

## ABSTRACT

Title of Document: ASSOCIATIONS AND PATHWAYS  
BETWEEN SUBSTANCE INVOLVEMENT  
AND RISKY SEXUAL BEHAVIOR OVER  
THE LIFE COURSE OF URBAN AFRICAN  
AMERICANS

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African Americans are disproportionately affected by HIV/AIDS and other sexually transmitted infections (STIs) relative to other racial/ethnic groups. Substance involvement has been linked to risky sexual behavior, an important risk factor for HIV/STI transmission, relatively early in the life course; yet such associations have not been found consistently among African Americans. Understanding of how substance involvement relates to risky sexual behavior among men and women over time and into midlife remains limited. The goal of this study was to examine the associations and pathways between substance involvement and risky sexual behavior over the life course in a community-based urban African American cohort (n=1242) followed prospectively from age 6 to 42 years. Using a combination of structural equation modeling and mediation testing, the study examined (1) prospective associations (from adolescence through adulthood) and within-life stage associations

(in adolescence, young adulthood, and midlife) between substance involvement and risky sexual behavior, (2) the role of young adult social bonds as potential pathways linking substance use and risky sexual behavior over time, and (3) gender differences in the associations and pathways. The results revealed statistically significant positive associations between earlier substance involvement and subsequent risky sexual behavior over the life course among men and women. Greater adolescent substance use predicted greater midlife risky sexual behavior, partly through greater young adult substance problems and risky sexual behavior for both genders. Substance involvement was also positively correlated with sexual/risky sexual behavior in adolescence, young adulthood, and midlife among men and women. Although greater adolescent substance use predicted fewer young adult social bonds for both men and women, the latter was associated with decreased involvement in midlife risky sexual behavior among women only. Considered individually, young adult social bonds were not significant mediators of the adolescent substance use–midlife risky sexual behavior association for either gender. Given the complex pattern of associations and pathways between substance involvement and risky sexual behavior over time, public health interventions to address substance involvement among urban African Americans at any life stage, starting with adolescence, may have immediate and long-term effects, and direct and indirect effects on decreasing sex-related HIV/STI risk.

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AFRICAN AMERICANS

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# Chapter 1: Introduction

## 1.1 Problem Statement: Overview

HIV/AIDS and other sexually transmitted infections (STIs) can have multiple deleterious consequences on individuals and society, including increased morbidity and mortality, high treatment costs, loss of productivity, and social stigma (Corbett et al., 2002; Holtgrave & Pinkerton, 1997; Hubben et al., 2008; Hutchinson et al., 2006; Institute of Medicine [IOM], 1997; Mawar, Saha, Pandit, & Mahajan, 2005). African Americans suffer from disproportionately high rates of HIV/AIDS and other STIs, which contributes greatly to racial disparities in health (Centers for Disease Control and Prevention [CDC], 2007; Laurencin, Christensen, & Taylor, 2008; Newman & Berman, 2008). Recent data indicate that African Americans constitute approximately 14% of the U.S. population; yet nearly 44% of new HIV infections among individuals aged 13 years or older are found in this racial group (CDC, 2011a; CDC, 2013a). Other potentially serious STIs, such as chlamydia, gonorrhea, and syphilis also occur at disproportionately high rates among African Americans (CDC, 2011b). Thus, identifying modifiable risk factors for HIV/AIDS and other STIs in this group is of utmost importance.

Alcohol and drugs have been linked to risky sexual behavior and increased HIV/STI risk in diverse populations (Braithwaite & Stephens, 2005; Kingree & Betz, 2003; Seth, Wingood, DiClemente, & Robinson, 2011; Stueve & O'Donnell, 2005). Much of the work exploring the link between substance involvement and HIV/STI risk has focused on cross-sectional examinations or longitudinal studies of relatively

short duration (Guo et al., 2002; Strachman, Impett, Henson, & Pentz, 2009), usually involving adolescence and emerging adulthood (e.g., Bailey, Camlin, & Ennett, 1998; Hendershot, Magnan, & Bryan, 2010; Stueve & O'Donnell, 2005). Among African Americans, such studies have yielded somewhat inconsistent results: while some investigations found an association between substance use and risky sexual behavior in predominantly or entirely African American samples (e.g., Kingree & Betz, 2003; Seth et al., 2011; Stueve & O'Donnell, 2005; Wingood & DiClemente, 1998), others did not (e.g., Hallfors, Iritani, Miller, & Bauer, 2007; Halpern et al., 2004; Stanton et al., 1993). Additionally, studies focusing on earlier life stages may not adequately assess substance involvement as a risk factor for and/or correlate of increased HIV/STI risk throughout adulthood, particularly among African Americans.

Substance involvement has been shown to persist or even intensify among African Americans throughout adulthood (Caetano & Kaskutas, 1995; Kandel, Chen, Warner, Kessler, & Grant, 1997; Ma & Shive, 2000). Following a similar pattern, involvement in risky sexual behavior such as lack of condom use has been found to increase with age (Corneille, Zyzniewski, & Belgrave, 2008; Ford & Norris, 1994; Myers, Javanbakht, Martinez, & Obediah, 2003). These findings are particularly concerning given that the majority of new HIV/AIDS cases occur among individuals aged 25-44 years, and approximately half of those cases are diagnosed in African Americans (CDC, 2007). Thus, examining the relationships between substance involvement and HIV/STI risk across a substantial portion of the life course in a large African American cohort may help to elucidate the mixed findings, and extend the

investigation into midlife as a potentially important stage for continued intervention efforts addressing substance use and HIV/STI risk behaviors.

Aside from the prospective and contemporaneous associations between substance involvement and risky sexual behavior, another area of interest relates to how these associations evolve over time. Development of abuse and/or dependence symptoms in young adulthood may represent a progression from adolescent substance use (e.g., Flory, Lynam, Milich, Leukefeld, & Clayton, 2004; Gil, Wagner, & Tubman, 2004), particularly among African Americans whose adolescent substance use tends to be lower relative to Whites (Gil et al., 2004; Johnston, O'Malley, Bachman, & Schulenberg, 2009; Johnston, O'Malley, Bachman, & Schulenberg, 2013), but whose likelihood of developing adult substance use disorders may be greater (Gil et al., 2004). Additionally, earlier risky sexual behavior is frequently associated with subsequent sexual risk (e.g., Moilanen, Crockett, Raffaelli, & Jones, 2010; Morrison-Beedy, Carey, Feng, & Tu, 2008; Scott et al., 2011). Such evidence suggests that both young adult substance problems and risky sexual behavior may function as important links between adolescent substance use and midlife risky sexual behavior.

Age-appropriate conventional social roles, bonds, and ties may also be important to consider when examining pathways between earlier and later problem and deviant behaviors (Fothergill, Ensminger, Green, Robertson, & Juon, 2009; Hamil-Luker, Land, & Blau, 2004; Mason & Windle, 2002; Sampson & Laub, 1990; Sampson & Laub, 2005). Changes in social attachments to other individuals and community through marriage or partnership, parenthood, employment as well as

religious and organizational involvement may constitute important mechanisms for continuity and discontinuity of problem behaviors over the life course (Fothergill et al., 2009; Laub & Sampson, 1993; Nielsen, 1999; Roche, Ensminger, Ialango, Poduska, & Kellam, 2006). Specifically, early problem behaviors, such as adolescent substance use, can have negative effects on adult social roles and bonds (Brook, Richter, Whiteman, & Cohen, 1999; Green & Ensminger, 2006; Newcomb, 1997). Weak social bonds and low level of social integration, in turn, may predict involvement in potentially deleterious behaviors such as substance use and HIV/STI risk behaviors (Green, Doherty, Reisinger, Chilcoat, & Ensminger, 2010; Merline, O'Malley, Schulenberg, Bachman, & Johnston, 2004; Ramirez-Valles, Zimmerman, & Newcomb, 1998). Despite these links, however, there is a lack of investigations examining the extent to which weak or absent social bonds to other individuals and community may account for the associations between substance use and HIV/STI risk behavior, and the perpetuation of disadvantage throughout the life course. Such investigations may help to clarify the role of social bonding and integration in pathways linking the two behaviors among African Americans.

One factor that should be considered as a potential moderator of the associations between substance use and HIV/STI risk is gender. Associations between substance involvement and HIV/STI risk have been found to differ for men and women in diverse samples (Lavan & Johnson, 2002; Stueve & O'Donnell, 2005; Tapert, Aarons, Sedlar, & Brown, 2001). Such gender differences may be partially rooted in disparate consequences of substance involvement on health outcomes and risk behaviors experienced by men and women (Mason et al., 2010; Nolen-

Hoeksema, 2004). They may also be related to gender-based differences in power and control dynamics that occur in sexual relationships (Amaro & Raj, 2000; Rickert, Sanghvi, & Wiemann, 2002; Wingood & DiClemente, 2000). Aside from gender modification of the associations, differences between men and women may also exist in pathways to involvement in both behaviors (Ensminger, Brown, & Kellam, 1982; Fothergill & Ensminger, 2006; Green, Zebrak, Robertson, Fothergill, & Ensminger, 2012; Shrier, Harris, Sternberg, & Beardslee, 2001; Zimmer-Gembeck, Siebenbruner, & Collins, 2004), and in the explanatory mechanisms behind substance use and HIV/STI risk (Brodbeck, Matter, & Moggi, 2006). Given the evidence for gender as a potential modifier of the relationships between substance involvement and HIV/STI risk across racial/ethnic groups, it is important to examine gender-based differences in a life course study of these problems among urban African Americans.

This study is informed by the age-graded theory of informal social control (Sampson & Laub, 1990; Sampson & Laub, 1993), which emerged in the life course developmental perspective (e.g., Elder, 1994; Elder, 1998), and the related concepts of social integration (Durkheim, 1951; Umberson, 1987) and cumulative disadvantage (Dannefer, 2003; Sampson & Laub, 1997). With the recognition that deviant and problem behaviors often persist from adolescence into adulthood, the age-graded theory of informal social control focuses on the importance of age-appropriate conventional social bonds in helping to explain both continuities and discontinuities in such behaviors throughout the life course (Laub & Sampson, 1993; Sampson & Laub, 1992). In adulthood, social bonds to other individuals and community through marriage/cohabitation, parenthood, employment, and church and



organizational membership may function as sources of investment and social capital that promote social relationships and obligations, thus exerting a degree of informal control over individuals' behavior (Berkman, Glass, Brissette, & Seeman, 2000; Coleman, 1988; Laub & Sampson, 1993; Sampson & Laub, 1993; Umberson, 1987). Such formal and informal social ties are also important dimensions of social integration, or one's attachment to society (Fothergill et al., 2011), which may constitute an important source of conventional norms that discourage deviance and promote normative behaviors (Durkheim, 1951; Umberson, 1987). Thus, individuals whose bonds to society are attenuated or broken are more likely to engage in deviant or harmful behaviors (Durkheim, 1951; Sampson & Laub, 1990).

Based on the concept of cumulative disadvantage (Dannefer, 2003; Sampson & Laub, 1997), while some of the continued involvement in risk behaviors can be attributed to early (childhood) behavior and adversity (Fergusson, Horwood, & Ridder, 2005; Laub & Sampson, 1993), engaging in adolescent problem behaviors can have an attenuating effect on adult social bonding (Brook et al., 1999; Newcomb, 1997; Sampson & Laub, 1997). Disadvantage resulting from weak social bonds may in turn promote continuity in and/or emergence of new problem or risk behaviors (Fothergill et al., 2009; Green et al., 2010; Merline et al., 2004; Patterson, 1993; Sampson & Laub, 1992; Sampson & Laub, 1997; Sharp, 1998). In such a conceptual framework, substance use can be considered not only a correlate, but also an antecedent of other risk behaviors, such as high-risk sexual behavior. Furthermore, adolescent substance use may negatively affect participation in adult social roles and formation of age-appropriate social bonds. The resulting attenuation of social bonds

and integration may in turn increase involvement in both adult substance use and risky sexual behavior.

This dissertation aims to augment the current knowledge by investigating both prospective (direct and indirect) and contemporaneous associations between substance involvement and risky sexual behavior over the life course of an urban African American community-based cohort. This investigation encompasses examination of weak social bonds to individuals and community as potential pathways underlying the link between earlier substance use and subsequent HIV/STI risk, and exploration of gender as a modifier of the relevant associations and pathways.

## **1.2 Aims and Hypotheses**

This dissertation addresses the following research aims and accompanying hypotheses:

**Aim 1. To examine how substance involvement relates to risky sexual behavior over the life course.**

Extant evidence suggests that substance involvement is associated with risky sexual behavior and increased HIV/STI risk (Francis, 2003; Kingree & Betz, 2003; Leigh & Stall, 1993; Stueve & O'Donnell, 2005; Wang, Matthew, Chiu, Yan, & Bellamy, 2007), in both cross-sectional and prospective examinations (e.g., Guo et al., 2002; Stueve & O'Donnell, 2005; Tapert et al., 2001; van Gelder, Reefhuis, Herron, Williams, & Roeleveld, 2011). Substances such as alcohol and various drugs have been linked to risky sexual behavior (Fullilove et al., 1993; Hendershot et al., 2010; Sanchez, Comeford, Chitwood, Fernandez, & McCoy, 2002; Seth et al., 2011).

Based on the premises of the age graded theory informal social control (Laub & Sampson, 1993; Sampson & Laub, 1992; Sampson & Laub, 1993), individuals who engage in substance use early may be at an increased risk for subsequent involvement in the same and other deleterious behaviors, such as HIV/STI risk behaviors.

**H1a:** Greater adolescent substance use predicts greater involvement in young adult risky sexual behavior.

**H1b:** Greater young adult substance problems are associated with increased involvement in midlife risky sexual behavior.

**H1c:** Greater adolescent substance use predicts greater involvement in midlife risky sexual behavior, in part through increased young adult substance problems and greater young adult risky sexual behavior.

**H1d:** Substance involvement is positively associated with sexual/risky sexual behavior in adolescence, young adulthood, and midlife.

**Aim 2. To determine whether young adult social bonds constitute pathways between adolescent substance use and midlife risky sexual behavior.**

Involvement in problem behaviors over the life course may be partially explained by the cumulative continuity of disadvantage – a process of attenuation or erosion of adult social bonds (Laub & Sampson, 1993; Sampson & Laub, 1997). Social integration, defined as an attachment to society through formal and informal social ties to other individuals and institutions (Fothergill et al., 2011), may be similarly attenuated. Social roles and conventional bonds to other individuals and community may have a unique effect on health and behavior of African Americans relative to what has been uncovered among Whites (Jager, 2011; Nielsen, 1999; Rushing, Ritter, & Burton, 1992). Thus, it is important to investigate their individual contribution to explaining the relationships between substance use and HIV/STI risk, in addition to examining the pathway involving the overall social bonding/integration.

**H2a:** Greater adolescent substance use is associated with weaker overall young adult social bonding/integration, which in turn predicts greater midlife risky sexual behavior.

**H2b:** Examined individually, marriage/cohabitation, custodial parenthood, employment, religious service attendance, and social organization membership in young adulthood partially mediate the association between adolescent substance use and risky sexual behavior in midlife.

**Aim 3. To examine gender as a potential moderator of the associations and pathways between substance involvement and risky sexual behavior over the life course.**

Associations between substance involvement and risky sexual behavior throughout the life course have been found to differ for men and women (Lavan & Johnson, 2002; Stueve & O'Donnell, 2005; Tapert et al., 2001). Such differences may stem partly from the existing gender-based imbalances in power and control in sexual relationships (Amaro & Raj, 2000; Rickert et al., 2002; Wingood & DiClemente, 2000), which may become magnified in the context of substance use (Davis, George, & Norris, 2004; Ratner, 1993; Sharpe, 2001; Wingood & DiClemente, 1998). Gender modification may also exist for pathways leading to participation in these deleterious behaviors (Aalsma, Tong, Wiehe, & Tu, 2010; Ensminger, 1990; Ensminger et al., 1982; Ensminger, Juon, & Fothergill, 2002; Ford et al., 2005; Green et al., 2012; Shrier et al., 2001; Zimmer-Gembeck et al., 2004), suggesting the need to examine if and how the relationships between substance involvement and risky sexual behavior over the life course differ for men and women.

