ = 3.35); ($t(155) = -2.93$, $p = 0.004$]. Participants also had significantly greater AUC in the "most likely to have an STI" condition (M = 9.22, $S.D.$ = 2.09) than the "least likely to have an STI" condition [(M = 6.95, $S.D.$ = 3.86); $t(155) = 8.45$, $p < 0.01$)]. Table 2 shows various Pearson correlation results among AUC (non-normalized) for the SDT partner conditions, number of photographs selected, and money discounting. A mean of 13.14 ($S.D.$ = 9.53, range = 1-43) photographs were selected. The number of photographs selected was not associated with any of the SDT partner conditions. Delay discounting AUC for Money (M = 0.49, $S.D.$ = 0.27) was not associated with AUC in any of the SDT conditions or number of photographs selected (Table 2) and was limited in its association with STI risk behavior (Table 3). Number of

photographs selected was not significantly associated with self-reported number of lifetime sexual partners.

Re-analyzing the SDT correlations using AUC values based on normalized indifference points did not alter the correlation direction in any case, and altered whether significance was reached in only four of the 124 cases: (1) the correlation between “least want to have sex with” AUC and ever having unprotected vaginal sex ($p = 0.02$ to 0.06), (2) the correlation between “least likely to have an STI” AUC and ever being tested for an STI ($p = 0.04$ to 0.16), (3-4) “least likely to have an STI” AUC and a willingness to or past engagement in oral sex ($p = 0.04$ to 0.07) with a recently met partner (Table 4).

A relation between gender and number of photographs was found as well X^2 (2, $N = 155$) = 94.59, $p < 0.01$, zero-delay time for "least likely to have an STI" ($F_{(1,152)} = 16.65$, $p < 0.01$), raw AUC for "most want to have sex with" ($F_{(1, 152)} = 9.51$, $p < 0.01$) , and "least likely to have an STI" ($F_{(1, 151)} = 19.41$, $p < 0.01$). Additionally, the difference between genders for "least want to have sex with" ($F_{(1, 152)} = 3.68$, $p = 0.06$) and “most likely to have an STI” ($F_{(1, 152)} = 3.62$, $p = 0.06$) approached significance. Gender differences also emerged for the following SDT normalized conditions: the "most want to have sex with" ($F_{(1,152)} = 6.83$, $p = 0.01$) and "least likely to have an STI" ($F_{(1,152)} = 15.17$, $p < 0.01$). Males consistently across conditions discounted a sexual commodity more than females. Unlike sexual discounting differences in monetary discounting, negative and positive affective decision making and premeditation across gender differences were not observed.

Association between discounting and STI risk

"Most want to have sex with" condition. Sexual discounting within the "most want to have sex with" condition was significantly associated with overall STI risk behavior ($r(148) = -0.21$, $p = 0.01$), such that greater discounting was associated to more sexual risk taking. Greater

AUC or less sexual discounting, was also positively associated with frequency of condom use when engaging in vaginal sex ($r(148) = 0.30$, $p < 0.01$), as well as ever having unprotected vaginal sex ($r(148) = 0.37$, $p < 0.01$). Lifetime number of oral sex ($r(148) = -0.24$) and vaginal sex ($r(148) = -0.27$) partners were significantly ($p < 0.01$) and negatively associated with sexual discounting. Greater sexual discounting was also significantly associated with a willingness or past history of engaging in vaginal sex($r(148) = 0.20$, $p = 0.02$) and anal sex ($r(148) = -0.17$, $p = 0.03$) with a recently met partner. Sexual discounting was also positively and significantly ($p < 0.05$) associated with a willingness or past engagement in oral and vaginal sex with a partner one was not in a relationship with ($r(148) = 0.20, 0.22$), as well as multiple partners in the same day or week ($r(148) = 0.19, 0.35$). See Table 3.

Analysis by gender revealed that greater sexual discounting was associated with higher engagement in STI risk ($r(90) = 0.40$, $p < 0.01$) , decreased frequency of condom use during vaginal sex ($r(90) = 0.37$, $p < 0.01$), ever having unprotected vaginal sex ($r(90) = 0.36$, $p < 0.01$), a greater number of lifetime oral sex ($r(90) = -0.32$, $p < 0.01$) and vaginal sex ($r(90) = -0.31$, $p < 0.01$) partners for females. Further, female sexual discounting was associated with a willingness or past engagement in vaginal sex with a recently met partner ($r(90) = 0.22$, $p = 0.04$), oral sex ($r(90) = 0.33$, $p < 0.01$), vaginal sex ($r(90) = 0.24$, $p = 0.02$) and anal sex ($r(90) = 0.31$, $p < 0.01$) with a non-committed partner, as well as vaginal sex with multiple partners in the same day or week ($r(90) = 0.33$, $p < 0.01$).

When examining males, sexual discounting was associated with ever having unprotected vaginal sex ($r(54) = 0.40$, $p < 0.01$) and a willingness to or past engagement in vaginal sex with multiple partners in the same day or week ($r(54) = 0.34$, $p = 0.01$).

"Least want to have sex with" condition. When observing sexual discounting within the “least want to have sex with” condition, it was found to significantly ($p < 0.05$) and positively

correlate with frequency of condom use during vaginal sex ($r(148) = 0.26$, $p < 0.01$) and ever having unprotected vaginal sex ($r(148) = 0.19$, $p = 0.02$; Table 3). For female participants, sexual discounting within this condition was associated to decreased frequency of condom use during vaginal sex ($r(90) = 0.28$, $p = 0.01$), ever having unprotected vaginal sex ($r(90) = 0.21$, $p = 0.04$), and greater lifetime oral sex partners ($r(90) = -0.30$, $p < 0.01$). For females the association between sexual discounting in this condition and a willingness to or past engagement in oral sex with a recently met partner approached significance ($r(90) = 0.20$, $p = 0.05$). For male participants, sexual discounting within this condition was associated with a decreased frequency of a condom use during vaginal sex ($r(54) = 0.35$, $p = 0.007$) and a willingness to or past engagement in vaginal sex ($r(54) = 0.226$, $p = 0.044$) with multiple partners in the same day or week.

"Most likely to have an STI" condition. The sexual discounting measured within the "most likely to have an STI" condition was only positively associated with frequency of condom use when engaging in vaginal sex ($r(148) = 0.22$, $p < 0.01$; Table 3). By gender discounting in this condition was only associated to a decreased frequency of condom use during vaginal sex ($r(90) = 0.22$, $p = 0.04$) for females. For males, sexual discounting was associated with greater engagement in STI risk behavior ($r(54) = 0.30$, $p = 0.03$), earlier sexual initiation for touch breasts ($r(54) = -0.36$, $p = 0.01$), touch penis ($r(54) = -0.36$, $p = 0.01$), touch vagina ($r(54) = -0.35$, $p = 0.01$), oral sex ($r(54) = -0.29$, $p = 0.03$), and vaginal sex ($r(54) = -0.27$, $p = 0.05$). In addition, for males, sexual discounting was associated with a decreased frequency of condom use during vaginal sex ($r(54) = 0.30$, $p = 0.03$) and anal sex ($r(54) = 0.36$, $p = 0.01$), ever having unprotected oral sex ($r(54) = -0.32$, $p = 0.02$) as well as a willingness or past engagement in oral sex with a non-committed partner ($r(54) = -0.30$, $p = 0.02$). The association between sexual discounting in this condition and a willingness or past engagement in oral sex with a recently met partner approached significance ($r(54) = -0.36$, $p = 0.06$).

"Least likely to have an STI" condition. Sexual discounting calculated within the "least likely to have and STI" condition was positively associated with frequency of condom use during oral sex ($r(148) = 0.17$, $p = 0.03$), vaginal sex ($r(148) = 0.30$, $p < 0.01$), and anal sex ($r(148) = 0.22$, $p < 0.01$) as well as ever having unprotected vaginal sex ($r(148) = 0.23$, $p < 0.01$; refer to Table 3). Sexual discounting was also associated with greater lifetime partners for oral sex ($r(148) = -0.26$, $p < 0.01$) and vaginal sex ($r(148) = -0.20$, $p = 0.02$. Greater sexual discounting was significantly ($p < 0.05$) associated with a willingness to or past history of engagement in oral sex ($r(148) = 0.17$) and anal sex ($r(148) = -0.21$) with a recently met partner, oral sex ($r(148) = 0.20$) with a non-committed partner, and ever being tested for an STI ($r(148) = 0.17$).

Examination by gender revealed that sexual discounting within the "least likely to have an STI" condition in females was associated with greater engagement in STI risk behavior ($r(90) = -0.23$, $p = 0.03$). Sexual discounting also associated with decreased frequency of condom use during vaginal sex ($r(90) = 0.39$, $p < 0.01$), ever having unprotected vaginal sex ($r(90) = 0.30$, $p < 0.01$), greater lifetime oral sex ($r(90) = -0.31$, $p < 0.01$) and vaginal sex partners ($r(90) = -0.26$, $p = 0.01$). Sexual discounting was also associated with female willingness or past engagement in oral sex with a recently met partner ($r(90) = 0.22$, $p = 0.03$), oral sex ($r(90) = 0.26$, $p = 0.01$) and anal sex with a non-committed partner ($r(90) = 0.26$, $p = 0.01$), oral sex with multiple partners in the same day or week ($r(90) = 0.21$, $p = 0.04$), and ever being tested ($r(90) = 0.25$, $p = 0.02$)

For males, sexual discounting within the "least likely to have an STI" condition was associated with decreased frequency of condom use during vaginal sex ($r(54) = 0.29$, $p = 0.03$) and anal sex ($r(54) = 0.32$, $p = 0.02$), as well as a willingness or past engagement in anal sex with a recently met partner ($r(54) = -0.30$, $p = 0.02$). Discounting in this condition approached significance in its association with lifetime oral sex partners for males ($r(54) = -0.26$, $p = 0.06$).

Monetary discounting. Monetary discounting was only associated with decreased frequency of condom use for anal sex ($r(148) = -0.16$, $p = 0.046$) and ever having unprotected anal sex ($r(148) = -0.17$, $p = 0.03$), as well as approached significance for an earlier sexual initiation for anal intercourse ($r(148) = -0.16$, $p = 0.052$). Gender analysis revealed that steeper monetary discounting was associated with an earlier age of initiation for anal sex ($r(90) = -0.21$, $p = 0.04$), decreased frequency of condom use during vaginal sex ($r(90) = 0.22$, $p = 0.04$), ever having unprotected anal sex ($r(90) = -0.25$, $p = 0.02$), and a willingness or past engagement in anal sex with a non-committed partners ($r(90) = -0.29$, $p = 0.01$) in females. In addition, for females monetary discounting approached significance in its association with the use of drug before engaging in sexual behavior ($r(90) = -0.33$, $p = 0.06$). In males, monetary discounting was associated with a willingness or past engagement in oral sex with multiple partners in the same day or week ($r(54) = 0.27$, $p = 0.05$).

Negative urgency. Negative urgency, or the tendency to experience strong impulses under conditions of negative affect, was positively associated with greater engagement in sexual risk behavior ($r(78) = 0.32$, $p < 0.01$, Table 5). Negative urgency was also significantly ($p < 0.05$) and negatively associated to sexual initiation for touch breasts ($r(78) = -0.27$), touch penis ($r(78) = -0.26$), touch vagina ($r(78) = -0.26$), oral sex ($r(78) = -0.34$), vaginal sex ($r(78) = -0.27$), and anal sex ($r(78) = -0.22$). In addition, negative urgency was negatively associated to ever having unprotected oral sex ($r(78) = -0.26$) and vaginal sex ($r(78) = -0.33$). Negative urgency was positively associated with lifetime oral sex ($r(78) = 0.29$, $p < 0.01$) and vaginal sex ($r(78) = 0.28$, $p = 0.01$) partners. Moreover, greater negative urgency was associated with a willingness or past engagement in vaginal sex ($r(78) = -0.33$, $p < 0.01$) with a recently met partner and oral sex ($r(78) = -0.31$, $p < 0.01$) and vaginal sex ($r(78) = -0.28$, $p = 0.01$) with a non-committed partner, and vaginal sex with multiple partners in the same day or week ($r(78) = -0.25$, $p = 0.03$.

With regard to females, negative affective decision making was significantly ($p < .05$) associated with an earlier age of initiation for French Kiss ($r(41) = -0.31$), oral sex ($r(41) = -0.37$), ever having unprotected vaginal sex ($r(41) = -0.34$) and anal sex ($r(41) = -0.31$), greater lifetime oral sex partners ($r(41) = 0.42$) and vaginal sex partners ($r(41) = 0.35$). Additionally, negative affective decision making was associated with a willingness to or past engagement in oral sex with a non-committed partner ($r(41) = -0.36$, $p = 0.02$). The association between negative affective decision making and the age of initiation for touch breasts approached significance ($r(41) = -0.29$, $p = 0.06$).

For males, negative affective decision making was associated with earlier age of initiation for oral sex ($r(33) = -0.38$, $p = .03$), and vaginal sex ($r(33) = -0.42$, $p = .01$) as well as decreased frequency of condom use during vaginal sex ($r(33) = -0.35$, $p = .04$), ever having unprotected oral ($r(33) = -0.35$, $p = 0.04$) and vaginal ($r(33) = -0.36$, $p = 0.03$) sex. Negative affective decision making was also associated with a willingness to or past engagement in vaginal sex with a recently met partners ($r(33) = -0.44$, $p = .01$) and a non-committed partner ($r(33) = -0.35$, $p = .04$).

Positive urgency. Positive urgency, or the tendency toward rash action in response to a very positive mood, was positively associated with engagement in an overall engagement in sexual risk behavior ($r(78) = 0.25$, $p = 0.03$, Table 5). Positive urgency was significantly ($p < 0.05$) negatively associated to sexual initiation for touch breasts ($r(78) = -0.23$), touch penis ($r(78) = -0.23$), touch vagina ($r(78) = -0.22$), and vaginal sex ($r(78) = -0.24$). Positive urgency was also associated with ever having unprotected vaginal sex; however this relationship was approaching significance ($r(78) = -0.22$, $p = 0.052$). With regard to casual sex, greater positive urgency was associated with a willingness or past engagement in vaginal sex ($r(78) = -0.24$, $p = 0.03$) and approaching significance for oral sex ($r(78) = -0.21$, $p = 0.06$) with a non-committed partner.

Greater positive affective decision making was associated with a willingness to or past

engagement in oral sex with a non-committed partner ($r(41) = -0.32$, $p = 0.04$) for females as well age of initiation for vaginal sex ($r(33) = -0.44$, $p = .01$) and willingness to or past engagement in vaginal sex with a recently met partner ($r(33) = -035$, $p = 0.04$) in males.

Premeditation. Lack of premeditation, or the tendency to fail to think and reflect on the consequences of an act before engaging in the act, was only associated with a willingness or past engagement in oral sex ($r(78) = -0.24$, $p = 0.03$) and vaginal sex with a partner one was not in a relationship with ($r(78) = -0.24$, $p = 0.04$; Table 5). Premeditation was associated with a decreased frequency of anal sex protection ($r(41) = -0.31$, $p = 0.05$) in females. For males, premeditation was associated with an earlier age of initiation for kiss ($r(33) = -0.36$, $p = 0.04$) and French kiss ($r(33) = -0.42$, $p = 0.01$).

Gender differences across drug use status

A chi-square test of independence was performed to examine the relation between gender and drug use status. The relation between gender and alcohol use status was significant X^2 (2, $N = 155$) = 9.62, $p = 0.01$. The majority of females reported being abstainers or light drinkers, while only a minority reported being moderate drinkers. For males, the majority reported either light drinking or moderate drinking, while a minority endorsed being non-drinkers or regular drinkers. The relation between gender and cigarette use status was also significant X^2 (2, $N = 155$) = 24.60, $p < 0.01$). More than half of females reported having never tried a cigarette, followed by trying a cigarette, with a few endorsing current cigarette use. The majority of males endorsed being current smokers ($n = 28$; 47.5%), followed equally by never having tried a cigarettes and having tried a cigarette. A relation between gender and marijuana use status was found as well X^2 (2, $N = 155$) = 17.14, $p < 0.01$. Group patterns were similar to cigarettes. Females were mostly non-smokers, followed by triers and a few endorsed being smokers. The majority of males were smokers,

followed roughly equally by non-smokers and triers. The number of males and females in each drug status group are presented in Table 1 and chi-square results are presented in Table 6.

Discounting across drug use status

No main effects were found for alcohol, cigarettes, and marijuana use status as well as dual drug use on sexual discounting in the "least want to have sex with," and "most likely to have an STI" conditions, monetary discounting, negative urgency, positive urgency or premeditation.

Additionally no main effect was found for alcohol use status on sexual discounting in the "least likely to have an STI" partner condition. However, differences in sexual discounting in the "least likely to have an STI" partner condition was found across cigarette use status ($F_{(2,129)} = 5.32$, $p = 0.01$) and by marijuana ($F_{(2,129)} = 3.82$, $p = 0.03$) use status. Cigarette triers ($m = 5.67$; $p = 0.03$) and smokers ($m = 5.41$; $p = 0.01$) displayed greater sexual discounting compared to non-smokers ($m = 7.57$). Marijuana smokers ($m = 4.44$) also displayed greater sexual discounting compared to non-smokers ($m = 7.14$; $p = 0.001$) and triers ($m = 7.00$; $p = 0.01$; see Table1 and 6).

STI risk by gender

A relation between gender and frequency of condom use during anal sex [X^2 (2, $N = 155$) = 9.81, $p < 0.01$], lifetime oral sex partners ($F_{(1,151)} = 7.59$, $p = 0.01$), a willingness to or past engagement in -- oral sex [X^2 (2, $N = 155$) = 33.01, $p < 0.01$], vaginal sex [X^2 (2, $N = 155$) = 26.38, $p < 0.01$] and anal sex [X^2 (2, $N = 155$) = 5.43, $p = 0.03$] with recently met partner; oral sex [X^2 (2, $N = 155$) = 8.01, $p < 0.01$], vaginal sex [X^2 (2, $N = 155$) = 14.79, $p < 0.01$] and anal sex [X^2 (2, $N = 155$) = 5.85, $p = 0.02$] with a non-committed partner; oral sex [X^2 (2, $N = 155$) = 44.13, $p < 0.01$], vaginal sex [X^2 (2, $N = 155$) = 16.41, $p < 0.01$], and anal sex [X^2 (2, $N = 155$) = 8.41, $p = 0.01$] with multiple partners in the same day or week was found.

STI risk by drug use status

Alcohol. Differences in sexual initiation for kiss ($F_{(1,128)} = 4.13$, $p = 0.02$), touch breasts ($F_{(1,128)} = 5.40$, $p = 0.01$), touch penis ($F_{(1,128)} = 5.90$, $p < 0.01$), touch vagina ($F_{(1,128)} = 5.71$, $p < 0.01$), oral sex ($F_{(1,128)} = 4.81$, $p = 0.01$), vaginal sex ($F_{(1,128)} = 7.45$, $p < 0.01$), and lifetime oral sex partners ($F_{(1,128)} = 3.83$, $p = 0.02$) emerged across alcohol use status. In addition, a relation between alcohol use status and frequency of condom use during oral sex [X^2 (2, $N = 155$) = 39.01, $p < 0.01$] and vaginal sex [X^2 (2, $N = 155$) = 34.66, $p < 0.01$], ever having unprotected oral [X^2 (2, $N = 155$) = 39.29, $p = 0.01$] and vaginal [X^2 (2, $N = 155$) = 22.79, $p = 0.01$] sex, use of drugs before sex [X^2 (2, $N = 61$) = 18.44, $p = 0.01$], ever being tested for an STI [X^2 (2, $N = 155$) = 12.01, $p < 0.01$], a willingness to or past engagement in -- oral sex [X^2 (2, $N = 155$) = 22.70, $p < 0.01$] and vaginal sex [X^2 (2, $N = 155$) = 25.45, $p < 0.01$] with a recently met partner; oral sex [X^2 (2, $N = 155$) = 37.55, $p < 0.01$], vaginal sex [X^2 (2, $N = 155$) = 35.61, $p < 0.01$] and anal sex [X^2 (2, $N = 155$) = 6.16, $p = 0.05$] with a non-committed partner; oral sex [X^2 (2, $N = 155$) = 12.07, $p < 0.01$] and vaginal sex [X^2 (2, $N = 155$) = 16.12, $p < 0.01$] with multiple partners in the same day or week was also found.