**H3:** The associations and pathways between substance involvement and risky sexual behavior throughout the life course differ for men and women.

### **1.3 Justification of the Problem**

Healthy People 2020 (Office of Disease Prevention and Health Promotion [ODPHP], 2010) outlines several national health improvement goals and objectives that address the continuing problems and needs in the areas of substance involvement, HIV/AIDS, and other STIs. In the context of HIV/AIDS prevention, two of the three major goals call for reduction in the number of people who become infected with HIV, and for reduction of HIV-related health disparities. Since culturally-tailored interventions aimed specifically at risk factors most relevant for African Americans, as well as those incorporating multiple levels of influence (including individual behavioral factors), have been shown to hold the most promise (Darbes, Kennedy, Peersman, Zohrabayan, & Rutherford, 2002; Jackson, Geddes, Haw, & Frank, 2012), continued efforts should be directed at identifying the most salient antecedents and correlates of risky sexual behavior and HIV/STI risk among members of this group.

In recognition of the link between substance involvement and HIV/AIDS among adolescents and adults, the Healthy People 2020 objectives highlight the need to “increase the proportion of substance abuse treatment facilities that offer HIV testing, HIV/AIDS education, counseling, and support” (ODPHP, 2010). However, as we search for the most effective prevention approaches, the presence of mixed evidence on the associations between substance use and HIV/STI risk among African Americans indicates a need to further evaluate the applicability of such recommendations to the members of this racial/ethnic group, particularly in urban settings where African Americans often face unique adversities (Williams & Collins, 2001). Results of additional examinations using all African American samples may

be helpful in gaining a better understanding of the relationships between these risk behaviors and harmful outcomes, potentially leading to refinement or modification of the more universal recommendations.

In addition to inconsistent findings, there is also a limited understanding of long-term substance use consequences on HIV/STI risk, and the mechanisms underlying the associations between these problems over time among African Americans. One of the important targets for HIV prevention based on the Healthy People 2020 goals and objectives are heterosexual individuals aged 15 to 44 years in recognition that the risk of infection, although potentially more pronounced among youth, is not limited to adolescence and young adulthood. Yet, as the subsequent literature review demonstrates, there is a dearth of studies examining the relationship between substance involvement and risky sexual behavior beyond the relatively early stages of the life course, particularly among urban African Americans. The need for such investigations is underscored by the previously mentioned evidence suggesting pronounced substance use and related problems that extend well beyond adolescence among African Americans (Caetano & Kaskutas, 1995; Doherty, Green, & Ensminger, 2008; Herd, 1990; Kandel et al., 1997; Ma & Shive, 2000), and the simultaneous tendency for certain HIV and other STI-related protective behaviors to decline with age (Corneille et al., 2008; Ford & Norris, 1994; Sheeran, Abraham, & Orbell, 1999). Beyond examination of prospective and contemporaneous associations, exploring the pathways from adolescent substance use to high-risk sexual behavior later in the life course may help to identify intermediate factors underlying these associations. Aside from providing a deeper understanding, such

information will add to the existing knowledge, and may eventually help in targeting and tailoring prevention efforts in the area of substance involvement and HIV/STI risk among African Americans.

One reason for the paucity of examinations exploring the substance involvement-risky sexual behavior association over time among minority populations is that longitudinal studies involving substantial portions of the life course are rare, potentially due to factors such as accessibility, cost, and the amount of resources required. Thus, having access to data from lengthy prospective studies provides a unique opportunity to examine how substance involvement relates to risky sexual behavior over the life course. Data from the Woodlawn Study, a rare longitudinal investigation of a community-based cohort of urban African Americans followed from age 6 to 42 years, enable a life course examination of alcohol and drugs not only as correlates, but also as potential antecedents of risky sexual behavior. This examination includes a relatively rarely explored later part of young adulthood and early part of midlife.

#### **1.4 Definitions**

The following are the definitions of key terms used throughout this dissertation:

*Adolescence*: typically a developmental period between the ages of approximately 12-18 years (Office of Children & Families in the Courts [OCFC], n.d.); among the Woodlawn cohort, adolescence is used to describe the life stage/data collection period when the participants were approximately 16-17 years of age.

*Conventional social bonds*: prosocial attachments to other individuals and community/society (e.g., through marriage/cohabitation, parenthood, or employment) (Laub & Sampson, 1993; Sampson & Laub, 1990).

*Cumulative disadvantage/continuity of disadvantage*: a potential for earlier adverse circumstances, processes, and behaviors to become perpetuated over the life course by influencing subsequent behavior and health, and contributing to intracohort differentiation (Dannefer, 2003; Ferraro & Kelley-Moore, 2003; Lynch, Kaplan, & Salonen, 1997; O’Rand & Hamil-Luker, 2005); in the context of the age-graded theory of informal social control, a process in which earlier problem behavior may influence subsequent involvement in deleterious behaviors by weakening adult social bonds (Sampson & Laub, 1997).

*Deviant behavior/deviance*: behaviors or actions that depart from or violate dominant social or cultural norms (Clinard & Meier, 2011; Macionis & Gerber, 2011); drug involvement, heavy or problem alcohol use, extensive adolescent sexual involvement, and certain sexual risk behaviors, such as exchanging sex for drugs or money, may be considered socially deviant (Benda & Corwyn, 1998; Clinard & Meier, 2011; Crosnoe, Erickson, & Dornbusch, 2002; Sharp, 1998; Whitbeck, Hoyt, Yoder, & Paradise, 2001); in the context of this dissertation, the term deviant/deviance is used in keeping with the original language of the theory, and/or to describe behaviors that do not conform to social norms.

*Health disparities*: according to the definition by Healthy People 2020, health disparity is a difference in health status strongly linked to social, economic and/or environmental disadvantages, and affecting certain groups who experience poor



health outcomes based on some characteristics such as race/ethnicity, socioeconomic status, religion, age, and/or gender (ODPHP, 2010).

*HIV/STI risk*: a potential for contracting HIV and/or other STIs, which may be linked to a variety of behavioral and contextual factors (CDC, 2012a; CDC, 2013b; Laurencin et al., 2003; Newman & Berman, 2008); in this dissertation *HIV/STI risk* represents a potential for contracting HIV and/or other STIs through risky sexual behavior.

*Informal social control*: regulation of or influence over deviant and/or high-risk behavior, which stems from conventional social bonds and social integration (Laub & Sampson, 1993; Umberson, 1978).

*Life course*: a term used to designate “a sequence of socially defined events and roles that the individual enacts over time” (Giele & Elder, 1998, p. 22); also developmental stages of life through which individuals move as they mature and age.

*Mediator*: a variable that accounts for or explains the association between an independent variable and a dependent variable (Baron & Kenny, 1986).

*Mid adulthood (midlife)*: typically a period of adulthood involving the ages of approximately 40-65 years (OCFC, n.d.); among the Woodlawn cohort, midlife is used to describe the life stage/data collection period when participants were approximately 42-43 years of age.

*Moderator*: a variable that affects the strength and/or the direction of the relation between an independent variable and an outcome (Baron & Kenny, 1986).

*Risky sexual behavior*: an umbrella term for various types of sexual behaviors that may increase the risk of contracting HIV and/or other STIs, including multiple sexual

partners, lack of or inconsistent condom use, and exchanging sex for money or drugs (Edwards, Iritani, & Hallfors, 2006; Khan et al., 2013).

*Sexually transmitted infections (STIs)*: Bacterial, parasitic, or viral infections acquired primarily through sexual contact with affected individuals (Mayo Clinic, 2014; National Library of Medicine, 2015).

*Social integration*: individual's attachment to society based on the existence or quantity of formal and informal social ties to other individuals and institutions (Durkheim, 1951; Fothergill et al., 2011; House, Umberson, & Landis, 1988).

*Substance use/involvement*: patterns (e.g. frequency) of use of various legal and illegal substances, including alcohol and drugs; involvement may include not only use, but also symptoms of abuse and dependence (Humeniuk et al., 2008; World Health Organization ASSIST Working Group, 2002).

*Substance/substance use problems*: harmful patterns of alcohol and drug use which include symptoms of abuse and/or dependence, and which may or may not involve clinically diagnosable disorders based on the criteria outlined in the relevant editions of the Diagnostic and Statistical Manual of Mental Disorders (DSM) (e.g., American Psychiatric Association [APA], 2000).

*Young adulthood*: typically a period of adulthood involving the ages of approximately 19-40 years (OCFC, n.d.); among the Woodlawn cohort, young adulthood is used to describe the life stage/data collection period when participants were approximately 32-33 years of age.

## Chapter 2: Literature Review

### **2.1 The Burden of HIV/AIDS and Other STIs among African Americans**

HIV/AIDS and other STIs impose enormous costs on individuals and society, including high treatment expenses, diminished productivity, elevated morbidity and mortality, and social stigma (Corbett et al., 2002; Holtgrave & Pinkerton, 1997; Hubben et al., 2008; Hutchinson et al., 2006; IOM, 1997; Mawar et al., 2005). Although much of the literature focuses on the seriousness of consequences related to HIV/AIDS infection, the frequently insidious sequelae of other STIs are no less important (IOM, 1997). For example, the health consequences of STIs include increased risk of HIV infection, infertility, chronic pelvic pain, certain types of cancers, and newborn disease, while social impacts may involve economic hardship, personal shame, and social stigma (IOM, 1997; Newman & Berman, 2008; Valentine, 2008).

The burden of new and existing infections with HIV and other STIs among African Americans is considered to be very high relative to other racial/ethnic groups, particularly compared to Whites (Barrow, Newman, & Douglas, 2008; CDC, 2007; Newman & Berman, 2008; Prejean et al., 2011; Valentine, 2008). During the period of 2001-2004, approximately 51% of the newly diagnosed HIV/AIDS infections occurred among African Americans (CDC, 2007). In 2003, 47% of 1.2 million individuals living with HIV in the U.S. were classified as non-Hispanic Blacks (CDC, 2006). Although African Americans constitute a fairly small percentage of the U.S. population, the rate of new HIV infections among members of this group has

surpassed the rates recorded for all other racial/ethnic groups (CDC, 2006; CDC, 2011a). In 2010, HIV infection rate for African American men was approximately seven times that of White men, and two times that of Hispanic men (CDC, 2012b). Among African American women, the rate of HIV infection was 20 times the rate among White women, and close to five times that of Hispanic women (CDC, 2012b). Evidence shows that most of the new HIV/AIDS diagnoses occurred among individuals aged 24-44 years, with African Americans constituting 48% of new cases in the 25-34 years age bracket, and 47% in the 35-44 years age bracket (CDC, 2007). Prevalence of HIV/AIDS is particularly high in urban areas with concentrated poverty (1.0%-2.3% versus 0.45% national average) (CDC, 2011d; CDC, 2013b). After being diagnosed with AIDS, African Americans tend to have the poorest survival rate of all racial/ethnic groups in the U.S. (CDC, 2005). Estimates indicate that in 2007 HIV/AIDS was the 9<sup>th</sup> leading cause of death among African Americans, and the third major cause of death for African American women and men between the ages of 35 and 44 years (CDC, 2011a).

In addition to HIV/AIDS, African Americans are also excessively burdened by other STIs. Over the recent years, increases in the rate of chlamydia (2003-2007), gonorrhea (2006-2007), and primary and secondary syphilis (2006-2007) infections were largest among African Americans compared to other racial/ethnic groups (CDC, 2008). In 2011, the rate of chlamydia infection among African Americans was approximately seven times the rate among Whites, and three times the rate among Hispanics, while the rate of gonorrhea was 17 times the rate reported for Whites, and eight times that of Hispanics (CDC, 2012a). Although it decreased somewhat overall,

the incidence of primary and secondary syphilis has remained disproportionately high among African Americans, with the rate of infection approximately eight times the rate among Whites, and three times that reported for Hispanics in 2010 (CDC, 2011b). Furthermore, approximately 33% of all chlamydia, 67% of all gonorrhea, and 50% of all syphilis cases in 2010 were diagnosed among African Americans (CDC, 2012a).

## **2.2 Sexual Contact, Risky Sexual Behavior, and HIV/STI Risk**

Sexual contact constitutes an important route of HIV/AIDS transmission among African American adolescents and adults (CDC, 2012b; Laurencin et al., 2008). In particular, heterosexual contact as a mode of transmission has been estimated to account for 14% of cumulative HIV cases and 10% of cumulative AIDS cases among African American men, and 45% of cumulative HIV cases and 42% of cumulative AIDS cases among African American women (CDC, 2005). More recent estimates for African American women indicate that as much as 87% of new HIV infections can be attributed to heterosexual sex (CDC, 2013a).

Among sexually active individuals, high-risk sexual behavior can substantially increase the risk of infection with HIV and other STIs (CDC, 2007; CDC, 2011b; CDC, 2012b; Laurencin et al., 2008; McCoy, Lai, Metsch, Messiah, & Zhao, 2004; National Institute of Allergy and Infectious Diseases, 2009; Newman & Berman, 2008). Risky sexual behavior constitutes a general category comprised of various behaviors, including involvement with multiple sexual partners, inconsistent or lack of condom use (Amirkhanian, Tiunov, & Kelly, 2001; Anderson et al., 1996; Bachanas et al., 2002a; Biglan et al., 1990; Catania et al., 1992; CDC, 2011c; Joffe et

al., 1992; Leigh, Temple, & Trocki, 1993), and exchanging sex for drugs or money (Edwards et al., 2006; King, Nguyen, Kosterman, Bailey, & Hawkins, 2012; Raj, Saitz, Cheng, Winter, & Samet, 2007; Windle, 1997). Given the general tendency of individuals to select sexual partners from the same racial/ethnic group, African Americans may often choose partners from limited pools and sexual networks with high prevalence of HIV/AIDS and other STIs (CDC, 2011a; Hallfors et al., 2007; Khan et al., 2009), thereby greatly increasing their risk for becoming infected with each new sexual encounter (CDC, 2011a). Thus, African Americans may be at greater risk of infection even when having only one sexual partner (Laumann & Youm, 1999), which may not constitute a definition of risk among other racial/ethnic groups.

Risky sexual behavior rarely occurs in isolation. Instead, as the literature review demonstrates, risky sexual behavior frequently occurs with other risk behaviors and problems, particularly substance involvement, underscoring the need to examine the latter as a potential antecedent and correlate of HIV/STI risk. Accordingly, this dissertation concentrates on investigating the relationships between various substances and risky sexual behavior throughout the life course.

### **2.3 African American Experience around Substance Involvement and Sexually Transmitted Infections**

Urban African American experience around substance involvement may be uniquely tied to certain contextual factors, such as disproportionate exposure to alcohol and drugs in economically disadvantaged urban neighborhoods. For example, researchers have found that urban areas with predominantly African American census

tracts have a substantially higher per capita concentration of outlets selling alcoholic beverages relative to other areas (LaVeist & Wallace, 2000). These outlets tend to increase the availability of alcohol destined for immediate consumption, by selling relatively inexpensive alcoholic beverages chilled and packaged in large quantities, which may facilitate frequent and excessive intake (Wallace, 1999). In addition to retail alcohol outlets, visible drug sales are also disproportionately concentrated in disadvantaged neighborhoods with limited resources (Ford & Beveridge, 2004; Saxe et al., 2001), increasing both access to and availability of drugs (Wallace, 1999).

Aside from physical availability of substances, African Americans have also experienced increased social availability of alcohol through intensive, targeted marketing efforts by the alcohol industry in low income urban communities (Wallace, 1999). Similar to the approach taken with tobacco products, billboards and other advertisements featuring alcohol, such as ads in magazines with predominantly African American readership, and sponsorship of athletic and other community activities have disproportionately targeted minority populations and communities (Wallace, 1999; Moore, Williams, & Qualls, 1996). Although not conducted through formal or legal channels, marketing of some drugs like crack cocaine has involved promoting them as aphrodisiacs (Fullilove, 2003), potentially increasing their popularity and uptake in urban communities.

Review of the extant literature suggests that substance involvement over the life course unfolds in distinct patterns among African Americans. In particular, while alcohol and drug involvement tends to be lower among African Americans relative to Whites in adolescence (Gil et al., 2004; Johnston et al., 2009; Johnston et al., 2013),

the opposite may be true in adulthood (Caetano & Kaskutas, 1995; Chen & Jacobson, 2012; Ensminger et al., in press; Kandel et al., 1997; Ma & Shive 2000; Nielsen, 1999). In what has been deemed a crossover effect (Ensminger et al., in press; Evans-Polce, Vasilenko, & Lanza, 2014), substance use tends to decrease throughout adulthood among Whites, while certain types of alcohol and drug involvement may persist or even intensify among African Americans (Kandel et al., 1997; Ma & Shive 2000; National Institute on Drug Abuse [NIDA], 2003; Nielsen, 1999). Indeed, despite the lower rates of adolescent substance use, African Americans are more likely to develop substance use disorders in adulthood (Gil et al., 2004). Although these paradoxical findings are yet to be explained, some have suggested the potential importance of cumulative strain, which may begin taking a negative toll on African Americans by early midlife, facilitating involvement in harmful coping behaviors such as substance use (Fothergill et al., 2009; Jackson, 2006).

Similar to substance involvement, the disparities and disproportionate burden of HIV/AIDS and other STIs affecting African Americans relative to other racial/ethnic groups should be considered in the context of the unique experiences of hardship and disadvantage throughout history and today. Discrimination, legacy of slavery and racism, and the not-so-distant memory of intentional abuses and harmful practices such as the Tuskegee Syphilis Study have left African Americans suspicious of interventions, and reluctant to seek HIV/STI-related testing and care (Laurencin et al., 2008; Thomas & Quinn, 1991; Valentine, 2008). Perhaps partly attributed to the historically rooted feelings of mistrust toward the medical and public health systems, HIV/AIDS conspiracy beliefs are endorsed in many African American communities



(Bogart & Thorburn, 2005). Prevalent HIV/AIDS conspiracy theories include a belief that the HIV virus has been artificially created by the U.S. government to exterminate the African American population as a form of racial/ethnic genocide (Gamble, 1997; Klonoff & Landrine, 1999; Thomas & Quinn, 1991). The existing suspicion and mistrust toward the medical system may be further exacerbated by the lack of cultural competence among health professionals (CDC, 2011c; Parrish & Kent, 2008), and experience of discrimination and judgmental attitudes within the medical system (Valdiserri, 2002; Valentine, 2008).

Given its association with sexual and drug use behaviors, HIV/AIDS has been heavily stigmatized (Brooks, Etzel, Hinojos, Henry, & Perez, 2005; Valdisseri, 2002). Stigma related to HIV/STI positive status and fear of discrimination may cause reluctance in African American communities to seek testing and counseling services (CDC, 2013a). Based on the prevalent family, community, and religious norms/values, homosexuality is still considered taboo in many communities of color (Brooks et al., 2005; Constantine-Simms, 2000; Ward, 2005). Combined with the existing HIV/AIDS-related stigma and discrimination, pronounced homophobia may be one of the reasons for African American men who have sex with other men to be nondisclosers of their sexual orientation, or to hide sexual encounters with other men while leading openly heterosexual lives, which may hamper prevention efforts and increase the risk of infection for both the men and their female partners (Brooks et al., 2005; CDC, 2003; Melabranche, 2003; Miller, Serner, & Wagner, 2005).

## **2.4 Theoretical Framework**

This dissertation is informed by the age-graded theory of informal social control (Laub & Sampson, 1993; Sampson & Laub, 1992; Sampson & Laub, 1993), as well as the concepts of cumulative disadvantage (Dannefer, 2003; Sampson & Laub, 1997), and social integration (Durkheim, 1951; Umberson, 1987). In general, life course and developmental theories focus on the role of early factors as well as subsequent adaptation in the development of long-term consequences on health and well-being (Berkman et al., 2000; Berkman & Kawachi, 2000; Elder, 1998). Problems that interfere with participation in and/or optimal timing of social and developmental events may hamper individuals' ability to reach important milestones throughout the life course, and create difficulties in transition from one life stage to another (Elder, 1998; Kellam, Branch, Agrawal, & Ensminger, 1975; Kellam & Ensminger, 1980; Kellam & Rebok, 1992). Similarly, maladaptation stemming from non-participation in key age-appropriate social roles, and lack of related social bonds to other individuals and community can affect behavior throughout the life course (Ensminger et al., in press).

Interest in social ties, bonds, and roles as potential determinants of behavior, health, and well-being is partially rooted in Emile Durkheim's seminal work on social integration and suicide (Berkman et al., 2000). Durkheim (1951) suggested that ties to family (e.g., through marriage and parenthood) and to community institutions help to integrate individuals into the fabric of society. Such integration provides a sense of purpose and serves as a source of social norms and obligations (Durkheim, 1951; Umberson, 1987). Changes and interruptions to social patterning can result in

attenuation of social bonds, norms, and related social integration, potentially leading to harmful behaviors such as suicide (Berkman et al., 2000; Durkheim, 1951). With the recognition of potential ways in which social determinants operate to influence behavior (e.g., social influence, attachment, and engagement) (Berkman et al., 2000), other theories focusing on the importance of social roles and bonds began to emerge.

One such theory arising within the life course developmental framework, the age-graded theory of informal social control (Sampson & Laub, 1990; Sampson & Laub, 1993), rests on the premise that antisocial or deviant behaviors are more likely to occur when bonds to society are weakened or broken. In this context, social integration operating through the structure of conventional bonds that link individuals to one another, to social institutions, and to their communities may be viewed as a source of informal social control (Laub & Sampson, 1993; Sampson & Laub, 1990; Umberson, 1987). Therefore, the erosion of social ties is thought to constitute a partial explanatory mechanism underlying the involvement in problem behaviors across the life course, above of and in complement to what can be explained by early factors and underlying propensity (Laub & Sampson, 1993). While strengthening of social bonding may prevent or decrease deviant and problem behaviors, its attenuation may precipitate occurrence of or increase in such behaviors (Agrawal & Lynskey, 2009; Merline et al., 2004; Sampson & Laub, 1990). Changes that affect social bonds may be either abrupt or incremental, and are best examined longitudinally over the life course (Sampson & Laub, 1990; Laub & Sampson, 1993). As the name “age-graded” suggests, different social bonds become more or less relevant depending on the stage of the life course (Sampson & Laub, 1990). In

adulthood, social ties of greatest relevance include marriage or cohabitation, parenting, employment, and church and organizational involvement (Ensminger et al., in press; Green et al., 2010; Laub & Sampson, 1993; Sampson & Laub, 1990).

Cumulative disadvantage is a complex process, which has been ascribed multiple meanings in the literature. Merton (1968) first used and described the contrasting concept of cumulative advantage in the context of his seminal work on the seemingly inequitable reward system among scientists. There, he used the term to explain how career paths of scientists in research settings undergo differentiation over time. According to Merton, the scientists who experienced success and recognition early on in their careers subsequently enjoyed greater advantages, resources, and support leading to productive and fruitful careers. This advantage was enjoyed by disproportionately few scientists relative to many others who did not experience early success and tended to have far less distinguished careers. Based on this explanation, both initial advantage and disadvantage can accumulate over the life course. The cumulative effects of advantage and disadvantage were referred to by Merton (1968) as the “Matthew effect,” from the Gospel of St. Matthew: “For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that little which he hath.” (p. 58).

Since its inception in the context of science careers, the process of cumulative disadvantage has been applied to explain intracohort differentiation in life course studies (Dannefer, 1987). Cumulative disadvantage perspective emphasizes the importance of early socioeconomic environment and processes to later health and

well-being (Dannefer, 2003; O’Rand & Hamil-Luker, 2005; Seabrook & Avison, 2012). Individuals exposed to early adversity such as poverty, family/residential mobility, residing in an economically disadvantaged neighborhood, being raised in single-parent household, and being exposed to poor parental mental health may experience both immediate and delayed as well as direct and indirect negative effects on health (DiPrete & Eirich, 2006; Ferraro & Kelley-Moore, 2003; Hatch, 2005; Johnson & Schoeni, 2011; Melchior, Moffitt, Milne, Poulton, & Caspi, 2007; O’Rand & Hamil-Luker, 2005; Stein et al., 2010). Early disadvantage can have a persistent long-term harmful effect not only on health outcomes, but also on individual behavior and lifestyle (Hayward and Gorman, 2004; Lynch et al., 1997; O’Rand, 1996). Cumulative disadvantage can be mitigated by various protective factors such as developing interpersonal ties, entering the workforce, joining peer groups, and becoming involved in religion (Hatch, 2005).

In the context of the age-graded theory of informal social control, the concept of cumulative continuity of disadvantage (Laub & Sampson, 1993; Sampson & Laub, 1997) is more narrowly defined. Specifically, this concept is used to explicate the process underlying the interplay between problem behaviors and social bonds/integration as crucial in explaining the continuity of problem behaviors throughout the life course. With the recognition that certain behavioral traits and propensities may also be of importance, earlier involvement in problem behavior is hypothesized to increase the likelihood of later antisocial or problem behavior through weakened or severed adult conventional social bonds (Laub & Sampson, 1993; Sampson & Laub, 1997). In this context, cumulative disadvantage may be

conceptualized as a process of earlier harmful behavior “knifing off” subsequent conventional options and opportunities (Caspi & Moffitt, 1995; Laub & Sampson, 1993). The process of cumulative continuity of disadvantage embedded in alienation from conventional roles and opportunities may be perpetuated throughout the life course affecting involvement in problem behaviors in a dynamic and systematic fashion (Sampson & Laub, 1997). Cumulative disadvantage may be particularly important in explaining the limited life opportunities of the disadvantaged urban poor where it may severely limit future options in conventional domains, and facilitate transitions into unconventional or marginalized societal and cultural subsets (Laub & Sampson, 1993; Sampson & Laub, 1997). Consistent with the age-graded theory of informal social control and the embedded process of cumulative disadvantage, this dissertation considers the deleterious effects of adolescent substance use on adult social bonding as one of the pathways to subsequent involvement in risky sexual activity.

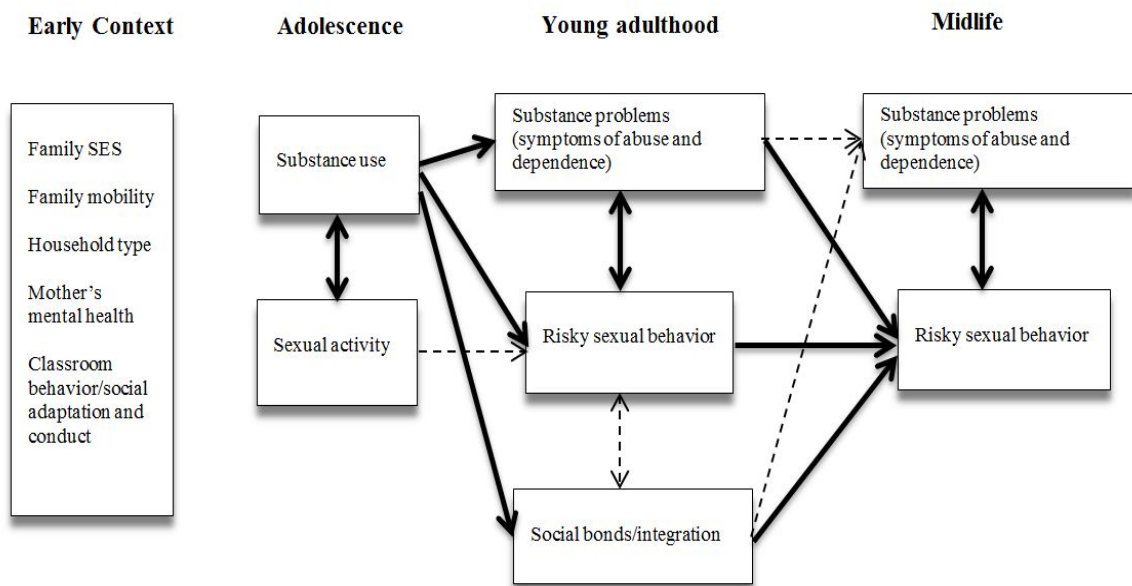
Combining influences from both sociology and criminology, the age-graded theory of informal social control has been used to guide studies of deleterious behaviors, such as crime (e.g., Laub & Sampson, 1993; Doherty & Ensminger, 2013) and substance involvement (e.g., Green et al., 2010; Nielsen, 1999). However, the theory has a far more general application potential in explaining a wider group of problem behaviors, and moving beyond continuity in the same behavior. Drawing on their previous work, and the work of others (e.g., Caspi & Moffitt, 1991; Gottfredson & Hirschi, 1990), Sampson and Laub (1992) explain that problem behaviors occurring early may not necessarily predict same behavior in the future. Instead, they

may predict other conceptually similar or analogous behaviors and problems in adulthood. Patterson (1993) likened this phenomenon to a *chimera*, positing that problem or antisocial behaviors that start early tend to undergo a cascade of qualitative and quantitative changes, with new forms of behaviors arising from the problem behavior core (Sampson & Laub, 1997). In other words, fueled by the accumulating disadvantage, with time, the original problem behavior can manifest or morph into other forms, including deviant or non-deviant behaviors and outcomes (Patterson 1993; Sampson & Laub, 1997). Thus, while adolescent problem behaviors such as substance use may continue or escalate through adulthood, they may also eventually become transmuted into other deleterious outcomes, such as problem substance use and involvement in risky sexual behavior (Mason et al., 2010). Socially and economically disadvantaged groups are particularly vulnerable to such shifts and changes in risk over the life course (Mason et al., 2010; Sampson & Laub, 1997).

## **2.5 Conceptual Model**

Informed by theory and existing literature, the conceptual model below depicts the hypothesized relationships between substance involvement and risky sexual behavior throughout the life course. Associations and pathways that are of interest to the current investigation are shown in bold face. Based on concept of shifts and transformations in problem behaviors suggested by the life course developmental theories, greater adolescent substance use is hypothesized to predict greater involvement in young adult risky sexual behavior, and greater young adult substance problems are hypothesized to predict increased involvement in midlife

risky sexual behavior. Furthermore, greater adolescent substance use is hypothesized to predict greater involvement in midlife risky sexual behavior in part through greater young adult substance use problems, and increased involvement in young adult risky sexual behavior. It is also expected that the two problems are positively related within distinct life stages. Additionally, while involvement in adolescent and adult problem behaviors may be partially attributed to early factors such as childhood social and behavioral maladaptation and early adversity, greater adolescent substance use is hypothesized to predict weaker young adult social bonding/integration, which in turn is associated with increased involvement in midlife risky sexual behavior.



*Figure 1.* Conceptual model depicting the hypothesized relationships between substance involvement and risky sexual behavior throughout the life course. Associations and pathways addressed in the current aims are shown in bold face.



## **2.6 Substance Involvement and Risky Sexual Behavior: Overview of Extant Evidence**

Among multiple factors thought to contribute to increased risk for HIV/AIDS and other STIs, substance involvement may be particularly salient. Evidence from the extant literature suggests that substance use may place individuals at increased risk for infection with HIV and other STIs through involvement in risky sexual behavior (Kingree & Betz, 2003; Leigh & Stall, 1993; Stueve & O'Donnell, 2005). Specifically, alcohol and/or drugs have been linked to such high-risk sexual behaviors as multiple sexual partners, unprotected sexual intercourse, exchanges of sex for drugs or money as well as self-reported and biologically confirmed STIs (Berger, Khan, & Hemberg, 2012; Hutton, McCaul, Santora, & Erbelding, 2008; Khan, Berger, Wells, & Cleland, 2012; Logan, Cole, & Leukefeld, 2002; Raj et al., 2007; Staton et al., 1999; Stueve & O'Donnell, 2005).