Abstainers displayed delayed initiation compared to light drinkers and moderate drinkers on first kiss, French kiss, touch breasts, touch penis, touch vagina, oral sex and vaginal sex. In addition, compared to light and moderate drinkers abstainers reported higher frequency of condom use during oral and vaginal sex, never having unprotected oral and vaginal sex, less lifetime oral sex partners, use of drugs before sex and were less likely to endorse a past engagement or willingness to engage in oral sex with a recently met partner and oral and vaginal sex with a non-committed partner. Abstainers were also less likely than moderate drinkers to have been tested for n STI and have engaged or be willing to have anal sex with a non-committed partner. Compared to moderate drinkers, light drinkers were more likely to use condoms during oral sex, less likely

to have unprotected vaginal sex, less oral sex lifetime partners as well as less likely to endorse past engagement or a willingness to have oral sex with a recently met partner, and oral and vaginal sex with a non-committed partner. Moderate drinkers were more likely than other groups to endorse a past engagement or willingness to have vaginal sex with a recently met partner and oral and vaginal sex with multiple partners in the same day or week.

Cigarettes. A relation between cigarette use status and frequency of condom use during oral sex [X^2 (2, N = 155) = 22.85, p = 0.01], ever having unprotected oral [X^2 (2, N = 155) = 10.56, p = 0.01] sex, use of drugs before sex [X^2 (2, N = 61) = 9.57, p = 0.05], ever being tested for an STI [X^2 (2, N = 155) = 6.58, p = 0.04], a willingness to or past engagement in -- oral sex [X^2 (2, N = 155) = 27.46, p < 0.01], vaginal sex [X^2 (2, N = 155) = 23.81, p < 0.01], and anal sex [X^2 (2, N = 155) = 11.15, p < 0.01] with a recently met partner; oral sex [X^2 (2, N = 155) = 33.77, p < 0.01], vaginal sex [X^2 (2, N = 155) = 20.30, p < 0.01] and anal sex [X^2 (2, N = 155) = 11.45, p = 0.05] with a non-committed partner; oral sex [X^2 (2, N = 155) = 27.32, p < 0.01], vaginal sex [X^2 (2, N = 155) = 15.66, p < 0.01], and anal sex [X^2 (2, N = 155) = 8.36, p = 0.02] with multiple partners in the same day or week was found.

Compared to triers and smokers, non-smokers were less likely to use drugs before engaging in sex, been tested for an STI and less likely to endorse a past engagement or willingness to engage in oral and vaginal sex with a non-committed partner. Non-smokers were more likely than smokers to use condoms during oral sex, less likely to have unprotected oral sex, and less likely to endorse a past engagement or willingness to engage in oral and anal sex with a non-committed partner and vaginal and anal sex with multiple partners in the same day or. Additionally, triers were less likely than smokers to endorse a past engagement or willingness in oral sex with non-committed partner. Finally, smokers were more likely than all groups to endorse

a past engagement or willingness to engage in oral, vaginal and anal sex with a recently met partner and oral sex with multiple partners in the same day or week.

Marijuana. A relation between marijuana use status and frequency of condom use during oral [X^2 (2, N = 155) = 26.99, $p < 0.01$] and vaginal [X^2 (2, N = 155) = 29.86, $p < 0.01$] sex, ever having unprotected oral [X^2 (2, N = 155) = 16.93, $p < 0.01$] and vaginal [X^2 (2, N = 155) = 13.82, $p = 0.01$] sex, use of drugs before sex [X^2 (2, N = 61) = 15.16, $p < 0.01$], ever being tested for an STI [X^2 (2, N = 155) = 12.64, $p < 0.01$], a willingness to or past engagement in -- oral sex [X^2 (2, N = 155) = 29.00, $p < 0.01$], vaginal sex [X^2 (2, N = 155) = 21.47, $p < 0.01$], and anal sex [X^2 (2, N = 155) = 7.15, $p = 0.03$] with a recently met partner; oral sex [X^2 (2, N = 155) = 41.47, $p < 0.01$], vaginal sex [X^2 (2, N = 155) = 51.97, $p < 0.01$] and anal sex [X^2 (2, N = 155) = 10.33, $p = 0.01$] with a non-committed partner; oral sex [X^2 (2, N = 155) = 32.09, $p < 0.01$], vaginal sex [X^2 (2, N = 155) = 27.18, $p < 0.01$], and anal sex [X^2 (2, N = 155) = 8.20, $p = 0.02$] with multiple partners in the same day or week also found.

Compared to all other groups, non-smokers were more likely to use condoms during oral and vaginal sex, less likely to have unprotected oral sex, been tested for an STI, and use drugs before sex and to endorse a past engagement or willingness to engage in oral and vaginal sex with a recently met partner and vaginal sex with multiple partners in the same day or week. Compared to triers, non-smokers were less likely to endorse a past engagement or willingness to engage in anal sex with a recently met partner, a non-committed partner and a multiple partners in the same day or week. Similarly, compared to smokers, non-smokers were less likely to endorse ever having unprotected vaginal sex and a past engagement or willingness to engage in oral and vaginal sex with a non-committed partner and oral sex with multiple partners in the same day or week. Triers were less likely than smokers to endorse a past engagement or willingness to engage in oral and

vaginal sex with a non-committed partner and oral sex with multiple partners in the same day or week.

Mediation analyses

Sexual discounting in the "least want to have sex with, "most likely to have an STI" and "least likely to have an STI" condition was not significantly associated with STI risk behavior, therefore no mediation analyses were conducted with regard to this condition.

Alcohol. Alcohol use status was negatively associated with sexual discounting, and sexual discounting was negatively associated with STI risk behavior [Model $R^2 = 0.31$, $F_{(3,151)} = 24.51$, $p < 0.01$]. The indirect effect for alcohol use on STI risk behavior via sexual discounting was also significant [*a* X b = 0.70, CI = 0.009 - 2.13], supporting a statistical mediation effect such that greater alcohol use was associated with steeper sexual discounting rates, which was in turn associated with greater STI risk behavior. The total effect of alcohol use on STI risk behavior was significant [b = 14.96, t(155) = 7.88, $p < 0.01$], and the direct effect which controls for sexual discounting, was also significant, but reduced [b = 14.26, t(155) = 7.47, $p < 0.01$]. This suggests that the effect of alcohol use on STI risk behavior was partially mediated by sexual discounting (see Table 7).

Cigarettes. Cigarette use status was negatively associated with sexual discounting, and sexual discounting was negatively associated with STI risk behavior [Model $R^2 = 0.15$, $F_{(3,151)} = 9.79$, $p < 0.01$]. The indirect effect for cigarette use on STI risk behavior via sexual discounting was not significant [*a* X b = 0.67, CI = -0.002 - 2.01]. However, the total effect of cigarette use on STI risk behavior was significant [b = 7.26, t(155) = 4.27, $p < 0.01$], and the direct effect which controls for sexual discounting, was also significant, but reduced [b = 6.60, t(155) = 3.89, $p < 0.01$]. This suggests that the effect of cigarette use on STI risk behavior was partially mediated by sexual discounting (see Table 7).

Marijuana. Marijuana use status was negatively associated with sexual discounting, and sexual discounting was negatively associated with STI risk behavior [Model $R^2 = 0.20$, $F_{(3,151)} = 13.68$, $p < 0.01$]. The indirect effect for marijuana use on STI risk behavior via sexual discounting was not significant [*a* X b = 0.66, CI = -0.006 - 2.03]. However, the total effect of marijuana use on STI risk behavior was significant [b = 9.49, t(155) = 5.09, $p < 0.01$], and the direct effect which controls for sexual discounting, was also significant, but reduced [b = 8.83, t(155) = 5.09, $p < 0.01$]. This suggests that the effect of marijuana use on STI risk behavior was partially mediated by sexual discounting (see Table 7).

CHAPTER IV

DISCUSSION AND SUMMARY

The primary goal of the present study was to investigate the role of discounting in STI risk behavior, including drug use. This is the first study to date that has examined the validity of the SDT exclusively in youth. In addition it is the first study to examine multiple domains of discounting among drug use status and the effects of drug use status on STI risk behavior. The results suggest the SDT should be considered a clinically meaningful assessment of STI risk behavior in youth. In addition, results revealed robust associations between discounting and STI risk, but this association appears to be domain specific and vary by gender. Main effects of gender and drug use on discounting and STI risk were also observed. Consistent with our predictions, sexual discounting mediated the relationship between drug use and sexual risk behavior. Although, contrary to our predictions this mediation was approaching significance for cigarette use. Overall, these results highlight the importance of discounting in understanding STI risk in youth, especially more domain specific forms of delay discounting, such as sexual discounting to help better contextualize this risk.

The SDT was sensitive to factors that may influence real world decisions to use condoms. Participants showed significantly greater discounting or preference for immediate unprotected sex for partners they found most sexually desirable compared with those they found least desirable, but with whom they were still willing to have sex with. The increased discounting of safe sexual activity when viewing and responding in regard to the most sexually desirable partner is consistent with previous findings in emerging adult, adult and drug dependent populations (Dariotis & Johnson, 2015; Herrmann et al., 2014; Johnson & Bruner, 2012). Thus, discounting may not be a factor solely in adult sexual risk behavior but also that of youth.

Participants also displayed significantly greater discounting for partners they judged least likely to have an STI compared to those they judged most likely to have an STI. This finding is consistent with previous research within adolescents and emerging adults which demonstrated that perceived STI risk did influence condom use (Prata, Morris, Mazive, Vahidinia, & Stehr, 2006). Mean data, as shown in Figures 1 and 2, indicate that the SDT was sensitive to differential discounting rates across conditions and appeared as a hyperbolic shape in each condition. The re-analysis, which occurred after the normalization of data relative to condom use in the 0-delay trial, further suggests that difference across conditions reflect differences in delay discounting, not just differences in condom use.

When comparing relationship among measures, questions on the SHQ were associated with all four SDT partner conditions. The “most want to have sex with” and “least likely to have an STI” were the two conditions most sensitive to real world factors and the two conditions most robustly associated with engagement in STI risk behavior. The situations in the SDT were hypothetical. Therefore, the partner they deemed “most want to have sex” may have been different than the partner “least likely to have an STI" because participants are not in a relationship with the chosen individuals. However, in real-world scenarios, it is surmised that youth are likely to combine these two assumptions with regard to their sexual partner or the person whom they are most attracted to is also whom they feel is at least risk for having an STI.

Women especially are more likely to make sexual health decisions with regard to attractive partners and those whom they deem least at risk for STIs. These two factors are strongly related, as most individuals perceive the least risk from attractive persons (Hennessy, Fishbein, Curtis, & Barrett, 2007). Further, romantic status was positively associated with STI risk in females and explained 9.6% of the variance. This suggests that women who believe themselves to be in monogamous, committed relationships are more likely to endorse engaging in STI risk behavior.