Various explanations have been offered in an effort to understand short-term effects of alcohol and drugs on sexual behavior. Some researchers suggest that substances may reduce the perception of risk and impair judgment, cognitive processing, and decision-making, while simultaneously lowering sexual inhibitions and enhancing sexual experience (Dausey & Desai 2003; Elkington, Bauermeister, & Zimmerman, 2010; George & Stoner, 2000; Leigh & Stall, 1993; Palepu et al., 2005; Stall, McKusick, Wiley, Coates, & Ostrow, 1986; Steele & Josephs, 1990). These factors may promote risky sexual behavior by decreasing the ability to negotiate and engage in safer sex practices, such as condom use (Elkington et al., 2010; George & Stoner, 2000; Scott-Sheldon et al., 2009). Additionally, sex-related alcohol and drug

expectancies, which involve beliefs and expectations about the way these substances affect sexual behavior, may promote sexual activity and facilitate sexual risk-taking (Dermen, Cooper, & Agocha, 1998; Hendershot et al., 2010; Kingree & Thompson, 2007). Certain stimulants, such as cocaine, may also heighten impulsivity (Fillmore & Rush, 2002; Lejuez, Bornovalova, Daughters, & Curtin, 2005), which in turn may increase involvement in high-risk sexual behavior (Lejuez et al., 2005).

Another explanation, frequently invoked in the context of crack cocaine and noninjection heroin involvement, focuses on the importance of exchanging sex for drugs or money (also called survival sex) especially in urban areas (Bailey et al., 1998; Fullilove, Fullilove, Bowser, & Gross, 1990; Sanchez et al., 2002; Word & Bowser, 1997). Such practices may increase the risk-promoting involvement with multiple partners (Bailey et al., 1998), and create an environment ripe for abuse in the light of diminished control over negotiating safe sex practices (Ratner, 1993; Sharpe, 2001), especially for women (Ratner, 1993; Sanchez et al., 2002; Sharpe, 2001).

Alcohol consumption may also increase vulnerability of some individuals, particularly women, to sexual exploitation, victimization, and assault (Davis et al., 2004; Nolen-Hoeksema, 2004; Testa, Livingston, & Collins, 2000). Finally, some researchers have suggested that the association between substance use and risky sexual behavior may be a spurious one (Cooper, 2002; Donovan, Jessor, & Costa, 1988; Kalichman, Heckman, & Kelly, 1996), explained instead by factors common to both behaviors (e.g., personality characteristics, attitudes, or beliefs) (Leigh, 1993; Weinhardt & Carey, 2000), particularly sensation-seeking (Kalichman et al., 1996).

and impulsivity (Caspi et al., 1995), which may function as general indicators for risk-taking propensity (Cooper, 1992; Leigh & Stall, 1993; Palepu et al., 2005).

Although much of the evidence from past studies lends stronger support for the temporal precedence of substance use to sexual initiation in adolescence (Brook et al., 2004; Kirby, 2002; Rosenbaum & Kandel, 1990), some studies with African American samples suggest that the reverse pattern—sexual initiation preceding substance use—may also be the case (Li et al., 2000; Stanton, Li, Cottrell, & Kaljee, 2001). Regardless of the temporal ordering of onset in adolescence, results of multiple studies suggest that substance involvement and risky sexual behavior tend to covary in adolescence and adulthood (e.g., Duncan, Strycker, & Duncan, 1999; Halpern et al., 2004; King et al., 2012). For example, among other findings, Whitaker, Miller, and Clark (2000) reported that out of 907 interviewed high school students, those who had two or more partners used more alcohol and marijuana than students with a single partner. Similar association was noted for those students who were planning to initiate sexual activity in the next year compared to those who did not. In latent model analysis involving individual, interpersonal, and organizational/community risk factors for HIV among sexually active minority adults, Wang et al. (2007) found that a latent construct combining alcohol, tobacco and other drug involvement was significantly related to sex with risky partners and drug-related sex. Analysis stratified by race/ethnicity revealed that these paths were significant for African American but not for Hispanic respondents. Van Gelder et al. (2011) examined the relationships between marijuana and cocaine use and risky sexual behavior using data from the 2002 National Survey of Family Growth. The men

(n=4928) and women (n=7643) were aged 15-44 years. The study found that those who used marijuana or cocaine (compared to non-users) initiated vaginal sex at younger ages (15.2-16.1 versus 17.3-17.5 years). Drug use was also associated with certain types of risky sexual behaviors in the past year, including sexual relations with non-monogamous partners, engaging in sex under the influence of alcohol or drugs, and exchanging sex for money or drugs. Most of the associations between drug use and risky sexual behaviors were statistically significant in both age groups examined (less than 25 and 26-44 years of age).

Past examinations of the associations between substance use and HIV/STI risk over time suggest that earlier substance use generally predicts subsequent risky sexual behavior, as well as acquisition of STIs (Berger et al., 2012; Khan et al., 2012; Staton et al., 1999; Stueve & O'Donnell, 2005). For example, Staton et al. (1999) investigated the relationship between adolescent alcohol and marijuana use and young adult sexual risk behavior. The findings revealed that increased substance use during adolescence was associated with riskier sexual behavior as well as increased alcohol and marijuana use at ages 19-21 years. In a prospective study of self-reported sexual risk-taking and substance involvement, Tapert et al. (2001) compared a sample of youth from substance abuse treatment programs to youth with no substance use disorder history. The youths were followed from age 15.5 to 21.5 years, and the measures of substance involvement (including both alcohol and drugs) and risky sexual behavior were collected over multiple waves of measurement. The authors found that youth in the substance abuse treatment sample (compared to non-substance abusing community youth) reported earlier onset for sexual activity, more sexual

partners, inconsistent condom use, as well as greater number of STIs. The relationship between substance involvement and risky sexual behavior continued as youth entered adulthood. Tapert et al. (2001) also reported that among participants from both samples, earlier substance involvement predicted high-risk sexual behavior at 6-year follow-up. Guo et al. (2002) conducted a longitudinal study of ethnically diverse urban youth, following them from age 10 to 21 years. These researchers investigated how various trajectories of adolescent substance use predicted risky sexual behavior at age 21. They discovered that after controlling for other substance use and early measures of sexual behavior, chronic binge-drinkers and late onset binge-drinkers had a greater number of sexual partners compared to those who did not engage in binge drinking. Relative to adolescents who did not use marijuana, late onset marijuana users had a greater number of sexual partners and greater odds of inconsistent condom use in early adulthood. However, other illicit drug use in adolescence, including the use of crack and other forms of cocaine, was not associated with subsequent risky sexual behavior.

Although the link between substance use and risky sexual behavior has gained considerable support, a closer examination and review of the existing literature helps to uncover somewhat mixed or inconsistent results (Halpern et al., 2004). In particular, while many investigations did reveal positive relationships between substance involvement and risky sexual behavior (Colfax et al., 2005; Edlin et al., 1994; Guo et al., 2002; Shillington, Cottler, Compton, & Spitznagel, 1995; Turner, Latkin, Sonenstein, & Tandon, 2011), some studies failed to find significant associations (Fortenberry, Orr, Katz, Brizendine, & Blythe, 1997; Leigh, 1993;

Leigh & Stall, 1990; Weatherburn et al., 1993). Results of extant studies also suggest both inter and intra-racial/ethnic differences in the relationships between substance use and sexual risk-taking. For example, while substance use has been linked to HIV/STI risk among Whites, such associations have not been found consistently for African Americans (Cooper, Peirce, & Huselid, 1994; Hallfors et al., 2007; Halpern et al., 2004). Closer examination reveals somewhat mixed findings for African Americans in particular, with some evidence supporting the presence of relationships between substance involvement (including alcohol and drugs) and sexual risk (Kingree & Betz, 2003; Seth et al., 2011; Stueve & O'Donnell, 2005; Word & Bowser, 1997), and other suggesting that the two are not related (Hallfors et al., 2007; Halpern et al., 2004; Kaestner & Joyce, 2001; Stanton et al., 1993). Such inconsistent results necessitate further investigations to elucidate the relationships between substance involvement and high-risk sexual behavior among African Americans.

#### 2.6.1 Alcohol and risky sexual behavior

One of the substances frequently examined in the context risky sexual behavior and increased risk for transmission of HIV/AIDS and other STIs is alcohol. Multiple studies have found that alcohol involvement (including use and problems) is associated with increase in sexual risk-taking and decrease in certain protective behaviors (Bryant, 2006; Dermen et al., 1998; Strachman et al., 2009; Stueve & O'Donnell, 2005; Weinhardt & Carey, 2000; Zimmer-Gembeck et al., 2004). These associations have been found both cross-sectionally (Bryant, 2006; McEwan, McCallum, Bhopal, & Madhok, 1992), and longitudinally (Khan et al., 2012; Stueve & O'Donnell, 2005; Zimmer-Gembeck et al., 2004). For example, Khan et al. (2012)

examined the relationship between adolescent alcohol use and young adult HIV/STI risk among participants of the National Longitudinal Study of Adolescent Health (n=10783). These authors found that alcohol use in adolescence predicted young adult sexual risk behaviors, such as inconsistent condom use and multiple sexual partners as well as self-reported and biologically confirmed STIs. Comparing African American and White respondents, the link between earlier alcohol use and subsequent inconsistent condom use was similar for members of both racial/ethnic groups; however, the association between earlier alcohol use and subsequent multiple sexual partnerships was stronger among African Americans. In addition, while adolescent alcohol involvement predicted adult self-reported STIs among African Americans and not among Whites, the reverse was true for biologically confirmed STIs.

Stueve and O'Donnell (2005) examined the associations between early alcohol use and subsequent alcohol involvement and sexual risk behavior among urban minority (predominantly African American) adolescents. After adjusting for early sexual initiation, they found that early drinking (grade 7) was associated with alcohol use and sexual risk-taking in mid-adolescence (grade 10). Students who initiated alcohol use early had greater odds of developing subsequent alcohol or drug problems, engaging in unprotected sexual intercourse, having multiple sexual partnerships, engaging in sexual intercourse under the influence of alcohol or drugs, and becoming pregnant through mid-adolescence. Seth, Wingood, and DiClemente (2008) conducted a study examining the associations between alcohol problems (as indicated by Cut down, Annoyed, Guilty, Eye opener [CAGE] screening), sexual behavior, and *Trichomonas vaginalis* (STI) infection in a sample of 366 HIV-

positive, predominantly African American women. These researchers found that experiencing alcohol problems was related to several high-risk sexual behaviors, including sex with spouse/partner under the influence of alcohol and testing positive for *T vaginalis*, even after adjustment for age and other substance use. In a later study Seth et al. (2011) examined the associations between alcohol use and risky sexual behavior as well as biologically confirmed STIs in a sample of adult African American women. They found that women who used alcohol at non-abuse levels were more likely to have multiple and risky partners in cross-sectional analyses, after adjusting for illicit drug use. In addition, controlling for baseline STI risk and illicit drug use, alcohol use was prospectively associated with testing positive for chlamydia and any STI as well as lack of condom use with a causal partner. In another recent study, Mason et al. (2010) found that late childhood alcohol use predicted young adult risky sexual behavior indirectly, through increase in adolescent alcohol involvement.

#### 2.6.2 Drugs and risky sexual behavior

Studies examining the associations between drug involvement and HIV/STI risk have often combined multiple substances instead of singling them out. Not only are various types of drugs often examined together, but drug involvement is frequently examined with alcohol involvement (e.g., Bachanas et al., 2002a; Staton et al., 1999; Tapert et al., 2001; van Gelder et al., 2011; Wang et al., 2007). Thus, it can be difficult to isolate the effect of a particular drug on risky sexual behavior. Nevertheless, a number of different drugs have been shown to increase HIV/STI risk. For example, studies have linked marijuana involvement to high-risk sexual



behaviors such as inconsistent use or nonuse of condoms, having multiple sexual partners, having sexual relations with casual partners, and to outcomes such as biologically confirmed STIs (Berger et al., 2012; Braithwaite & Stephens, 2005; Broman, 2007; Hendershot et al., 2010; Mertz et al., 2000). In a longitudinal study, Berger et al. (2012) examined the association between adolescent marijuana involvement and multiple sexual partnerships as well as self-reported and biologically confirmed STIs in young adulthood. Among other findings, analyses comparing African American and White respondents revealed that current marijuana use in adolescence predicted multiple sexual partnerships among African American men, and biologically confirmed STIs among Whites. In an ethnically-diverse sample of adjudicated youth, Hendershot et al. (2010) found cross-sectional and prospective associations between marijuana involvement and risky sexual behavior. In particular, the cross-sectional analyses revealed that both frequency of marijuana use and number of dependence symptoms were related to the use of marijuana before sexual intercourse, and to lower likelihood of condom use. In prospective analyses (at one-year follow-up), earlier marijuana use was associated with a subsequent STI diagnosis, while symptoms of dependence predicted lower frequency of condom use. Similarly, in a cross-sectional study, Kingree and Betz (2003) examined participant and partner alcohol and marijuana use in relation to, among other outcomes, two sex-related risk behaviors: absence of discussion about sexual risk and lack of condom use in a sample of African American male detainees. They found that personal marijuana use was related to both risk behaviors in bivariate analysis; however, in

multivariate analysis, personal use remained a significant predictor of condom nonuse only.

Another drug frequently linked to risky sexual behavior is crack cocaine. Current data indicate that crack cocaine use is higher among African Americans than among Whites (Substance Abuse and Mental Health Services Administration [SAMHSA], 2011). Soon after entering the urban scene, crack cocaine use increased to epidemic proportions (Cornish & O'Brien, 1996; Goldberger, Graham, Nelson, Cadet, & Gold, 2007; Golub & Johnson, 1996). The increase in popularity and involvement with crack cocaine in the late 1980s and early 1990s is strongly linked to increase in risky sexual behavior (Booth, Watters, & Chitwood, 1993; Hser, Chou, Hoffman, & Anglin, 1999; Fullilove et al., 1993), and partially blamed for the for the disproportionately high burden of HIV/AIDS in African American adolescent and young adult population (Word & Bowser, 1997). Cocaine involvement has been associated with multiple high-risk sexual behaviors (Braithwaite & Stephens, 2005; Fullilove et al., 1993), including low rates of condom use, multiple sexual partners, and exchanging sex for money and/or drugs (Fullilove et al., 1993; Word & Bowser, 1997). Urban crack cocaine users have been found to have higher rates of lifetime STI diagnoses (Word & Bowser, 1997), and to engage in risky sexual behavior even after HIV-positive diagnosis (Campsmith, Nakashima, & Jones, 2000).

There is a notable preponderance of cross-sectional studies of the relationship between crack cocaine and HIV/STI risk over longitudinal investigations. In one such study of young adult crack smokers and nonsmokers in three large urban areas, Edlin et al. (1994) found higher prevalence of HIV seropositive status among crack

smokers compared to non-smokers, particularly among women who had sex in exchange for drugs. In multivariate analyses, the higher prevalence of HIV-positive status among crack smokers was explained by risky sexual practices. In a sample of inner-city adolescents, Fullilove et al. (1993) found that crack cocaine users differed significantly from non-users on multiple high-risk sexual behaviors. For example, crack cocaine users had lower mean age at first intercourse than non-users. Users were also more likely to exchange sex for drugs or money, and to have sexual intercourse under the influence of drugs or alcohol. Gender-specific differences were also identified when comparing users and non-users among males and females (Fullilove et al., 1993). In particular, male crack users (relative to non-users) had a greater average number of sexual partners during the past year, and more frequent reports of one or more HIV/STI risk behaviors. On the other hand, compared to non-users, lower percentage of female crack users reported using a condom during the most recent sexual episode. In a logistic regression model involving the entire sample, crack use was found to predict one or more HIV/STI sexual risk behaviors (Fullilove et al., 1993). In yet another investigation of young adult African American male crack users in San Francisco, Word and Bowser (1997) found that compared to non-crack users, crack using men reported more sexual partners in the last 12 months, greater lifetime number of STIs, and more episodes of paying for sex and exchanging sex for drugs.

Heroin is commonly included in the injection drug use (IDU) category (e.g., Booth, Kwiatkowski, & Chitwood, 2000; Khan et al., 2013; Rondinelli et al., 2009). Therefore, early studies examining heroin in relation to HIV/AIDS infection focused

predominantly on injection-related or parenteral risk stemming from sharing contaminated needles and other equipment (Chitwood, Comeford, & Sanchez, 2003; Celentano, Latimore, & Mehta, 2008; Nelson et al., 2002; Strathdee et al., 2001; Strathdee & Sherman, 2003). Over time, it has been recognized that heroin involvement is also associated with indirect HIV/STI transmission through risky sexual behavior, such as unprotected sex, multiple sexual partners, and exchanging sex for money or drugs (Celentano et al., 2008; Gyarmathy, Neaigus, Miller, Friedman, & Des Jarlais, 2002; Kral et al., 2001; McCoy et al., 2004). Sexual contact is a particularly relevant route of transmission in cases when heroin is sniffed or snorted (Chitwood et al., 2003; Gyarmathy et al., 2002; Sanchez et al., 2002). This method of heroin administration is far more common among African American relative to White heroin users (Broz & Ouellet, 2008; Gyarmathy et al., 2002).

Review of the literature reveals several studies focusing on the association between heroin use and risky sexual behavior. For example, in their study of 180 HIV or hepatitis C virus (HCV) infected non-injecting heroin users (NIUs), Neaigus, Miller, Friedman, and Des Jarlais (2001) found that although many NIUs with either type of infection reported having lower risk sex partners in a 30-day period, they also reported engaging in unprotected sexual intercourse (33.3% of HIV-positive NIUs and 48.4% of HCV-positive NIUs). Gyarmathi et al. (2002) conducted interviews with 483 New York City NIUs who tested positive for HIV, hepatitis B virus (HBV), and HCV antibodies. The selected sample included both never injectors and former injectors of heroin. These authors found that among never injectors, the main route of infection with HIV was through unprotected sex. In another study, Sanchez et al.

(2002) recruited a sample of heroin sniffers with no history of injection drug use and at high risk for HIV infection in South Florida, U.S. These researchers found that both men and women reported multiple high-risk sexual behaviors, such as having multiple sexual partners, lack of or inconsistent condom use, and exchanging sex for drugs or money. Many of the interviewed participants also used marijuana and crack cocaine. Risky sexual behavior was greater among heroin sniffers who also used crack cocaine.

Studies examining other drugs, such as inhalants, hallucinogens, as well as prescription drugs like sedatives, tranquilizers, and stimulants in connection with risky sexual behavior are far less common. Nonetheless, extant literature has linked both inhalant nitrates and hallucinogens to risky sexual behavior, such as unprotected sex among men who have sex with other men (e.g., Halkitis & Parsons, 2002; Woody et al., 1999). Association has also been found between inhalant use and HIV seroconversion in the same population (e.g., Buchbinder et al., 2005; Chesney, Barrett, & Stall, 1998). Prescription drug misuse frequently co-occurs with illicit drug use (Berenson & Rahman, 2011; Johnson, Fibi, Langer, Silva, & Lankenau, 2013; Lankenau et al., 2012), and thus has been often examined along with other substances in relation to risky sexual behavior. However, misuse of opioids, tranquilizers, and stimulants has been linked with risky sexual behavior even after accounting for injection drug use (e.g., among injection drug users) (Johnson et al., 2013).

Longitudinal studies examining non-situational or event-specific associations and patterns between substance involvement and HIV/STI risk among urban African

Americans are notably lacking, which underscores the need to conduct such examinations both across the life course and within the distinct life stages. Even rarer are studies that include less commonly used substances as well as prescription drugs in connection with risky sexual behavior. Including multiple types of substances and looking at alcohol and drug problems (symptoms of abuse and/or dependence), which strongly suggest intensive and maladaptive use patterns (APA, 1987; APA, 2000), may provide a more comprehensive assessment of the effect of these substances on HIV/STI risk among urban African Americans.

## **2.7 Substance Involvement and Risky Sexual Behavior: The Relevance of Social Bonds**

Life course theories suggest that one's pathway through life involves entering age-appropriate social roles, and forming social bonds to other individuals and to community (Berkman et al., 2000; Elder, 1994; Ensminger et al., in press). The passage from adolescence to adulthood is a time of important changes as many young people enter into marriage, form attachments to the labor market through employment, and become parents (Ensminger et al., in press; Hogan & Astone, 1986; Schulenberg, O'Malley, Bachman, Wadsworth, & Johnston, 1996). Conventional social bonds to family through marriage/partnership and parenthood, as well as to community/society through employment, religious participation, and organizational membership involve a certain degree of commitment, investment, and obligations (Arnett, 1998; Durkheim, 1951; Laub & Sampson, 1993; Roberts & Pomerantz, 2004). Therefore, these adult ties are considered an important source of informal social control and overall social integration, both of which tend to reduce problem

behaviors and facilitate prosocial conduct (Durkheim, 1951; Hartnagel, 1996; Roberts & Pomerantz, 2004; Sampson & Laub, 1997; Umberson, 1987).

According to the theory of age-graded informal social control, delinquent behavior in adolescence can attenuate or erode conventional adult social bonds, thus decreasing informal social control associated with these bonds, and facilitating involvement in future problem behaviors (Laub & Sampson, 1993; Sampson & Laub, 1990; Sampson & Laub, 1997). Extant evidence provides support for the presence of deleterious effects of adolescent substance use on social bonding in adulthood (Krohn, Lizotte, & Perez, 1997; Newcomb, 1997; Schulenberg et al., 1996; Schuster, O'Malley, Bachman, Johnston, & Schulenberg, 2001), potentially weakening social integration. For example Green and Ensminger (2006) analyzed the Woodlawn Study data to examine the effects of heavy adolescent marijuana use on young adult marriage, employment, and patterns of parenthood. The study used propensity score matching to match marijuana users and nonusers on a range of early demographic and behavioral characteristics to reduce selection bias. Green and Ensminger found that heavy adolescent marijuana use predicted future unemployment and lack of marriage as well as less conventional pattern of parenthood, i.e. having children outside of marriage. Another examination of the Woodlawn Study data revealed that adolescent substance use was prospectively associated with less frequent church attendance in young adulthood (Fothergill et al., 2009).

Studies involving other samples and/or datasets reported similar results. For example, Brook et al. (1999) conducted a longitudinal study to examine whether earlier marijuana use affected, among other outcomes, participation in conventional

adult roles through marriage, parenthood, and employment in a sample of participants followed from childhood through young adulthood (late 20s). Brook et al. (2012) also examined the impact of conventional social bonds on subsequent marijuana involvement. These researchers found that more frequent marijuana use in adolescence and emerging adulthood was associated with being unemployed, unmarried, and experiencing unconventional parenthood by having a child out of wedlock. The results remained significant even after adjusting for multiple covariates, such as gender, age, and early family SES. Controlling for earlier marijuana involvement, Brook et al. also found that marriage in young adulthood reduced the risk of subsequent marijuana use. Additionally, in a review of his research, Newcomb (1997) reported finding that adolescent drug use was related to difficulties in multiple adult social areas including marriage, job stability, and social integration, even after controlling for propensity toward deviance and other baseline measures. Interestingly, there is a notable lack of studies examining the impact of adolescent substance use on adult social organization membership. However, the results of cross-sectional studies among youth (e.g., Bartkowski & Xu, 2007; Ramirez-Valles et al., 1998; Vieno, Nation, Perkins, & Santinello, 2007), suggest that civic involvement is inversely associated with problem behaviors such as substance use and risky sexual behavior. The cross-sectional links and the suggestion of growing salience of social organization involvement in young adulthood (Duke, Skay, Pettingell, & Borowsky, 2009; Flanagan & Levine, 2010; Hawkins, Kosterman, Catalano, Hill, & Abbott, 2008), together underscore the importance of examining the



potential role of this social tie in explaining problem behavior involvement throughout the life course.

Another group of studies examined the effect of conventional social roles and bonds on deviant or problem behaviors. The results suggest that while presence of attachments to family and community are predictive of decrease in problem behaviors such as general and problem substance use (Agrawal & Lynskey, 2009; Duncan, Wilkerson, & England, 2006; Fothergill et al., 2009; Umberson, 1987), weak conventional social bonds characterized by unemployment, lack of custodial parenthood, absence of marriage, and infrequent church attendance are associated with increased substance use, substance use problems, and/or substance use disorders (Bowie, Ensminger, & Robertson, 2006; Green et al., 2010; Merline et al., 2004). In addition to individual ties, an indicator of lower overall social integration defined by fewer conventional roles/bonds in young adulthood may be an important predictor of drug use onset and drug use disorder in midlife (Green et al., 2010).

Despite a plethora of studies investigating the way social bonds may affect substance use patterns, there is a surprising lack of examinations involving risky sexual behavior as an outcome. In fact, the majority of studies examining conventional bonds/roles in relation to risky sexual behavior have been conducted among youth, likely due to pronounced focus on HIV/STI risk in adolescent populations. Collectively, evidence from these studies suggests that in adolescence ties to school, family, church/religion, and community organizations may be associated with delayed sexual initiation, fewer sexual partners, and more frequent condom use (Bachanas et al., 2002b; Catalano, Haggerty, Oesterle, Fleming, &

Hawkins, 2004; Cohen, Farley, Taylor, Martin, & Schuster, 2002; McCree, Wingood, DiClemente, Davies, & Harrington, 2003; Ramirez-Valles et al., 1998; Zimmer-Gembeck & Helfand, 2008). In adolescence, bonds to family, school, and community may constitute important age-appropriate sources of prosocial activities and norms as well as informal social control (Ramirez-Valles et al., 1998; Sampson & Laub, 1990; Zimmer-Gembeck & Helfand, 2008), which suggests that adult social roles and ties may be equally important to examine in the context of HIV/STI risk. Rare cross-sectional studies among adults have found support for inverse associations between marriage/cohabitation (Dolcini et al., 1993; Peterson, Catania, Dolcini, & Faigles, 1993; Wayment et al., 2003) and religiosity/church attendance (Arnett, 1998; Gillum & Holt, 2010; Lefkowitz, Gillen, Shearer, & Boone, 2004), and risky sexual behaviors. Additionally, loss of custodial parenthood has been linked with increased sex-related risk among women (Sharp, 1998).

Results of past studies suggest that examining the sum of bonds/roles in which individuals are involved as a measure of overall social integration may be particularly effective in capturing the overall cumulative advantage (or disadvantage) in relation to problem behaviors (Green et al., 2010). Examining the contribution of individual adult social bonds in pathways leading to involvement in risk behaviors among African Americans may also be important. One reason is that participation in adult social roles may affect the health and well-being of urban African Americans differently compared to Whites (Jager, 2011; Rushing et al., 1992; Waldron & Jacobs, 1989). For example, in testing Sampson & Laub's (1990, 1993) age-graded theory of informal social control to examine racial/ethnic differences in the way adult social

bonds explained changes in heavy drinking, Nielsen (1999) found that while marriage explained frequent drunkenness for Whites, and to some degree for Hispanics, it had no effect on times drunk among African Americans. This divergence may be partially attributed to racial/ethnic differences in the role of social capital and informal social control associated with conventional roles and bonds in promoting successful transition into adulthood (Laub & Sampson, 1993).

Furthermore, examining church attendance as a measure of social bonding and integration may be especially relevant among African Americans. In general, African Americans tend to be more religious than members of other racial/ethnic groups (Chatters, 2000; Taylor, Mattis, & Chatters, 1999). Historically significant centers of leadership and support, African American churches constitute a potentially important source of social influence and control (Barnes, 2005; Billingsley, 1999; Du Bois, 2000; Johnson, Jang, Li, & Larson, 2000; Krause, 2004; Krause, 2006), which may be particularly relevant in the context of problem and risk behaviors (e.g., Fothergill et al., 2009; Johnson et al., 2000).

## **2.8 Gender as a Moderator of the Relationships between Substance Involvement and Risky Sexual Behavior**

Extant evidence suggests gender differences in the relationships between substance use and HIV/STI risk. For example, Stueve and O'Donnell (2005) reported that while early drinking was associated with subsequent alcohol problems for both genders, this behavior was also related to sexual initiation and recent sexual intercourse among women only. Bailey et al. (1998) examined the associations between marijuana and crack cocaine use and risky sexual behavior among

predominantly African American homeless and runaway youth. These researchers found that male drug users were approximately twice as likely as their female counterparts to use condom during the last sexual encounter. In a study looking at adolescent substance involvement and young adult risky sexual behavior, Staton et al. (1999) found gender differences in early substance use and sexual initiation patterns, as well as in the link between earlier substance use and subsequent high-risk sexual behavior. Regarding prospective associations, Staton et al. (1999) uncovered that while the number of sexual partners in the last 3 months varied depending on the frequency of adolescent substance use among young men, women reported similar numbers of sex partners regardless of earlier substance use patterns. The study also found that women were more likely to report condom use irrespective of earlier frequency of substance use. In another investigation, Tapert et al. (2001) reported that the association between substance use and risky sexual behavior during the transition from adolescence to young adulthood was stronger for men relative to women. Women in this study were less likely than men to have multiple sexual partners; yet women reported greater number of STIs than their male counterparts. Lastly, Lavan and Johnson (2002) found that although substance use was associated with risky sexual behavior among both men and women, substance use disorders were related to elevated number of lifetime sexual partners among women only. Although somewhat inconsistent regarding direction and patterns, collectively these studies suggest the need to examine gender differences in the associations between substance use and HIV/STI risk over the life course.

One potential explanation for the observed gender differences is that they are partially rooted in power imbalances between men and women, which may be embedded in the notions about traditional gender roles, and expressed through the dynamics of sexual relationships (Amaro & Raj, 2000; Blanc, 2001; Wingood & Diclemente, 2000). Traditional stereotypical gender roles tend to emphasize passivity and faithfulness to one partner as desirable characteristics among women, while regarding promiscuity and multiple sexual partnerships as expressions of masculinity among men (Amaro, 1995; Amaro & Raj, 2000; Aronson, Whitehead, & Baber, 2003; Prentice & Carranza, 2002; Wingood & DiClemente, 2000). Despite the strides toward greater gender equality, women continue to perceive having limited ability to make decisions about certain aspects of sexual encounters and behavior, such as contraception use (Pulerwitz, Amaro, De Jong, Gortmaker, & Rudd 2002; Rickert et al., 2002). Control over certain protective behaviors in sexual relationships has traditionally rested with men (Amaro & Raj, 2000). This is particularly true of the male condom, which necessitates different behaviors for men and women (Weinhard & Carey, 2000). While men are able to directly control condom application, women may need to exert indirect influence over condom use by their male partners through effective negotiation (East, Jackson, O'Brien, & Peters, 2007; Weinhard & Carey, 2000).