This is unfortunate, given that youth often have concurrent relationships and only a minority of individuals whose partners had other partners were aware of this, which was independently associated with STI risk and individuals underestimate their partner's actual engagement in STI risk behavior and have perceptions that they are at little to no risk of ever being diagnosed with an STI, even when STI indicators are present (Drumright, Gorbach, & Holmes, 2004; Ethier et al., 2003; Kelley, Borawski, Flocke, & Keen, 2002; Parsons et al., 2000; Stoner et al., 2003). Though a youth may only have had sexual encounters with one sexual partner or a brief encounter with one sexual partner, if that partner is a member of a risky sexual network, the adolescent is at higher risk for STI acquisition (Healthy People 2020, 2013).

Male engagement in STI risk behavior was strongly associated with sexual discounting in the "most likely to have an STI condition." This suggests that males modify their sexual risk taking by evaluating how likely their attractive partner is to have an STI. This is consistent with previous literature, which concluded that males are more motivated to have sex with an attractive female, but perceive physically attractive females as sexually promiscuous. Therefore, sex with an attractive female implies a higher risk for contracting an STI, but a tendency towards condom use for males when engaging in sexual behavior. (Dijkstra, Buunk, Blanton, 2006).

Consistent across conditions, males displayed steeper sexual discounting curves compared to females for both the raw and normalized AUC values. Males are less likely than females to wait for delayed access to their condoms and instead have unprotected sex. A meta-analysis examining sex differences in impulsivity found no differences between genders on discounting (Cross, Copping, & Campbell, 2011). However, the main effect of gender on sexual discounting but not monetary, affective and premeditative discounting further support the domain specificity and sensitivity of sexual discounting with regards to not only STI risk behavior but gender differences therein. The same meta-analysis found that women were more punishment sensitive and men

showed higher sensation seeking and risk taking which relates to why males may display steeper sexual discounting curves. Females maybe more sensitive to the possibility of obtaining an STI (or getting pregnant) whereas males may enjoy the risk and spur of the moment experience of having unprotected sex. Differences in sexual discounting, punishment sensitivity, sensation seeking and risk taking is supported by previous neurocognitive research that shows remodeling changes are more pronounced in males, making males more reward sensitive (Steinberg, 2008). Steeper sexual discounting rates help explain the results that males are more likely to endorse STI risk behaviors than females. However, as discussed, how sexual discounting related to actual engagement in STI risk behavior varied by gender and what partner conditions the AUC value was obtained.

Selecting more photographs, or a greater number of individuals one is willing to have sexual intercourse with, was significantly associated with greater sexual discounting in the "least likely to have an STI" conditions. However, unlike the original validation of the SDT on adults (Johnson & Bruner, 2012), the number of photographs selected could not be considered a model of promiscuity within the task because it did not significantly correlate with lifetime oral sex, vaginal sex and anal sex partners. One possible reason why the number of photographs may not reflect real life promiscuity is the age demographic. Unlike the previous adult population, this sample was composed entirely of youth who are still developing and becoming sexually experienced. Therefore, the number of photographs may reflect their desired level of promiscuity but not their actual attained level of promiscuity. This is supported by the significant and positive correlation between sexual discounting and photographs selected, which suggests that youth who display greater sexual discounting have a preference for more partners. To add, males chose significantly more photographs than females or reflected a willingness to have sex with more individuals based on physical attraction alone. This supports that females may be more selective

in choosing partners that are both attractive and least likely to have an STI, whereas males are open to partners even when STI indicators are present. Correlations involving the SDT conditions were largely unchanged when replicated using normalized data relative to condom use in the 0-delay trial, suggesting that discounting for sex was responsible for the associations above beyond just condom use preference. Gender differences again emerged for the 0-delay trail -- with males more likely than females to prefer not using a condom when one was readily available. Males may have a preference for unprotected sex even with casual partners. For females, as stated above -- their desire for having unprotected sex may stem from a belief in monogamy with a partner.

Several considerations should be kept in mind when reviewing the results of the present study. The SDT involves hypothetical consequences rather than real consequences. Therefore, it is possible that participants' responses regarding immediate, unprotected sex versus delayed sex with a condom do not accurately reflect the actual behavior that participants would show if the consequences had been real. Indeed, one could assume based on national data statistics in this population that sexual discounting, as reflected by the SDT, is likely to be an underestimate of actual behavior (CDC, 2011). Testing whether results on the SDT would differ when using hypothetical versus real consequences would be entirely unethical, but it has been previously demonstrated with a monetary commodity that hypothetical versus real consequences demonstrate similar results (Johnson & Bickel, 2002; Baker, Johnson, & Bickel, 2003; Madden et al., 2003, 2004; Lagorio & Madden, 2005; Johnson et al., 2007) as well as neurobiological responses (Bickel et al., 2009). Thus, it is reasonable to assume the validity of the SDT when using hypothetical consequences.

Another consideration recognized in the original validation article of the SDT (*see* Johnson & Bruner, 2012) was the choice between immediate unprotected sex or delayed sex with a condom. Delay discounting procedures have traditionally utilized discrete trial choice procedures

to determine the value of a delayed reward, with choices varying between smaller and larger amounts of the same commodity (e.g., money, exposure to erotic film, number of sexual acts). Although previous delay-discounting models used a choice procedure manipulating the duration or amount of sexual activity (Jarmolowicz, Bickel, & Gatchalian, 2013; Lawyer et al., 2010), this was determined to be problematic due to individual preferences in regards to duration and amount of sexual activity. One study other study to date, not employing the SDT, did not use a discrete trial choice procedure (Jarmolowicz et al., 2015). Discrete choice procedure or not, these studies did not capture discounting with the context of STI risk (safe sex now or possible harm to one's health later). Further results from the SDT reflect appropriate modeling of discounting delayed sexual outcomes (*see* Johnson & Bruner, 2012). For the present study, the author chose to remain consistent with this choice and were found to be consistent with the discounting of delayed sexual outcomes.

The SDT had a forced choice between outcomes that differed by aspects other than delay. Immediate sex was always without a condom and delayed sex was always under the assumption of being with a condom. However, it was determined that the face validity and relevance regarding STI risk resulting from condom use manipulation was more important than isolating the pure effect of delay versus condom use preference.

Further, participants were also not afforded the option to choose not to have sex with the target partner during the VAS conditions. This was addressed during the selection of sexual partners. Participants could select as few or as many photographs of their choice, meaning that they could have chosen 0 photographs. For example, if a participant chose zero photographs, the observation would have been reported as suggested by Johnson and Bruner (2012), and the participant would have not been included in other analyses. It was suggested that future studies may modify that procedure to increase the likelihood that participants would select photographs

including modifying the narrative and increasing the number and/or variety of photographs. The present study chose to follow through on these recommendations and both modified the narrative to indicate that participants were to assume that desired partners had all the optimal personal attributes, not just personality features (e.g., religious affiliation), as well as increased the number of photographs from 30 male and 30 female pictures to 50 male and 50 female pictures. All participants indicated a willingness to have sex with at least one person and completed the VAS conditions in reference to that photograph.

Most participants reported a very high likelihood of using a condom when one was immediately available. However, depending on conditions, even a few hours of delay was able to drastically decrease the likelihood of using a condom, especially for youth who are more susceptible to engaging in STI risk behavior due to situational temptation (Parsons et al., 2000). This may explain why almost 40% of high school students did not use a condom during their last sexual intercourse. Most youth do not have immediate access to condoms. For many youth, parents are likely to prohibit engaging in sexual intercourse. Therefore buying condoms in advance would require secrecy, deception, and the opportunity for it to be discovered and one to be punished. As a result most youth do not buy condoms in advance. Further, purchasing condoms may be associated with additional stigma due to their young age and embarrassment, leading to a decreased desire to purchase condoms. Also condoms can be viewed as expensive for youth who may not be employed or work part-time and thus purchasing condoms in advance are low on the priority list. The aforementioned are all factors as to why condoms are likely to not be readily accessible to youth and why a certain amount of delay in condom availability is inherent. As a result, the likelihood of using a condom during sexual intercourse decreases and the act of sexual intercourse with a condom is discounted. Instead the focus shifts to more immediate gratification including sexual pleasure, intimacy, and partner approval.

Consistent with domain specificity, sexual discounting was not associated to monetary discounting. The domain specificity observed in the present study is consistent with two previous studies showing that delay discounting may depend on the nature of the commodity being discounted in a more immature population. For example, two studies showed that participant body mass index was more strongly associated to delay discounting for food than for monetary delay discounting (Bonato & Boland, 1983; Johnson, Parry, & Drabman, 1978). However, both of these studies and the present results demonstrated a lack of correlation between monetary discounting and more tangible, non-abstract discounting (e.g., food, condoms), dissimilar to previous findings on adult populations (Charlton & Fantino, 2008; Johnson et al., 2010; Odum, 2011). This indicates heightened domain specificity for youth in making specific, high risk choices, such as excessive eating and engagement in STI risk behavior.

Monetary discounting and premeditation was found to have limited associations with STI risk behavior. This suggests delay discounting or decision making may be an underlying behavioral mechanism linked to risk behavior, but it is domain specific. Monetary discounting may be informative when understanding financially related pathology such as gambling and premeditation may be informative when understanding delay discounting abstractly but the SDT is more sensitive at assessing STI risk behavior. Consistent with this domain specificity, the SDT was not correlated to monetary discounting or premediation. The domain specificity observed in the present study is consistent with two previous studies showing that delay discounting may depend on the nature of the commodity being discounted in a more immature population. For example, two studies showed that participant body mass index was more strongly associated to delay discounting for food than for monetary delay discounting (Bonato & Boland, 1983; Johnson, Parry, & Drabman, 1978). However, both of these studies and the present results demonstrated a lack of correlation between monetary discounting and more tangible, non-abstract discounting

(e.g., food, condoms), dissimilar to previous findings on adult populations (Charlton & Fantino, 2008; Johnson et al., 2010; Odum, 2011). This illustrates the benefits of using domain specific discounting assessments in youth, who are still developing neurologically, when attempting to understand health risk behaviors, such as excessive eating and engagement in STI risk behavior.

Results also revealed that negative affective decision making was related to youths' overall engagement in STI risk behavior, age of sexual initiation, having unprotected sexual behavior, lifetime sexual partners and casual sex in both males and females. This reflects that youth, are likely to initiate and participate in STI risk behavior when experiencing negative affect. Negative affective decision making may influence STI risk via coping. The Coping and Stress Model suggests that during times of negative affect, adolescents may initiate and maintain high risk sexual behavior as a means to relax and cope with the negative affect (Folkman, Chesney, Pollack, & Phillips, 1992). Given that adolescence is associated with high negative affect, this is particularly problematic (Moneta, Schneider, & Csikszentmihali, 2014). In addition it may be that youth are more sensitive to partner perception and partner pleasing. Dissonance between their sexual intentions and their partner's demands could lead to experiencing negative affect. In turn they may make more rash decisions such as initiating sexual behavior earlier than they anticipated, engage in sexual behavior with partners they may not have considered otherwise, and engage in unprotected sexual behavior because they are more focused on alleviating negative affect.