Power differentials and gender stereotypes in sexual relationships may become magnified in the context of substance involvement. For example, condom use negotiation may be more difficult and less effective when substances are involved (Lotfi, Tehrani, Yaghmaei, & Hajizadeh, 2012; Scott-Sheldon et al., 2009; Sly,

Quadagno, Harrison, Eberstein, & Riehman, 1997; Wingood & DiClemente, 1998). Experimental evidence suggests that alcohol consumption and/or intoxication may increase women's vulnerability to acquiesce to unwanted sexual advances and view their male partner's aggressive behavior as acceptable (Davis et al., 2004; Testa et al., 2000). Women crack cocaine users, particularly those from impoverished inner-city areas may be especially vulnerable to exchanging sex for money or drugs (Edlin et al., 1994; Fullilove, Lown, & Fullilove, 1992; Ratner, 1993; Wingood & DiClemente, 2000). Such exchanges are often characterized by exposure to multiple, at times anonymous partners, and simultaneous decrease in the power and ability to negotiate safe sex through condom use (Ratner, 1993; Sharpe, 2001), which may place female crack cocaine users at greater risk for infection with HIV and other STIs (Edlin et al., 1994).

Studies examining pathways to involvement in substance use and risky sexual behavior (Ensminger et al., 1982; Fothergill & Ensminger, 2006; Green et al., 2012; Shrier et al., 2001; Zimmer-Gembeck et al., 2004), as well as mediators of the substance involvement–risky sexual behavior relationship (Brodbeck et al., 2006) have also produced some evidence to support the presence of gender differences. Theories focusing on the relevance of social bonds and integration in the context of risk behaviors do not specifically address the issue of gender differences (Mason & Windle, 2002). In fact, Sampson and Laub's seminal work on the importance of conventional social bonds involved data from an all-male cohort (e.g., Laub & Sampson, 1993; Sampson & Laub, 1990). Yet, there is some evidence suggesting that adolescent problem behavior may affect adult conventional bonds differently for

men and women (e.g., Blair, 2010). Thus, it is important to consider potential gender differences not only in the context of the associations between substance use and risky sexual behavior, but also when examining pathways between these two behaviors.

## **2.9 Antecedents and Risk Factors for Substance Involvement and Risky Sexual Behavior**

Life course theories suggest the importance of early socioeconomic factors to subsequent health and well-being across the life course (Berkman & Kawachi, 2000; Dannefer, 1987; Elder, 1998; O’Rand & Hamil-Luker, 2005; Seabrook & Avison, 2012). Exposure to early adversity such as poverty, family/residential mobility, residence in a socially disadvantaged area, being raised in a single-parent household, and poor parental mental health can have both immediate and long-term persistent harmful effects on health and well-being (DiPrete & Eirich, 2005; Ferraro & Kelley-Moore, 2003; Hatch, 2005; O’Rand & Hamil-Luker, 2005; Stein et al., 2010). Early disadvantage may also affect subsequent substance and risky sexual behavior involvement (Fergusson et al., 2005; Fergusson & Woodward, 2000). Therefore, it is important to account for the potential influence of early socioeconomic circumstances and processes when examining the associations between substance involvement and risky sexual behavior.

The age-graded theory of informal social control suggests that certain childhood traits and behavioral characteristics may contribute to or influence subsequent involvement in problem behavior (Sampson & Laub, 1993; Sampson & Laub, 1997). Evidence from extant studies lends support for the link between early

behavioral and social adaptation factors, and the emergence of problem behaviors in adolescence and beyond (Compas, Hinden, & Gerhardt, 1995; Ensminger et al., 2002; Farrington, Loeber, & Van Kammen, 1990; Fergusson et al., 2005; Fergusson & Woodward, 2000). With regard to substance use, previous Woodlawn studies found that teacher's ratings of aggression (less acceptance of authority) was prospectively related to increased substance use in adolescence and indirectly in adulthood (Fothergill & Ensminger, 2006; Fothergill et al., 2009; Kellam, Brown, Rubin, & Ensminger, 1983). Others studies reported similar associations for variations in aggressive behaviors (Brook, Whiteman, Finch, & Cohen, 1996; Hawkins, Catalano, & Miller, 1992). Adding other measures of early social adaptation, Green et al. (2012) found that a latent construct of poor classroom behavior, composed of indicators for immaturity, restlessness, aggressiveness, and conduct problems was related to adolescent substance use among male Woodlawn Study participants.

Similar connection for aggressive behavior may exist in relation to sexual involvement. For example, aggression has been linked to initiation of sexual activity in adolescence (Miller-Johnson et al., 1999; Zimmer-Gembeck & Helfand, 2008). In addition, early attention problems such as restlessness, inattentiveness, and hyperactivity have been prospectively linked to later risky sexual behavior (Fergusson & Woodward, 2000). Finally, studies looking at antecedents and correlates of both substance use and risky sexual behavior simultaneously have linked aggression and other measures of behavioral dysregulation to both behaviors (e.g., Caspi et al., 1995; Mezzich et al., 1997; Timmermans, van Lier, & Koot, 2008). Given the theoretical recognition and supporting evidence for the importance of early behavioral and social



adaptation in influencing later involvement in risk or problem behaviors, it is important to control for these measures when examining the associations and pathways between substance involvement and HIV/STI risk.

## **2.10 Overview of Interventions in the Area of Substance Involvement and HIV/STI Risk**

Considerable number of interventions focusing on substance involvement and HIV/AIDS has been conducted in adolescence and emerging adulthood (Darbes et al., 2002; Jackson et al., 2012). They are reviewed here as it is expected that this investigation will inform preventive interventions. In a systematic review, Jackson et al. (2012) found that effective interventions with adolescents and young adults tended to involve one or more domains or levels of influence, such as individual, peer, family, school, and community, with many focusing on preventing multiple, instead of specific risk behaviors. Based on the findings by Jackson et al., the effects of such interventions on substance use and risky sexual behaviors have been mixed and somewhat inconsistent. In particular, of the relatively rare interventions reporting on both outcomes, some were only able to affect one and not the other type of risk behavior, or only certain indicators of each risk behavior. In addition, many interventions were found to have only temporary effects, with results varying based on factors like gender (Jackson et al., 2012).

Some programs focusing specifically on substance use among youth were prospectively evaluated for a potential effect on young adult HIV/STI risk. For example, a school-based intervention focusing on drug prevention (changing drug use-related norms and increasing the ability to resist drug use pressures) called

Project ALERT was shown to reduce the likelihood of engaging in risky sexual behavior, such as having multiple sex partners and unprotected sex because of drug use 5-7 years post intervention (at age 21) (Ellickson, McCaffrey, & Klein, 2009; Jackson et al., 2012). The evaluation revealed no significant gender differences in the effectiveness of the intervention, and no measurable impact on inconsistent condom use (Ellickson et al., 2009). The changes in risky sexual behavior were mediated in part by reduction in alcohol and drug abuse (Ellickson et al., 2009). The results, however, should be interpreted with caution, as this long-term evaluation suffered from notable methodological weaknesses, namely a strong possibility of selection bias and high attrition (Jackson et al., 2012). Griffin, Botvin, and Nichols (2006) evaluated a long-term impact of a school-based drug prevention trial conducted in grades 7, 8, and 9 on HIV risk behavior in young adulthood (average age of 24). These researchers found that the intervention was successful in decreasing HIV risk behaviors at adult follow-up. Among participants who received at least 60% of the intervention, decrease in young adult HIV risk behaviors was mediated in part by reduction in growth of alcohol and marijuana intoxication throughout adolescence (Griffin et al., 2006). However, the young adult HIV risk behavior outcome combined risky sexual behaviors and high-risk substance use, thus making it difficult to isolate the effect of the intervention on risky sexual behavior alone (Ellickson et al., 2009). Together, the results of these interventions suggest potentially complex prospective links between substance involvement and risky sexual behavior, which should be further explored in life course studies.

Although, intervening early before problem and risk behaviors emerge in adolescence constitutes an ideal prevention approach (Jackson et al., 2012; Schantz, 2002), interventions are also needed among adults who engage in substance use and risky sexual behavior. Number of interventions targeting HIV/STI risk behaviors among adults have been conducted in inpatient substance abuse treatment programs/facilities in recognition of their potential to capture high-risk individuals, and thus play an important role in prevention and control of HIV/AIDS (Darbes et al., 2002; SAMHSA, 2010). Overall, the results of such interventions have been encouraging (Darbes et al., 2002; Prendergast, Urada, & Podus, 2001). Yet, they leave much ambiguity with regard to the nature of the relationships between substance use and HIV/STI risk, particularly among African Americans. Darbes et al. (2002) provided a systematic review of HIV/AIDS prevention/intervention efforts among African Americans. One such intervention was conducted among 152 male African American patients in a drug dependence treatment program. Relative to a standard information control, a theory-based psycho-educational intervention that included information and skill building was associated with a decrease in HIV risk behaviors and increase in condom use skills at 3-month follow-up (Darbes et al., 2002). Specifically, the percentage of individuals classified as high-risk based on their behavior at baseline decreased from 75% to 32%. Thus, it appears that the effect of the HIV/AIDS intervention on risk behavior was independent of the drug dependence treatment, as the latter was held constant (i.e., the same for both groups). However, the number of partners decreased in both group (i.e., independent of the intervention) (Darbes et al., 2002).

Another theory-informed intervention targeting heterosexual risk behavior was conducted among poor African American women, many of whom were recruited from drug recovery programs in Los Angeles (Darbes et al., 2002). Based on the description by Darbes et al. (2002), one group received standard HIV/AIDS education as part of the intervention, while the second group received a culturally appropriate enhancement. At a 2-year follow-up, women in both groups reported decrease in HIV/AIDS risk behaviors relative to baseline. Compared to standard education, the enhanced intervention appeared to also decrease drug use behavior. Because the HIV/AIDS risk behaviors decreased at the same rate for both groups (control and intervention), it is possible that the drug dependence treatment that many of the women were also receiving could have produced the overall decrease in HIV/STI risk (Darbes et al., 2002).

Systematic reviews of interventions in the area of substance involvement and HIV/AIDS indicate that the most promising interventions are those grounded in theory, culturally targeted toward African Americans and their unique needs, and those incorporating skill training and involving multiple levels of influence (Darbes et al., 2002; Jackson et al., 2012). Yet, it has been suggested that the primary reason for decrease in AIDS-related deaths is the recent advances in treatment, rather than changes in risk behaviors associated with HIV transmission (Griffin et al., 2006). Such findings underscore the continued need for development of effective interventions that focus on prevention of infections with HIV and other STIs, and incorporate behavior change as well as community and policy-level components.

Given the severity of HIV and other STI burden in African American communities (CDC, 2012a; CDC, 2013a), there is a continued need for interventions focusing on members of this racial group, taking into consideration potential gender differences, and incorporating a life course perspective. Development of such interventions must be informed by research involving predominantly or entirely African American cohorts. Findings from prospective and contemporaneous examinations of the relationships between substance involvement and risky sexual behavior can add to the existing knowledge, to help with determining how these behaviors/outcomes should be addressed in interventions. If substance involvement and risky sexual behavior are related, it is possible that addressing one type of risk may also produce positive changes in the other. If the two are not associated, each may need to be addressed independently. Exploring theory-informed pathways can help with identifying new targets, particularly those most relevant for urban African Americans, to inform intervention content. Furthermore, examining gender differences can aid in designing interventions optimally targeted to the needs of African American men and women.

## Chapter 3: Methods

### 3.1 Description of the Population and the Study

To address the proposed aims and hypotheses, this examination used data from the Woodlawn Study, a prospective community cohort study of urban African American children and their families (Ensminger et al., 2002; Ensminger, Juon, Lee, & Lo, 2009; Kellam et al., 1975; Petersen & Kellam, 1977). Located on Chicago's south side, Woodlawn was one of 76 neighborhoods that made up the City of Chicago. The sections below provide a detailed description of the Woodlawn Study based on the information on study background, inception, and progression provided by Kellam et al. (1975) unless otherwise indicated.

The Woodlawn study began in 1966-67 with a partnership involving the University of Chicago, the Chicago Board of Health, the Woodlawn Mental Health Center, the Woodlawn schools, and the Woodlawn community. Few years before the study commencement, Woodlawn community leaders advocated for creation of a mental health clinic that would serve the local community. Once the commitment of support for the mental health center in Woodlawn was obtained from the City of Chicago, the State of Illinois, and the University of Chicago, the university psychiatrists involved in the process approached various community members and leaders about developing mental health programs to meet the community's needs.

Once the community support was obtained, the study team sought active involvement by the community in any decision-making related to processes such as policy setting, prioritizing, and programming, both at the inception of the study and throughout the project. Consequently, an advisory board comprised of leaders from

the existing community organizations representing different constituencies was formed specifically for the purpose of approval and active collaboration. In setting community priorities, the advisory board members soon decided that the Woodlawn children should be the focus of the programs, due to ongoing concerns about the children's well-being, future, and the capacity of the public school system to meet the children's needs. First grade was thought to constitute an important time of transition and change in the lives of the children. Based on this reasoning, and with full support of the Woodlawn schools, first grade children were selected as the target of a first-level assessment and intervention. The project's major goal was to examine two dimensions of mental health of the Woodlawn children: societal dimension (involving society's perceptions of children's social performance), and individual dimension (involving children's psychological well-being) in order to determine the nature of their association during the early school years.

Consequently, the study began with an assessment of 1242 predominantly (99%) African American first grade children attending nine public and three parochial schools in Woodlawn (Ensminger, Juon, & Green, 2007). All families of first graders in the community were invited to take part in the study, and only 13 families declined participation (Ensminger et al., 2002). According to Kellam et al. (1975), as part of the study design, the Woodlawn schools were divided into two matched groups. One group was randomly assigned the intervention status, while the other group was designated as control schools. The intervention schools participated in a classroom-based intervention program grounded in baseline assessments and the conceptual life course framework. The intervention was subsequently evaluated by comparing

mental health outcomes in the intervention and control schools. Although it began as an intervention, with continued funding and support, the Woodlawn Study eventually became a prospective study covering a large portion of participants' life course. Meanwhile, the Mental Health Center continued to provide clinical services to the Woodlawn residents as one of the crucial ways of giving back to the community, since as Kellam et al. (1975) suggested, any benefits from the project likely would not have been visible for some time.

Based on discussion by Kellam et al. (1975), in the 1960s, the Woodlawn community was undergoing rapid changes in socioeconomic and racial/ethnic composition. Specifically, the predominantly middle-class White east side and predominantly middle-class African American west side were becoming entirely African American with a notable influx of lower SES individuals. As a result, at the study inception, Woodlawn was the 5<sup>th</sup> most impoverished neighborhood in Chicago (Ensminger et al., 2002; Green & Ensminger, 2006), with low median income and high rates of unemployment, poverty, and welfare (De Vise, 1967; Green & Ensminger, 2006). In addition, approximately 97% of Woodlawn residents were African American (Ensminger & Slusarcick, 1992). The Woodlawn community was severely overcrowded with 90,000 individuals residing in a space designed to house 45,000 (Ensminger & Slusarcick, 1992). Presence of abandoned buildings contributed to physical dilapidation (Green & Ensminger, 2006). Despite the overall low SES status, with housing discrimination practices prevalent during this time (Lamb, 2005), African Americans living in Woodlawn were still fairly diverse with regard to important characteristics such as education, income, employment, and home



ownership (Ensminger et al., 2002; Ensminger & Slusarcick, 1992; Green & Ensminger, 2006).

Against the backdrop of rapid transitions, leaders of some community groups advocated for development of a basic political organization that would represent the interests and aspirations of the community (Kellam et al., 1975). Consequently, as described by Kellam et al., the Woodlawn Organization (TWO) was created as a confederation of numerous block clubs, church groups, and other organizations. The Woodlawn children were in elementary school when the Chicago civil rights protests were taking place, and the TWO was highly active in the community (Ensminger & Slusarcick, 1992).

Figure 2 created by the Woodlawn research team presents the flow of the assessment stages and process, including the numbers of participants who could be located for an interview and/or consented to be interviewed, those who were not interviewed for reasons other than death, as well as those who could not be interviewed due to being deceased. After the initial childhood assessment, the cohort members and their mothers were located for subsequent interviews. While only 705 participants completed the adolescent assessment, 952 of the original cohort were located and interviewed in young adulthood, and 833 in midlife. Total of 85 participants were deceased and 7 incapacitated by the time of the midlife interview.

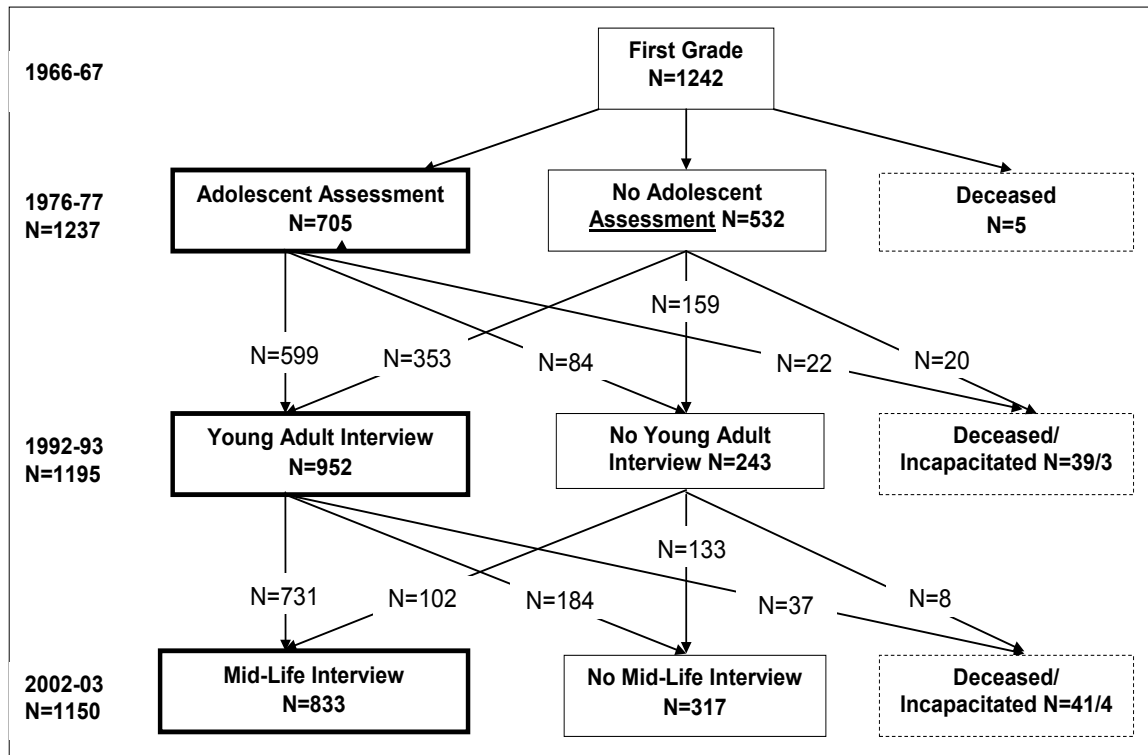


Figure 2. Interview process and status of the Woodlawn Study participants.

During the first grade assessment, mothers or mother surrogates (approximately 7%, e.g., female relative, father) and teachers provided information on the Woodlawn children. In addition to answering questions about their children, the mothers also reported on the family context and their own psychosocial well-being. First grade teachers assessed children's classroom adaptation and conduct. The adolescent data collection took place in 1976-77 (ages 16-17 years), after obtaining permission from participants' mothers or mother surrogates. The adolescent assessment was completed by 75% (n=705) of the 939 adolescents whose mothers were re-interviewed (Ensminger et al., 1982; Green & Ensminger, 2006). During the adolescent assessment, information was collected on key adolescent measures including substance use, general health (including sexual activity), psychological health, delinquency, family and peer relationships, and school

performance. The questionnaires were administered to small groups of participants by trained African American college students using slides and audiotapes to account for differences in reading ability among the adolescents (Green & Ensminger, 2006; Petersen & Kellam, 1977).

In young adulthood (ages 32-33 years, 1992-93), the interviewers collected extensive self-reports on patterns of substance use, mental health, criminal involvement, general health (also covering risky sexual behaviors/HIV risk), marriage, family, education, employment, living arrangements, as well as religious, community, and political involvement. The interviews lasting 90 minutes to 3 hours were conducted by trained African American interviewers over the phone or in person (Ensminger et al., 2002; Green & Ensminger, 2006). The midlife interview following a similar administration format was conducted in 2002-03 (ages 42-43 years) to collect information nearly identical to that gathered in young adulthood, with additional information particularly suited to the midlife stage, such as questions on general health, religiosity, and community involvement. Total follow-up time for the participants was approximately 35 years.

Self-reports by the cohort members were supplemented with information collected from their mothers (or mother surrogates) who, after the first interview in 1966-67, were subsequently re-interviewed on two occasions—in 1975 and in 1997-98. Depending on the interview date, the mothers provided information on their children's behavior, family context, and/or their own psychosocial well-being. To further augment participants' self-reports, additional information was obtained from

the Chicago Board of Education, the Federal Bureau of Investigations, the Chicago Police Department, the Illinois State Police, and the National Death Index.

The Woodlawn Study was intended to cover a large portion of the participants' life course. Accordingly, as discussed in detail by Ensminger et al. (in press), the study captured several important historical and social events, which provide the context in which the study participants aged and matured. For example, the activities and struggles of the Civil Rights Movement were particularly pronounced in the 1960s. The assassination of Dr. Martin Luther King in 1968 sparked violent riots on Chicago's west side. The south side (including Woodlawn) was largely spared from the riots and their aftermath, partly due to the control exerted by two major south side gangs – the Blackstone Rangers and the East Side Disciples (Freeman, n.d.). As the number of HIV/AIDS-related deaths became alarmingly high among African Americans throughout the 1990s, the introduction of improved HIV testing and highly active antiretroviral therapy ushered a new wave of hope in the fight against the infection and its impact on African American communities (AIDS.gov, n.d.; CDC, n.d.). Chicago became most affected by the crack cocaine epidemic in the early 1990s (Johnson & Ouellet, 1996; Ouellet, Wiebel, Jimenez & Johnson, 1993). The Woodlawn cohort members also witnessed an election of the first African American Chicago mayor, Harold Washington, in 1983 (Ensminger et al., in press). Another sociopolitical event of major importance was the 2008 election and subsequent 2012 re-election of the first African American president, Barack Obama, a former Illinois senator who lived in Chicago before his presidency.

### **3.2 Attrition**

Because attrition is frequently a key concern in longitudinal studies spanning over multiple decades, attempts were made to minimize attrition through exhaustive efforts to locate and follow-up as many participants as possible and structuring interviews to minimize non-response through skipping questions. Given the differential number of participants interviewed in disparate life course stages, attrition analyses were conducted by the researchers working with the Woodlawn data (Crum et al., 2006; Doherty et al., 2008; Ensminger et al., 2002, Ensminger et al., 2009; Fleming, Kellam, & Brown, 1982; Green, Doherty, Zebrak, & Ensminger, 2011; Green et al., 2012; Kellam et al., 1983). Most notable loss to follow-up occurred in adolescence, with 76.2% of the original cohort assessed during this time. Reasons for non-participation in the adolescent assessment included the departure of some participants from the Chicago area, the ability of interviewers to contact only the adolescents whose mothers were interviewed and consented to the assessment of the target child, and funding cutbacks (Ensminger et al., 2007; Green et al., 2011).

Attrition analyses comparing participants not assessed in adolescence to those who completed the adolescent assessment revealed no statistically significant differences on salient childhood variables, such as gender, poverty level, welfare receipt status, family income, or behavior scores (Doherty et al., 2008; Ensminger et al., 2002; Green et al., 2011; Green et al., 2012). However, participants missing the adolescent assessment were more likely to have been high school dropouts and have low first grade math scores compared to those assessed as teenagers (Doherty et al., 2008). Examining adult outcomes, missing the adolescent assessment was not related

to important adult measures, such as a diagnosis of depressive disorder or drug and alcohol use disorders (Doherty et al., 2008; Green et al., 2011). Participants assessed in adolescence (compared to those not assessed) were more likely to have a violent arrest in young adulthood (Green et al., 2011).

Additional attrition analyses were conducted by comparing participants with at least one adult interview (n=1053) to those with no adult interview (n=189) on multiple carefully selected variables including gender, socioeconomic status, behavior problems in childhood, adolescent substance use, self-reported adolescent delinquency measures, adult criminal record information, lifetime depressive disorder, and neighborhood characteristics (Doherty et al., 2008; Ensminger et al., 2009; Green et al., 2012). The results of the analyses revealed no differences on those variables between participants who were interviewed at least once in adulthood, versus those not interviewed in adulthood. However, compared to those not interviewed, the cohort members interviewed in adulthood were more likely to have completed high school, and to have a criminal record for violent or drug-related crime (Doherty et al., 2008). In addition, participants without either adult interview were more likely to have lived in poverty in childhood or adolescence (Doherty et al., 2008; Green et al., 2011). Participants deceased by midlife were more likely to be male, to have not finished high school, to have been heavy smokers in adolescence, and to have had a criminal record for a violent crime (Zebrak & Green, 2014). Despite some differences between participants who were available for follow-up and/or consented to be interviewed compared to those not interviewed, the results of the attrition analyses revealed very few areas of concern (Doherty et al., 2008).

### 3.3 Measures

#### 3.3.1 Substance involvement

**Adolescent substance use.** In adolescence, the participants provided information on their use of alcohol and marijuana as part of the *What's Happening?* instrument (Petersen & Kellam, 1977), designed to elicit information on adolescents' behavior and functioning. In the structural equation modeling (SEM) framework, adolescent substance use was modeled as a latent (unobserved) variable comprised of three self-reported indicators, including frequency of lifetime use of beer or wine, hard liquor or whiskey, and marijuana (0=never, 1=just once or twice, 2=3 to 9 times, 3=10 to 19 times, 4=20-39 times, 5=40 or more times), as was done in Fothergill and Ensminger (2006). For mediation analyses involving individual young adult social bonds, a single variable measuring adolescent lifetime frequency of alcohol use (beer or wine, or hard liquor or whiskey) or marijuana use was computed from the three indicators for inclusion in the appropriate regression analysis.

**Young adult substance problems.** In young adulthood, symptoms of abuse and dependence involving alcohol and drugs (marijuana, cocaine, heroin, inhalants, hallucinogens, stimulants, sedatives and hypnotics, analgesics, and tranquilizers) were assessed using the Composite International Diagnostic Interview (CIDI) modules (Anthony, Warner, & Kessler, 1994; Kessler et al., 1994; Kessler & Ustun, 2004), developed at the University of Michigan for the National Center for Statistics. In line with the conceptualization and operationalization by Fothergill and Ensminger (2006), substance problems were modeled as a latent variable, with symptoms of abuse and dependence categorized based on the DSM-III-R (APA, 1987) criteria: (1)

using alcohol and drugs in larger quantities and over longer periods of time than intended, (2) experiencing negative effects of alcohol and drugs on physical and mental health, (3) alcohol and drugs interfering with work, school or parenting, and (4) experiencing signs of addiction to alcohol and drugs, including tolerance, withdrawal symptoms, and inability to stop using substances despite trying. After conducting principal component analysis for the hypothesized categories to ascertain that all items in each category loaded on only one factor, binary responses (no/yes) in each category were summed and used as indicators for a latent variable representing young adult substance problems. The final set of four indicators comprising the latent variable measured (1) extensive and/or prolonged use (0=absent/low to 4=high; Cronbach's alpha [ $\alpha$ ]=0.85), (2) physical and mental health effects (0=absent/low to 6=high;  $\alpha$ =0.76), (3) social and functional effects (0=absent/low to 5=high;  $\alpha$ =0.77), (4) signs of addiction (0=absent/low to 6=high;  $\alpha$ =0.81).

Substance problems were modeled together, as alcohol and drug abuse and/or dependence symptoms are frequently found to be interrelated (e.g., Compton, Thomas, Stinson, & Grant, 2007; Hasin Stinson, Ogburn, & Grant, 2007). Additionally, using any one drug exclusively or in isolation is rare (Martinotti et al., 2009; Pressley & McCormick, 2007; Tarter & Mezzich, 1992). Evidence also suggests the association between substance problems, such as dependence symptoms, and risky sexual behavior may not be substance specific (Mackesy-Amiti, Frendrich, & Johnson, 2010).

**Midlife substance problems.** In midlife symptoms of abuse and dependence involving alcohol and drugs (marijuana, cocaine, heroin, ecstasy, inhalants,



hallucinogens, sedatives or tranquilizers, stimulants, and analgesics) were assessed using the CIDI modules, just as in young adulthood. The CIDI version used in the midlife interview had an error in the skip pattern, which resulted in participants being asked about symptoms of dependence only if they met the criteria for abuse (Green et al., 2010). Potential result of this error was an underestimation of the frequency of alcohol and drug dependence symptoms (Grant et al., 1992; Green et al., 2010). Midlife alcohol and drug problems were categorized based on the DSM-IV-TR (APA, 2000) diagnostic criteria, using the same categories as in young adulthood. Population-based studies evaluating agreement among diagnostic systems, generally indicated adequate concordance between DSM-III-R and DSM-IV diagnoses for drug and alcohol abuse and dependence (current and lifetime) (Grant, 1996; Hasin, McCloud, & Endicott, 1996). After using the same procedures as in young adulthood to obtain the final set of four indicators, the latent variable *midlife substance problems* included (1) extensive and/or prolonged use (0=absent/low to 3=high;  $\alpha=0.87$ ) (2) physical and mental health effects (0=absent/absent to 2=high;  $\alpha=0.71$ ), (3) social and functional effects (0=absent/low to 5=high;  $\alpha=0.90$ ), (4) signs of addiction (0=absent/low to 5=high;  $\alpha=0.91$ ).

### 3.3.2 Risky sexual behavior

**Adolescent sexual behavior.** In adolescence, the participants reported on their sexual activity as part of the *What's Happening?* instrument (Petersen & Kellam, 1977). In the SEM framework, adolescent sexual behavior was modeled as a latent variable with two indicators, including lifetime frequency of engaging in sexual

intercourse (0=never, 1=one to two times, 2=more often), and current use of birth control (0=always, 1=sometimes, 2=never).

**Young adult risky sexual behavior.** During the young adult interview, the participants were asked questions about their sexual behavior. Studies suggest that examining individual sexual risk behaviors separately may not adequately capture the overall HIV/STI risk (Beadnell et al., 2005; Reiter, 2009; Susser, Desvarieux, & Wittkowski, 1998). Thus, to capture the overall sex-related risk in the SEM framework, young adult risky sexual behavior was modeled as an observed variable, created by counting the number of individual sexual risk behaviors for each participant. These items included (1) two or more sexual partners in the last 30 days, (2) inconsistent or no condom use by participant or sexual partner(s) in the last 30 days, (3) ever obtaining drugs in exchange for sex, (4) ever giving drugs in exchange for sex, and (5) ever having sex for money (0=no risky sexual behaviors to 5=all risky sexual behaviors, with higher values representing greater sex-related risk).

**Midlife risky sexual behavior.** Midlife sexual behavior measures were similar to those collected in young adulthood. One exception is that questions asking about exchanging (obtaining or giving) drugs for sex, and having sex for money assessed these behaviors in the last 10 years (since young adult interview). The same approach as in young adulthood was used in operationalizing midlife risky sexual behavior in the SEM framework, and for mediation analysis using regression.