Positive affect was related minimally, to sexual behavior for both males and females. It can be suspected that youth influenced by positive affective decision making are likely to initiate sexual behavior when in or trying to maintain a positive mood state. Positive affective decision making may also be related to perceptions of invincibility. Invincibility during youth has been linked to engagement in delinquent and problematic behavior and youth, (Wickman, Greenberg,

& Boren, 2010). However, since positive affective decision making was only minimally it should be considered with caution.

As initially hypothesized, men tended to be heavier drug users (e.g., heavy drinkers and smokers) than women. This finding is consistent with those of recent studies which suggest that as adolescents age, males demonstrate greater use, which may be due to biological and social factors, including greater tolerance and social acceptance (Chen & Jacobson, 2012; Nolen-Hoeksema & Hilt, 2006; Schulte, Ramo, & Brown, 2009). The majority of males reported being heavy drinkers or social drinkers. It is important to note, that though the authors queried frequency of drinking -- the quantity consumed per episode was not queried. Thus, it is possible that for a male participant who endorsed drinking once to twice a month, each episode resulted in intoxication. Males were also more likely to be cigarette or marijuana smokers. Given the serious physical and mental health implications of drug use, especially at earlier ages, it is important to continue to investigate the development of serious drug use pathology, especially young males -- targeting both biological and social factors to help prevent their progression to heavy and chronic use.

Female youth were most likely to endorse being social drinkers or non-drinkers, and non-smokers or triers with regard to both cigarettes and marijuana. Similar to males, the quantity of alcohol was not queried, so it is possible that though females drank infrequently, they may have consumed large quantities. However, assuming that female alcohol intake was consistent with their use of cigarettes and marijuana, it still bears some important implications. The experimental use of drugs is associated with higher levels of aggression, maladjustment, less social support, and impulsive behavior (van den Bree & Pickworth, 2005; Farhat, Simons-Morton, & Luk, 2011; Reynolds & Fields, 2012; Tucker, Ellickson, Collins, & Klein, 2006). Therefore, even if female youth were endorsing experimental or occasional use, they too are at risk for poor physical and

mental health outcomes. Also, social drinkers and triers of cigarettes and marijuana are at risk for regular use. Since interventions often focus on drug users or preventing initiation, triers and experimental users are often overlooked. Females have a greater representation within these groups, therefore intervention efforts may be inadequate or not comprehensive in addressing drug use within females. For example, female youth may be under the incorrect assumption that this type of use is not harmful to one's health because interventions do not target experimental or infrequent use. Interventions should not only target drug users or prevention of drug use, but also social and experimental users, with a particular focus on gender differences.

Despite evidence indicating monetary discounting was steeper among drug users than non-users (Bickel, Odum, & Madden, 1999; Reynolds & Fields, 2012; Petry, 2001; Quisenberry, Franck, Bickel, 2015), monetary discounting did not differ by drug use status in the present sample. One reason for the discrepancy may be the age demographic. One study, which examined adolescent cigarette use status, found no differences in discounting between experimenters and smokers, which was supported in the present study, but a significant difference was found between smokers and non-smokers which was not observed in the present study (Reynolds & Fields, 2012). The former study focused on a slightly different age cohort, adolescents ages 13-17, whereas the present study focused on an older sample of 14-19. The studies also too place in different regions -- a metropolitan center versus a more rural city. It is possible that the discrepancy is an artifact of the different samples. The present findings on cigarette use status was consistent across alcohol and marijuana use as well as in the literature described below.

The remaining studies included mixed findings. Although users were significantly different than non-users, whether experimental users were intermediate in their discounting rates, similar to either users or non-users, varied. These studies also included adult samples. Why may this be important? Adolescent discounting rates are steeper than adults, and remain fairly stable,

regardless of interventions (Audrian-McGovern et al., 2009; Lee, Stagner, & Budney, 2015). Adolescent discounting rates also do not discriminate between drug use trajectories in youth (Audrian-McGovern et al., 2009). However, drug use has been shown to alter or interrupt the development of executive functioning, such as decision making (Lopez-Caneda et al., 2013). All of this information suggests that differences in monetary discounting among drug use status in youth may not develop because adolescents, in general, have steeper but stable rates of discounting, regardless of drug use. The lack of difference in discounting rates between those who use and those who do not is what makes all youth vulnerable to engage in risk behavior, like drugs, in the first place (Smith, Chein, Steinberg, 2013). Further, the differences in discounting rates observed in studies involving drug using and non-using adults may not manifest until chronic drug use has had time to affect neurological processes. Monetary discounting may be important in understanding drug pathology and the effects of drug use in adults, but may not be as informative for initiation or drug use in youth.

Differences in drug use status by sexual discounting were also observed. Trends across alcohol, cigarettes, and marijuana were consistent, with drug users having significantly steeper sexual discounting rates than non-users. Social drinkers and regular drinkers, as well as cigarette and marijuana triers, had intermediate discounting rates to those of users and non-users. Heavy drinkers did significantly differ on sexual discounting compared to social drinkers, but social drinkers and regular drinkers did not significantly differ from non-users. In addition, cigarette triers did not significantly differ from smokers, whereas marijuana triers did not significantly differ from non-smokers. The subtle nuances between intermediate sexual discounting rates, and whether they were more similar to users or non-users, can be attributed to the fairly stable discounting rates described above, regardless of drug use (Audrian-McGovern et al., 2009; Lee, Stagner, & Budney, 2015). As a result it may be difficult to tease apart intermediate discounting rates.

Similar to gender, this may explain why drug users were more likely to endorse STI risk behaviors. Users were at greatest risk for engaging in STI risk behavior with triers intermediate in risk when compared to users and non-users. Interesting results emerged for sexual discounting accessed via the "most likely to have an STI" condition, such that non-users demonstrated steeper discounting than triers and users. This finding is similar to the gender differences that were observed, in which drug users may be more aware of their risk for contracting STIs when indicators are present and adjust their condom use accordingly, whereas non-users may feel invincible or perceive their risk of contracting an STI less likely even when indicators are present and therefore are inconsistent in their condom use. Given that females are more likely than males to be non-users, this further gives credence to why heterosexual females are at heightened risk for STIs. Non-users are also at risk for contracting an STI even when not engaging in drug use in accurate perceptions of risk.

Results were inconsistent across drugs for "least want to have sex with" condition which, again, is likely attributable to the condition's inability to connect to real world situations. Youth whether they use drugs are not, are likely to engage in sexual behavior with a desired partner, a partner viewed as less sexually risky or a partner they view as attractive but sexually promiscuous, as I the case with males. However, when both attraction and risk are removed, there is no incentive toward using a condom or not using a condom, and decisions are made with regard to individual preference and the degree to which they may be attracted the person selected, contributing to inconsistent results for the "least want to have sex with" condition among drug types and statuses.

When processing this information a consideration should be made. For example, when looking at the use of alcohol, youth who have used alcohol are compared to those who have never tried alcohol. When thinking of adolescents who have never tried alcohol, they are unlikely to be those that have tried other drugs such as marijuana. However, when looking at other drugs, such

as marijuana, youth who have used marijuana are compared to youth who have never used heroin. The “never used marijuana” group is likely made up of both individuals who have never used drugs at all, but also may include youth who have engaged in other more easily accessible drugs (i.e. alcohol, tobacco, etc.). Therefore, dependent on the type of drug used, an adolescent may have a greater proclivity to engage in STI risk behavior when compared to not only non-drug users but non-illicit drug users who are also at risk of engaging in risky sexual behavior.

Understanding the larger trend is beneficial for elucidating the relationship between delay discounting and drug use status. Sexual discounting in drug use status revealed a trend in youth similar to those found using monetary discounting in adults. This trend was not observed in youth when assessing for monetary discounting. This supports the notion that sexual discounting may be domain specific. Risky and reckless behaviors, often known as "problem behavior," often cluster together (Problem Behavior Theory; Biglan et al., 1990; Champion, 2004). Assessing sexual discounting may be more salient in the minds of youth to their drug use compared to monetary discounting. It can be argued that the concept of premeditation, emotions, or a commodity such as money is too conceptual and abstract for youth, compared to more concrete items such as condoms. This has an important clinical implication: sexual discounting may be more sensitive than monetary discounting at detecting subtle differences between drug use status by delay discounting in youth who are still developing cognitively.

As stated previously, the contribution of drug use to STI risk has been well established in youth (Castilla, Barrio, Belza, & de la Fuente, 1999; Cavazos-Rehg et al., 2011; Floyd & Latimer, 2010; Fortenberry, 1995; Guo et al., 2002; Hingson et al., 1990; Malow et al., 2001; Poulin & Graham, 2001; Rosenbaum & Kandel, 1990; Santelli et al., 1998; Santelli et al., 2001; Tapert et al., 2001). Further, the association between sexual discounting and drug use has been demonstrated in adults (Herrmann et al., 2014; Jarmolowicz, Bickel, & Gatchalian, 2013; Jarmolowicz et al.,

2014; Johnson & Bruner, 2012; Koffarnus et al., 2015). Sexual discounting has also be found to be associated with a limited number of STI risk behaviors (Johnson & Bruner, 2012; Dariotis & Johnson, 2015). However, the association between sexual discounting and drug use has been limited to adult samples. Also, the association between sexual discounting and STI risk behaviors has been limited to a discrete number of risk behaviors. To the authors' knowledge this is the first study to determine whether sexual discounting mediates the relationship between drug use and STI risk behavior. In the present research, sexual discounting partially mediated the effects of drug use – alcohol, cigarettes and marijuana -- on STI risk behavior. Partial mediation occurs when the path from the independent variable, drug use, to the dependent variable, STI risk behavior, is reduced in absolute size but remains different from zero when the mediator is introduced (Hamilton, Ansell, Reynolds, Potenza, & Sinha, 2013).

Interestingly, while sexual discounting approached significance in mediating the relationship between cigarette use and STI risk, global associations have been made between alcohol, cigarette and marijuana use as relevant cofactors for engagement in sexual risk behaviors (Thamotharan, Grabowski, Stefano, & Fields, 2014). Research examining situational and event-level associations reveal drug use and sexual-related expectancies for alcohol and marijuana but not cigarette use. The alcohol myopia model (Steele & Josephs, 1990), suggests that the immediate cognitive decline due to alcohol consumption makes salient cue more pronounced, such as sexual encounters. Event analysis in youth has shown positive relationships between alcohol use and engagement in sexual behavior, including first-time sexual events (Halpern-Felsher, Millstein, & Ellen, 1996). Similarly, strong sex-related marijuana expectances were predictive of greater intentions for and frequency of marijuana use in sexual situations in youth (Hendershot, Magnan, & Bryan, 2010). Meaning that sexual discounting, reflective of sexual risk behavior, may be closely interrelated to alcohol and marijuana use in youth. Although cigarettes have been shown

to impair cognitive performance, the effects are not immediate or situational specific, unlike alcohol and marijuana. Youth smokers have shown a decline in working memory, which is exacerbated during smoking cessation (Jacobsen et al., 2005). Consequently, though sexual discounting is able to discriminate smoking status, it may not be as temporally related to cigarette use as it is with alcohol and marijuana use.

Across both models, drug use were associated with steeper sexual discounting rates, and steeper sexual discounting was associated with greater engagement in STI risk behavior. This demonstrates the importance of the contribution of sexual discounting to STI risk behavior. The mediation findings support the belief that the domain specificity of sexual discounting may be more pertinent to STI risk behavior in youth than monetary discounting. When examining risk behaviors in youth in the context of delay discounting, it appears to be beneficial to use a specific, highly relatable commodity -- condoms for high risk sexual behavior or number of cigarettes for understanding drug use, etc. This is especially important because behavioral assessments of choice impulsivity have been shown to be clinically relevant to treatment outcomes in youth (Krishnan-Sarin et al., 2007). However, given a partial mediation, sexual discounting is not the only factor responsible for the effects of drug use on engagement in STI risk behavior. The significant direct effect of drug use on STI risk behavior further validates the importance of drug use as a factor impacting STI risk in youth, even without the influence of sexual discounting.

Some limitations of the current findings should be noted. Data collection included self-report data on drug use. To help minimize a bias response style the testing sessions were structured so that participants were able to complete demographic and drug use measures electronically in a private room. The cross sectional nature of the sample is not ideal for a mediation and cannot imply causality. However, in this context a mediation model can be suggestive of a structural relationship thereby supporting the present hypothesis (Iacobucci, 2008; MacKinnon, 2008). The

models only accounted for 15-31% of the variances in STI risk behavior indicating that a more complex model of factors is involved in the drug use status of youth. This complexity is expected given that youth are experiencing major developmental, biological, neurological, social and emotional changes that are co-occurring. Finally, the sample was limited in demographics, including ethnicity and education. Drug use and STIs are reported to be higher among minorities, such as Native Americans and Mexican Americans, and school is a protective factor against health risk behaviors (Bernard & Marshall, 1997; CDC, 2015; Rutman, Park, Castor, Tauali, & Forquera, 2006; Wallace et al., 2002). Greater ethnic and educational diversity is needed in future samples.

In conclusion, despite the limitations, discounting is likely to be an important factor in the STI epidemic plaguing our youth and should be examined, especially since females are likely to be ignored in current interventions which may narrowly focus on drug users instead of also encompassing experimenters or recreational users. Sexual discounting may have more utility than monetary discounting when assessing STI risk in youth due to its domain specificity, tangibility, and saliency to sexual behavior. Extending from this, future prospective research might explore other domain specific forms of delay discounting in various youth risk behaviors (e.g., food for obesity, cigarettes for drug use, condoms for sexual behavior) to determine the relative contributory role of domain specific forms of discounting. These domain specific forms of delay discounting may be more informative in better understanding the behavioral mechanisms underlying the health risk behaviors in youth and the progression of risk into adulthood. This will, hopefully, provide valuable insight into modifying the current methods of intervention, especially for STI risk in youth.

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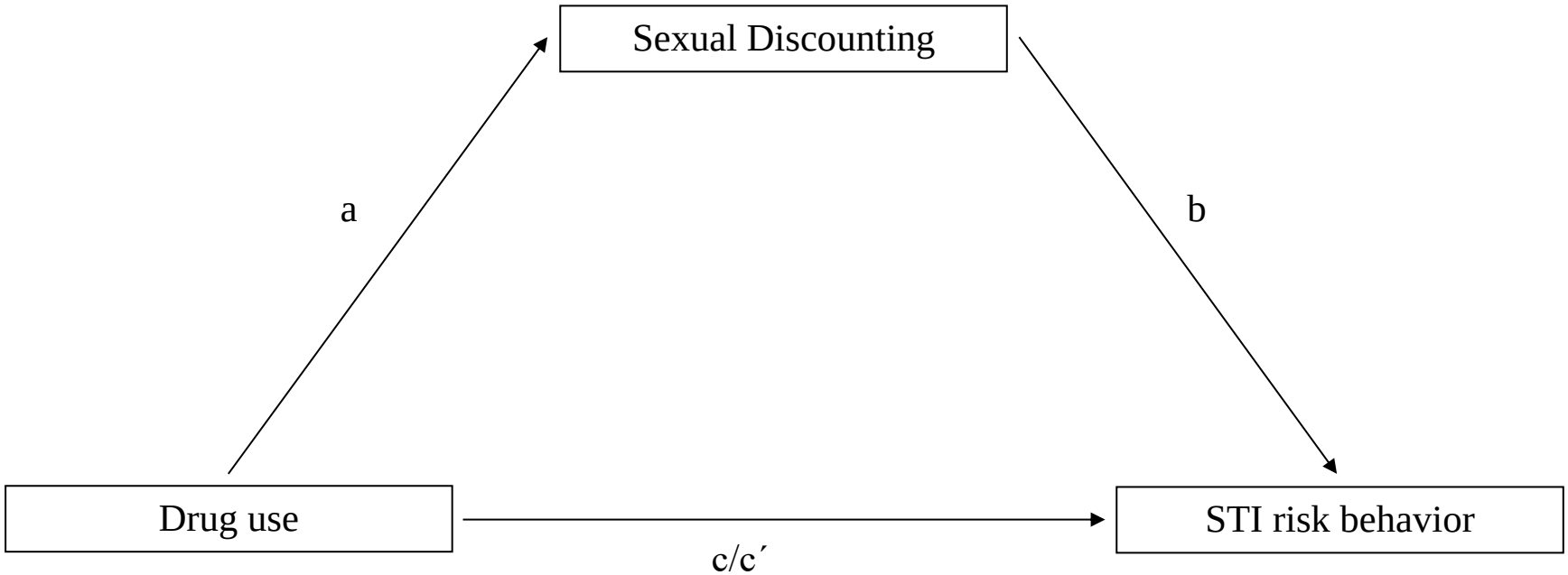

Figure 1. Mediation model of drug use, sexual discounting and STI risk behavior

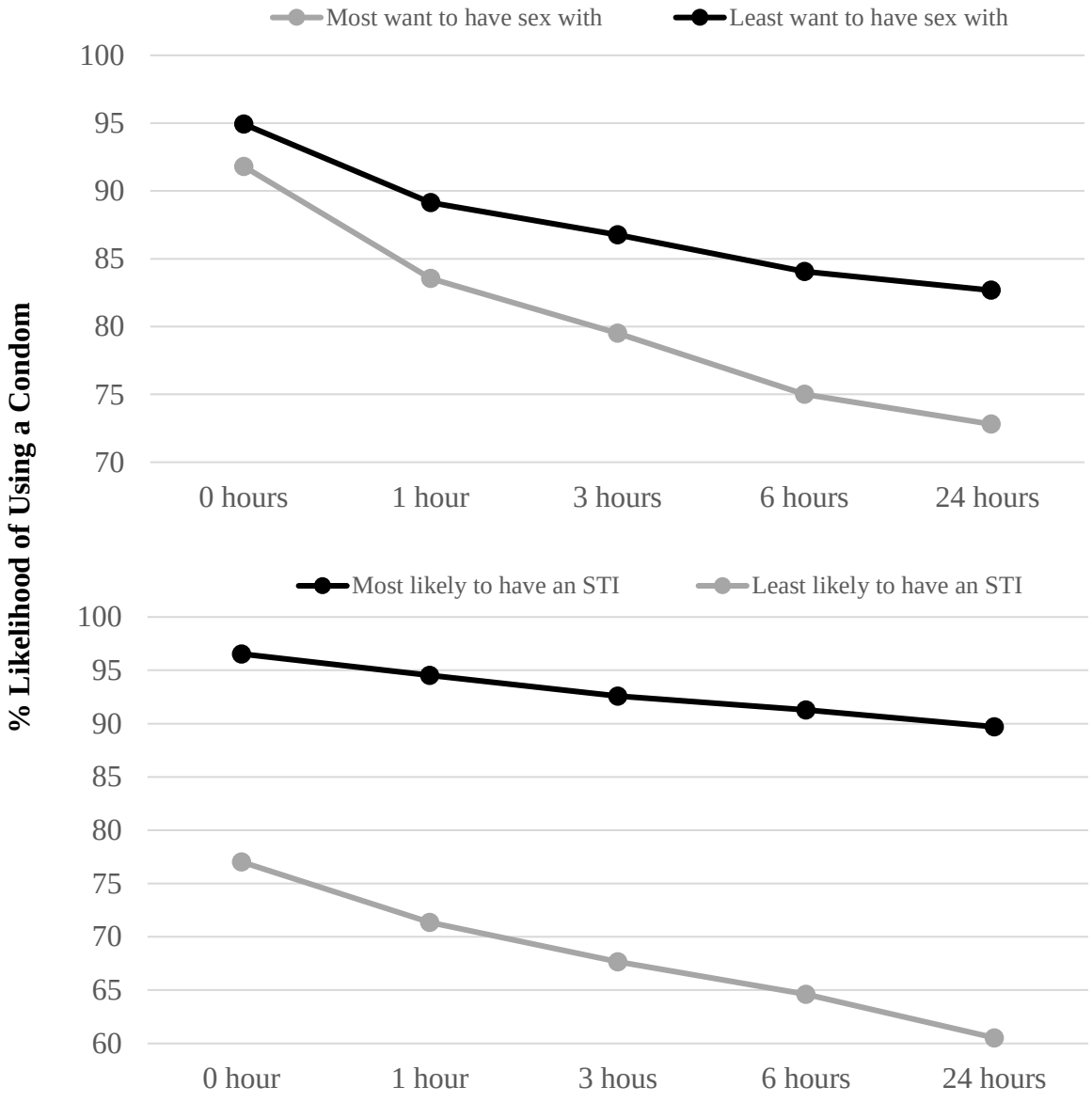

*Figure 2***.** Sexual discounting group mean data for the four conditions. The top panel shows data from the "most want to have sex with" and the "least want to have sex with" conditions. And the bottom panel shows data from the "most likely to have an STI" and the "Least likely to have an STI" conditions

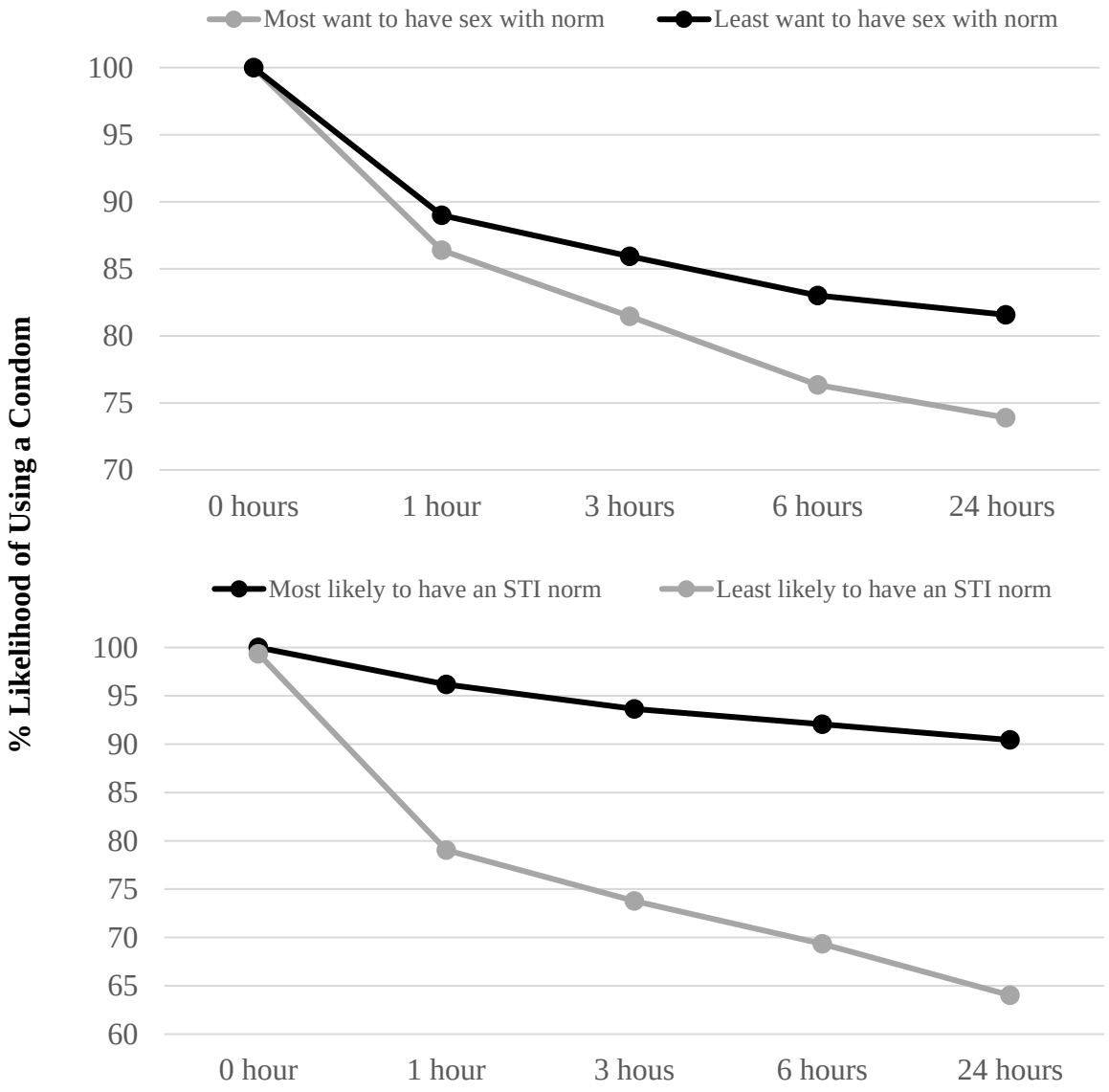

Figure 3. Sexual discounting group mean data for the four conditions (normalized). Data have been normalized relative to likelihood of using a condom at no delay, so that delay discounting differences across groups are not confounded by differences in condom use regardless of delay. The top panel shows data from the "most want to have sex with" and the "least want to have sex with" conditions. The bottom panel shows data from the "most likely to have an STI" and the "least likely to have an STI conditions.

Table 1

Demographics

	Females			Males			Total	
	n	%		*n*	%		*n*	
Sample size	96	61.94		59	38.06		155	
Ethnicity								
African American	2	2.08		7	11.87		9	
Asian	3	3.13		2	3.39		5	
Euro-American	68	70.83		37	62.71		105	
Hispanic	17	17.71		9	15.25		26	
Other	6	6.25		4	6.78		10	
Romantic Status								
Single	24	25.00		27	45.76		51	
Dating	28	29.17		24	40.68		52	
Monogamous	41	42.71		8	13.56		49	
Engaged	1	1.04		0	0		1	
Married	2	2.08		0	0		2	
Alcohol use status								
Abstainer	23	23.96		12	20.34		35	
Light drinker	58	60.42		25	42.37		83	
Heavy drinker	15	15.63		22	37.29		37	
Cigarette use status								
Non-smoker	54	56.25		16	27.12		70	
Trier	30	31.25		15	25.42		45	
Smoker	12	12.50		28	47.46		40	
Marijuana use status								
Non-smoker	58	60.42		19	32.20		77	
Trier	25	26.04		16	27.12		41	
Smoker	13	13.54		24	40.68		37	
	m	*S.D.*	*Range*	*m*	*S.D.*	*Range*	*m*	*S.D.*
Age	19.54	*1.26*	14-21	19.05	*1.55*	15-21	19.35	*1.39*

Table 2

Means, standard deviations and correlations among variables

Measure	*M*	S.D.	2	3	4	5	6
1. DDQ	-0.39	0.30	0.02	0.08	0.05	0.05	0.04
2. Most want to have sex with	7.59	3.38	---	0.72	0.42	0.59	0.06
3. Least want to have sex with	8.46	2.93		---	0.61	0.49	0.02
4. Most likely to have an STI	9.13	2.21			---	0.48	0.16
5. Least likely to have an STI	6.46	3.96				---	0.04
6. Photographs selected	13.14	9.53					---

Note: Denotes significance at $^{*}p < 0.05$; $^{**}p < 0.01$

Table 3

Correlation among SDT partner conditions, monetary discounting, and STI risk

	Most want to have sex with	Least want to have sex with	Most likely to have an STI	Least likely to have an STI	Monetary Discounting
Risky sex score	-0.21*	-0.06	0.10	-0.15	0.01
Male	-0.19	0.08	0.30*	-0.05	0.11
Female	-0.22*	-0.16	-0.07	-0.23*	-0.03
Sexual initiation					
Kiss	0.14	0.08	-0.08	0.00	0.02
Male	0.21	0.09	-0.23	-0.07	0.02
Female	0.04	0.05	0.06	0.04	-0.01
French kiss	0.12	0.04	-0.08	0.04	0.01
Male	0.19	0.05	-0.17	-0.03	-0.06
Female	0.05	0.02	0.01	0.09	0.03
Touch breasts	0.09	0.01	-0.15	-0.02	0.01
Male	0.08	-0.07	-0.36*	-0.16	-0.08
Female	0.05	0.05	0.04	0.08	0.02
Touch penis	0.08	-0.01	-0.14	0.00	0.04
Male	0.05	-0.11	-0.36*	-0.16	-0.09
Female	0.07	0.06	0.05	0.11	0.10
Touch vagina	0.06	0.01	-0.13	0.02	0.03
Male	0.05	-0.10	-0.35*	-0.13	-0.08
Female	0.05	0.07	0.05	0.13	0.07
Oral sex	0.14	0.04	-0.08	0.10	-0.003
Male	0.12	-0.13	-0.29*	0.02	-0.16
Female	0.16	0.17	0.09	0.17	0.07
Vaginal sex	0.13	0.02	-0.08	0.08	0.08
Male	0.05	-0.14	-0.27*	-0.08	-0.07
Female	0.18	0.12	0.07	0.18	0.14
Anal sex	0.07	0.00	-0.10	0.14	-0.16+
Male	-0.02	-0.01	-0.07	0.20	-0.10
Female	0.15	0.02	-0.09	0.11	-0.21*
Sexting	0.09	-0.09	-0.17	0.10	0.14
Male	0.32	0.14	-0.15	0.08	0.09

Female	-0.14	-0.20	-0.20	0.09	0.14
Condom use frequency					
Oral sex	0.15	0.07	-0.03	0.17*	0.05
Male	0.15	-0.05	-0.14	0.17	-0.04
Female	0.15	0.16	0.05	0.19	0.06
Vaginal sex	0.30*	0.26*	0.22*	0.34*	0.14
Male	0.22	0.25*	0.30*	0.29*	-0.08
Female	0.37*	0.28*	0.22*	0.39*	0.22*
Anal sex	0.11	0.14	0.14	0.22*	-0.16*
Male	0.02	0.13	0.36*	0.32*	-0.13
Female	0.20	0.17	0.01	0.17	-0.20*
Ever having unprotected sex					
Oral sex	0.05	-0.01	-0.13	0.04	0.09
Male	0.04	-0.16	-0.32*	-0.02	0.05
Female	0.06	0.09	0.01	0.08	0.09
Vaginal sex	0.37*	0.19*	0.04	0.23*	0.07
Male	0.40*	0.16	-0.16*	0.11	0.13
Female	0.36*	0.21*	0.15	0.30*	0.03
Anal sex	0.09	0.01	-0.09	0.11	-0.17*
Male	0.00	0.01	-0.04*	0.21	-0.08
Female	0.18	0.04	-0.09	0.06	-0.25
Lifetime partners					
Oral sex	-0.24*	-0.01	0.04	-0.26*	0.09
Male	-0.23	0.16	0.18	-0.26+	0.14
Female	-0.32*	-0.30*	-0.15	-0.31*	0.04
Vaginal sex	-0.27*	-0.03	0.05	-0.20*	0.11
Male	-0.25	0.07	0.14	-0.16	0.19
Female	-0.31*	-0.18	-0.3	-0.26*	0.01
Anal sex	-0.01	-0.01	0.09	-0.07	0.03
Male	0.14	0.10	0.12	-0.00	-0.04
Female	-0.13	-0.10	0.05	-0.13	0.10
Ever been tested for an STI	0.07	-0.01	-0.07	0.17*	-0.01
Male	0.00	-0.15	-0.19	0.05	-0.03
Female	0.11	0.07	0.00	0.25*	0.00
Use of drug before sex	-0.07	-0.10	-0.03	0.09	0.05
Male	0.01	-0.05	-0.05	0.17	0.12

Female	-0.31	-0.24	-0.18	-0.11	-0.33^{+}
Recently met partner					
Oral sex	0.11	0.11	0.00	0.17*	0.04
Male	-0.01	-0.02	-0.26^{+}	0.10	0.14
Female	0.20	0.20^{+}	-0.18	0.22*	-0.04
Vaginal sex	0.20*	0.09	0.04	0.13	0.06
Male	0.16	0.02	-0.09	0.14	0.10
Female	0.22*	0.14	0.13	0.10	0.01
Anal sex	-0.17*	-0.14	-0.09	-0.21*	0.01
Male	-0.23	-0.17	-0.10	-0.30*	0.07
Female	-0.06	-0.04	-0.03	-0.06	-0.14
Non-committed partner					
Oral sex	0.20*	0.06	-0.04	0.20*	0.09
Male	0.01	-0.14	-0.30*	0.10	0.17
Female	0.33*	0.19	0.10	0.26*	0.04
Vaginal sex	0.22*	0.03	-0.10	0.14	0.05
Male	0.16	0.02	-0.17	0.16	0.23
Female	0.24*	0.01	-0.11	0.10	-0.07
Anal sex	0.03	0.05	-0.10	0.02	-0.07
Male	-0.19	-0.05	-0.12	-0.17	0.12
Female	0.31*	0.19	-0.07	0.26*	-0.29*
Multiple partners					
Oral sex	0.19*	0.09	-0.10	0.12	0.09
Male	0.23	0.07	-0.15	0.06	0.27*
Female	0.11	0.09	-0.06	0.21*	-0.17
Vaginal sex	0.35*	0.12	-0.06	0.13	-0.01
Male	0.34*	0.12*	-0.06	0.04	0.01
Female	0.33*	0.10	-0.11	0.19	-0.04
Anal sex	-0.06	-0.08	-0.07	-0.12	0.06
Male	-0.11	-0.14	-0.11	-0.20	0.09
Female	---	---	---	---	---

Note: *Significant at $p \leq 0.05$; $^{+}$approaching significance

Table 4

Correlation among normalized SDT partner conditions and STI risk

	Most want to have sex with	Least want to have sex with	Most likely to have an STI	Least likely to have an STI
Risky sex score	-0.17*	-0.02	0.06	-0.09
Sexual initiation				
Kiss	0.11	0.06	-0.06	-0.05
French kiss	0.09	0.05	-0.06	-0.02
Touch breasts	0.06	-0.06	-0.11	-0.08
Touch penis	0.08	-0.03	-0.10	-0.04
Touch vagina	0.04	-0.05	-0.09	-0.05
Oral sex	0.09	0.00	-0.04	0.04
Vaginal sex	0.11	0.00	-0.04	0.02
Anal sex	0.02	-0.02	-0.09	0.13
Sexting	0.03	-0.20	-0.19	-0.04
Condom use frequency				
Oral sex	0.11	0.06	0.00	0.12
Vaginal sex	0.23*	0.19*	0.25*	0.27*
Anal sex	0.08	0.11	0.14	0.23*
Ever having unprotected sex				
Oral sex	0.00	-0.04	-0.10	-0.05
Vaginal sex	0.33*	0.15	0.07	0.20*
Anal sex	0.06	-0.01	-0.08	0.12
Lifetime partners				
Oral sex	-0.22*	0.01	0.02	-0.24*
Vaginal sex	-0.24*	-0.03	0.03	-0.20*
Anal sex	0.00	0.02	0.09	-0.05
Ever been tested for an STI	0.03	0.00	-0.05	0.11
Use of drug before sex	-0.08	-0.10	-0.02	0.08
Recently met partner				
Oral sex	0.10	0.09	0.02	0.15
Vaginal sex	0.21*	0.09	0.06	0.18
Anal sex	-0.15*	-0.13	-0.08	-0.17*
Non-committed partner				
Oral sex	0.18*	0.03	-0.02	0.18*
Vaginal sex	0.18*	0.01	-0.09	0.14
Anal sex	0.02	0.03	-0.09	0.04
Multiple partners				
Oral sex	0.18*	0.10	-0.07	0.12
Vaginal sex	0.33*	0.12	-0.05	016+
Anal sex	-0.09	0.02	-0.07	-0.14

Photographs selected (m = 13.14)	0.07	0.02	0.13	0.03

Note: *Significant at $p \leq 0.05$; +approaching significance

Table 5

Correlation among negative urgency, positive urgency, premeditation and STI risk

	Negative Urgency	Positive Urgency	Premeditation
Risky sex score	0.32*	0.25*	0.16*
Male	0.30	0.27	0.21
Female	0.37*	0.23	0.14
Sexual initiation			
Kiss	-0.04	-0.15	-0.22*
Male	0.11	-0.14	-0.36*
Female	-0.17	-0.14	-0.08
French kiss	-0.14	-0.18	-0.23*
Male	0.07	-0.13	-0.42
Female	-0.31*	-0.20	-0.08
Touch breasts	-0.27*	-0.23*	-0.11
Male	-0.25	-0.28	-0.13
Female	-0.29+	-0.16	-0.12
Touch penis	-0.26*	-0.23*	-0.10
Male	-0.25	-0.28	-0.20
Female	-0.27	-0.16	-0.10
Touch vagina	-0.26*	-0.22*	-0.09
Male	-0.25	-0.28	-0.12
Female	-0.28	-0.15	-0.09
Oral sex	-0.34*	-0.16	-0.08
Male	-0.38	-0.12	-0.05
Female	-0.37*	-0.20	-0.11
Vaginal sex	-0.27*	-0.24*	-0.06
Male	-0.42	-0.44*	-0.11
Female	-0.17	-0.10	-0.01
Anal sex	-0.22*	-0.12	-0.11
Male	-0.25	-0.07	0.04
Female	-0.23	-0.15	-0.22
Sexting	-0.24	-0.21	0.09
Male	-0.26	-0.31	-0.06
Female	0.07	0.00	0.02
Condom use frequency			

Oral sex	-0.17	0.00	0.02
Male	-0.18	0.15	0.04
Female	-0.19	-0.10	0.00
Vaginal sex	-0.21	-0.10	0.01
Male	-0.35*	-0.12	-0.20
Female	-0.17	-0.12	0.13
Anal sex	-0.17	-0.14	-0.11
Male	-0.10	-0.03	0.13
Female	-0.26	-0.26	-0.31*
Ever having unprotected sex			
Oral sex	-0.26*	-0.08	-0.07
Male	-0.35*	-0.01	-0.04
Female	-0.23	-0.15	-0.10
Vaginal sex	-0.33*	-0.22+	-0.06
Male	-0.36*	-0.29	-0.04
Female	-0.34	-0.20	0.14
Anal sex	-0.20	-0.19	-0.10
Male	-0.14	-0.18	0.06
Female	-0.31*	-0.23	-0.20
Lifetime partners			
Oral sex	0.29*	0.16	0.16
Male	0.28	0.09	0.16
Female	0.42*	0.27	0.17
Vaginal sex	0.28*	0.20	0.13
Male	0.19	0.12	-0.02
Female	0.35*	0.24	0.24
Anal sex	0.06	0.03	0.05
Male	0.00	0.02	-0.01
Female	0.17	0.06	0.18
Ever been tested for an STI	-0.09	-0.05	-0.04
Male	-0.02	0.13	-0.05
Female	-0.17	-0.17	-0.04
Use of drug before sex	0.11	0.10	-0.08
Male	0.10	0.11	-0.12
Female	0.07	0.00	0.02

Recently met partner			
Oral sex	-.20	-0.05	-0.14
Male	0.27	-0.04	-0.18
Female	-0.18	-0.10	-0.11
Vaginal sex	-0.33*	-0.21+	-0.09
Male	-0.44	-0.35*	-0.13
Female	-0.24	-0.08	-0.06
Anal sex	-0.04	0.09	0.02
Male	-0.04	0.13	0.19
Female	-0.14	0.04	-0.29
Non-committed partner			
Oral sex	-0.31*	-0.21+	-0.24*
Male	-0.27	-0.10	-0.18
Female	-0.36*	-0.32*	-0.29+
Vaginal sex	-0.28*	-0.24*	-0.24*
Male	-0.35*	-0.26	-0.27
Female	-0.22	-0.24	-0.21
Anal sex	-0.04	0.00	-0.06
Male	0.00	0.01	0.03
Female	-0.14	0.04	-0.29
Multiple partners			
Oral sex	-0.08	-0.13	0.01
Male	-0.14	-0.16	-0.05
Female	0.07	-0.06	0.12
Vaginal sex	-0.25	-0.15	-0.03
Male	-0.22	-0.19	0.02
Female	-0.25	-0.11	-0.09
Anal sex	-0.02	-0.01	0.14
Male	-0.03	0.00	0.21
Female	---	---	---

Note: *Significant at $p \leq 0.05$; +approaching significance

Table 6

Chi-square and analysis of variance results

	Monetary discounting *m*	Sexual discounting *m*	*Chi-square*		univariate ANOVA				Sex X Drug use status			
					Monetary		Sexual		Monetary		Sexual	
			X^2	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Alcohol use status			9.62	0.01	0.22	0.81	0.66	0.52	1.14	0.32	1.99	0.14
Abstainer	0.46	7.22										
Light drinker	0.50	6.86										
Heavy drinker	0.49	4.84										
Cigarette use status			24.60	<0.001	1.64	0.20	5.32	0.01	0.33	0.72	0.91	0.41
Non-smoker	0.48	7.57										
Trier	0.53	5.67										
Smoker	0.47	5.41										
Marijuana use status			17.14	<0.001	1.29	0.28	3.82	0.03	0.38	0.68	1.59	0.21
Non-smoker	0.49	7.14										
Trier	0.48	7.00										
Smoker	0.49	4.44										

Table 7

Mediation analysis of drug use and sexual discounting in predicting sexual risk behavior

	Effect of IV on M (a)	Effect of M on DV (b)	Total effect (c)	Direct effect (c´)	Indirect effect (*a* X *b*)	95% CI
Alcohol	-0.47*	-1.50*	14.96*	14.26*	0.70*	0.001-2.13
Cigarettes	-0.34*	-1.94*	7.26*	6.60*	0.67	-0.002-2.01
Marijuana	-0.37*	-1.79*	9.49*	8.83*	0.66	-0.006-2.03

Note: Denotes significance at $^{*}p < 0.05$