### 3.3.3 Young adult social bonds

Quantity of social ties is an important measure of social integration (House et al., 1988), which may be associated with greater protection against engaging in

maladaptive or problem behaviors through accumulation of multiple agents of social control (Durkheim, 1951; Green et al., 2010; Hirschi, 1969; Hirschi, 2004; Umberson, 1987). Thus, to capture the overall young adult social bonding/integration, a summative measure was created by counting the number of conventional social bonds for each participant, similar to the approach taken by Green et al. (2010). These bonds (described in more detail below) included whether or not the participant was (1) currently married or cohabiting, (2) currently employed, (3) had children in the household, (4) regularly attended religious services, and (5) belonged to a social organization. For this examination, social integration variable was reverse-scored to capture low social integration (0=all social bonds to 5=no social bonds). Modeling low frequency of social bonds allowed for capturing the accumulation of social disadvantage associated with having fewer social ties, and the cumulative risk stemming from low integration into conventional society (Green et al., 2010). This approach also allowed for exploring the possibility that the overall frequency or number of social bonds could be more important in the pathway between adolescent substance use and midlife risky sexual behavior than any one bond considered individually (Green et al., 2010). Young adult social integration variable was included in the SEM framework as an observed variable.

In addition to exploring the overall summative risk related to low adult social bonding/integration in the SEM framework, the current study also explored the importance and explanatory contribution of each social bond as a potential partial mediator of substance use–risky sexual behavior relationship. To accomplish this,

variables representing each formal or informal conventional bond were used in mediation tests described in more detail in the analysis plan.

**Marriage or cohabitation.** During the young adult interview, the participants were asked about their current marital status. Although marriage represents a more formal bond between two individuals than cohabitation (living with a partner), both theory and empirical evidence suggest that cohabitation may also be important in reducing involvement in risk or problem behaviors (Duncan et al., 2006; Kruttschnitt, Uggen, & Shelton, 2000; Laub & Sampson, 1993; Sampson, Laub, & Wimer, 2006). This evidence further suggests that social control associated with a bond between two individuals may stem from the presence of a partnership regardless of the arrangement type (Sampson et al., 2006). Considering cohabitation as a potential source of informal social control may be particularly important among African Americans who may be less likely to marry (Dixon, 2009; Nielsen, 1999; Raley, 1996; Raley, 2000), and more likely to cohabit (Raley, 2000; Teachman, Tedrow, & Crowder, 2000) than Whites. To capture the maximum social control related to marriage/cohabitation, this variable was operationalized as being currently married/living with a partner versus being unmarried/not cohabiting (including never married, separated, divorced, or widowed) in young adulthood.

**Employment.** In young adulthood, the participants were asked about their current employment status (within past week). In line with the approach taken by Green et al. (2010), to capture the most informal social control stemming from involvement the labor market, participants who reported having a job/working at the time of the young adult interview were coded as employed (versus not employed).

**Parenthood.** In young adulthood, the participants were asked to list individuals (including children) who were part of their current household. This information was summarized by the interviewers who specifically indicated whether the participants had children living in the household. Previous studies have suggested that living with one's child (custodial parenthood) may constitute a more important source of informal social control in the context of risk behaviors than merely being a parent or step-parent (Merline et al., 2004; Nielsen et al., 1999; Umberson, 1987). Thus, this variable was operationalized as having children in the household, versus not having children in the household at the time of the young adult interview.

**Religious service attendance.** In young adulthood, the participants reported on the frequency of attending regular church/religious services. In order to capture the most social control stemming from religious participation, this variable was coded as attending religious services at least once weekly (weekly or more) versus less than weekly in young adulthood, parallel to the approach taken by Green et al. (2010).

**Social organization membership.** In young adulthood, the participants were asked about belonging to various civic, social, or professional groups. Organizational membership offering a potential for informal social control in young adult life stage was operationalized as belonging to any social non-religious organization (including parent/school groups, local school council, civil rights groups, women's rights groups, welfare rights groups, labor union or professional groups, neighborhood or block clubs, veteran's groups, sororities/fraternities, and social clubs) versus not belonging to any groups, based on the operationalization described in Green et al. (2010).

### 3.3.4 Early (childhood) context and adaptation

**Family socioeconomic status (SES).** Childhood SES based on the information provided by participants' mothers was modeled in the SEM framework as a latent variable composed of two indicators: mother's education level (0-22, with higher scores indicating lower education level), and household income (0=\$10,000 or more to 10=under \$2,000), in line with the approach taken by Fothergill and Ensminger (2006).

**Family mobility.** In the SEM framework family mobility was modeled as a measured variable capturing the number of times (0-9) a family moved since the birth of the focal child.

**Household type.** In 1966-67 mothers were asked to list all individuals residing in their household. From this information an observed variable was created to represent household type (0= two-parent household and 1=other).

**Mother's mental health.** In the SEM framework, mother's mental health was modeled as a latent variable composed of two indicators: frequency of days when feeling sad and blue, and frequency of days when feeling nervous, tense, on edge (both 0=hardly ever, 1=occasionally, 2=fairly often, 3=very often), as was done in Green et al. (2012).

**First grade classroom behavior and social adaptation.** First grade teachers were asked to rate their students on aggression, immaturity, restlessness (0=adapting to 3=severely maladapting), and conduct (0=excellent to 3=unsatisfactory) as part of the Teacher's Observation of Classroom Adaptation (TOCA) (Kellam et al., 1975) instrument. In the SEM framework, the four indicators were combined to form a

latent variable measuring classroom behavior and social adaptation, in accordance with the approach taken by Green et al. (2012).

### **3.4 Plan of Analysis**

#### **3.4.1 Data preparation**

Given its longitudinal nature with multiple assessments over time and thousands of variables collected, the Woodlawn dataset is inherently complex. Thus, the first step in the analysis was to explore the dataset and prepare the variables for statistical modeling. When necessary, the original variables were recoded to account for skip patterns, combine the categories, and to ensure that the starting value was always 0. In addition, new variables were computed from two or more of the original variables as needed. Descriptive statistics (e.g. frequencies, means and standard deviations) were generated for all indicator variables used in statistical modeling.

#### **3.4.2 Aim 1**

Aim 1 of the proposed dissertation involved examining the associations between substance involvement and risky sexual behavior throughout the life course. The hypothesized associations and paths were examined using SEM in IBM AMOS 21 (Arbuckle, 2012). SEM is a general modeling technique that can be used to examine the relationships among constructs represented by either latent or observed variables (Garson, 2012; Hox & Bechger, 1998). Although SEM requires large samples of approximately 200 observations to ensure unbiased estimates (Hoogland & Boomsma, 1997; Hox & Bechger, 1998), the technique is considered to be more flexible and powerful than regression analysis, allowing to model measurement error

as well as correlations between exogenous (independent) variables, and between error terms (Garson, 2012). SEM also tends to be fairly robust to multicollinearity problems, incomplete data, and nonnormality (Garson, 2012; Lei & Lomax, 2005). As a modeling technique, SEM lends itself well to a longitudinal design where temporal ordering can be established. Thus, SEM is well suited for use with data from fairly large prospective cohort studies. This technique allows for examination of both within and across life stage associations.

Path model with latent variables, which is of particular relevance to the proposed analysis of the relationships between substance involvement and risky sexual behavior throughout the life course, involves testing two separate models conceived a priori: 1) measurement model consisting of the associations between latent variables and their indicators (including unmeasured covariances among latent constructs, direct effects of latent variables on their indicators (factor loadings), and direct error effects), and 2) structural model comprising of contemporaneous and prospective associations among the latent and observed variables in the model (including correlations, unstandardized coefficients, and standardized regression weights for paths specified in the model) (Garson, 2012; Schreiber, Stage, King, Nora, & Barlow, 2006).

Accordingly, the first step of the analysis was to construct a measurement model by correlating all the latent variables. The model was then evaluated in the confirmatory factor analysis framework. In addition to examining the factor loadings, the measurement model was also tested for goodness of fit between the hypothesized



and actual variance-covariance structure (Garson, 2012; Hox & Bechger, 1998; Ullman & Bentler, 2001).

Once the measurement model was evaluated, a corresponding structural model was constructed and tested. For between life-stage prospective associations, directional arrows were drawn as depicted in the conceptual model. For within life-stage associations, non-directional correlations were specified using bidirectional arrows. The magnitude and significance of correlations for within life-stage relations as well as unstandardized and standardized (beta weights) regression coefficients for the prospective associations across the life course were examined. In addition, just as in the case of the measurement model, the structural model was evaluated for goodness of fit.

As recommended in the SEM literature, maximum likelihood estimation (ML) was used to estimate the coefficients (Garson, 2012). As a powerful estimation technique, ML uses multiple iterations to generate parameter estimates that maximize the likelihood of producing the observed covariances (Garson, 2012). When missing data is present, AMOS uses full information maximum likelihood estimation (FIML) to address missing data, provide parameter estimates, and generate standard error estimates all in one step (Graham, 2009). Goodness of fit indices generated by AMOS were used to determine how well the proposed models fit the data. At least three different fit indices were used as recommended in the literature (Jaccard & Wan, 1996), including relative chi-square ( $\chi^2/df$ ) (Garson, 2012), comparative fit index (CFI) (Garson, 2012), and the root mean square error of approximation (RMSEA) (Garson, 2012; Hox & Bechger, 1998). While the exact recommendations

for relative chi-square value cutoffs vary among researchers, a  $\chi^2/\text{df}$  value of 5 or less generally reflects an adequate model fit (Bollen & Long, 1993; Schumacker & Lomax, 2004; Wheaton, Muthen, Alwin, & Summers, 1977). CFI should be 0.90 or greater to be indicative of an acceptable fitting model (Garson, 2012). For RMSEA, the value of 0.05 or less generally indicates a good model fit (Bollen & Long, 1993).

### 3.4.3 Aim 2

Aim 2: H2a of the proposed dissertation involved examination of the overall social bonding/integration in young adulthood as a pathway between adolescent substance use and midlife risky sexual behavior. Because young adult social integration is a continuous variable, it was included and examined in the SEM framework. Aim 2: H2b involved examining the importance of each young adult social bond as a potential mediator of the substance use–risky sexual behavior association. Because the measures representing individual social bonds were coded as dichotomous variables, the Sobel test (Sobel, 1982) was employed to examine the potential mediating effects of marriage/cohabitation, employment, parenthood, religious service attendance, and social organization membership. In examining mediation, the Sobel test may be a more powerful approach than the older Baron and Kenny (1986) method, as it directly tests the significance of the mediated (indirect) effect (Preacher & Hayes, 2004). As discussed by Preacher and Hayes (2002), such a direct test involves examining the product of coefficients for indirect paths (between an independent variable and a hypothesized mediator, and between a hypothesized mediator and a dependent variable), divided by the standard error of the indirect effect. The acquired critical ratio is then compared to the critical value from the

standard normal distribution at selected alpha level (Preacher & Hayes, 2004). The Sobel test is well suited for use with larger samples (Preacher & Hayes, 2004), and appropriate for use with dichotomous mediators (Herr, n. d.; MacKinnon & Dwyer, 1993). The values needed to conduct the Sobel test in the case of dichotomous mediators (unstandardized regression coefficients and their corresponding standard errors) come from a mix of linear and logistic regression models, instead of linear regression only, as in the case of traditional application with all continuous variables (Herr, n. d.).

The Sobel test for the adolescent substance use–midlife risky sexual behavior association entailed examining the product of coefficients for 1) the path between adolescent substance use and the selected hypothesized mediator (i.e., marriage/cohabitation, employment, parenthood, religious service attendance, or social organization membership), and 2) the path between the selected mediator and midlife risky sexual behavior. The initial step was to conduct regression analyses involving adolescent substance use, the selected young adult social bond, and midlife risky sexual behavior. If the regression coefficients for the association between adolescent substance use and the hypothesized mediator, and the hypothesized mediator and midlife risky sexual behavior were both statistically significant ( $p < .05$ ) in this simple mediation model, the next set of regression analyses was conducted with inclusion of early contextual variables/potential confounders (total family income, mother’s education, family mobility, mother’s mental health, and first grade aggression), as well as young adult substance problems and young adult risky sexual behavior. If the associations involved in the indirect effects were significant in this

step, the coefficients were used to conduct the Sobel test. The proposed analysis used a reliable Sobel test calculator offered by Preacher and Leonardelli (2001) on their website. Because the coefficients needed to conduct the Sobel test were in different scales due to using a mix of logistic and linear regression, recommended adjustment procedures were employed to prepare the final set of coefficients for use in the Sobel test calculator (Herr, n.d.).

#### 3.4.4 Aim 3

Aim 3 of the current study focused on examining the moderating effect of gender on the associations and pathways between substance involvement and risky sexual behavior throughout the life course. Extant recommendations for moderation analysis in the SEM framework involve testing for multigroup invariance (Byrne, 2001; Holmbeck, 1997; Joreskog, 1971; Sauer & Dick, 1993). This is accomplished by comparing the model fit under two conditions: 1) unconstrained (allowing the parameter values to vary across gender, taking on values unique to each group [approach that assumes interaction]), and 2) with equality (invariance) constraints (with model parameters constrained to be equal for males and females [approach that assumes no interaction]) (Holmbeck, 1997), starting with the measurement model (Byrne, 2004). According to Holmbeck (1997), the unconstrained model is then compared to the model with constrained parameters to determine if there is a statistically significant deterioration in model fit. If the difference is significant, it can be concluded that the parameters are not invariant between different levels of the moderator (Holmbeck, 1997).

The current study used multiple-group analysis in AMOS, which automatically specified cross-group constraints (Arbuckle, 2012) to test for measurement invariance between men and women. This step was used to determine whether separate male and female models should be presented. To examine gender differences in mediation analyses for individual young adult social bonds using the Sobel test, the analyses were stratified by gender.

### **3.5 Missing Data**

Longitudinal designs spanning over large periods of time are susceptible to attrition. The Woodlawn Study is no exception in being affected by missing data. The extant literature points out that failing to address missing data appropriately can result in biased and/or inefficient parameter estimates (Graham, 2009; White, Royston, & Wood, 2011). In order to address missingness in the analysis using SEM, FIML was employed as a recommended method (Graham et al., 2009). Instead of deleting cases with missing values, FIML uses non-missing values to calculate a complete set of parameter estimates (Garson, 2012), thus avoiding the loss of statistical power due to sample size reduction.

To address missing data in the mediation analysis using regression and the Sobel test, multiple imputations using chained equations (MICE) were employed as recommended by Royston and White (2011) and White et al. (2011). The advantage of such novel imputation techniques over older, simpler methods is that instead of imputing a single value to replace the missing data point, a set of plausible values is estimated for each missing value with inclusion of random variation to indicate the uncertainty of the estimation (Graham, 2009; White et al., 2011). The imputed

datasets are analyzed separately but identically, and the estimates are combined to obtain the overall parameter estimates, variances, and standard errors (White et al., 2011). Using MICE to generate imputed datasets is particularly advantageous, because the procedure can handle variables with different measurement levels, with separate imputation models used to impute each variable (White et al., 2011).

MICE was conducted in Stata 12.0 SE using the following steps:

- Dataset including the key variables of interest, as well as any relevant auxiliary variables (variables highly correlated with the variables of interest, even if they are not a part of the substantive model [Graham, 2009]) was compiled.
- Patterns of the missing data were examined.
- Dry runs were conducted to determine which default settings for the regression models involving the missing variables needed to be manually changed in order to build an optimal imputation model, based on each variable's measurement level.
- Based on the current recommendations, 40 datasets were imputed to balance the need to retain power and the need to produce unbiased and efficient estimates (Graham, Olchowski, & Gilreath, 2007).
- The datasets were visually inspected to ensure the imputation was successfully completed.
- In order to generate estimates needed to conduct the Sobel test of the indirect effect, appropriate regression analyses were conducted on combined datasets.

## Chapter 4: Results

This chapter presents the results of analysis involving structural equation modeling and mediation testing using the Sobel test. Presented first are the baseline characteristics of the Woodlawn Study participants, by gender. The next section presents descriptive statistics for all study variables. The third section presents the findings from SEM, while the final section provides the results of mediation analysis.

### **4.1 Baseline Characteristics of Woodlawn Study Participants**

Table 1 presents baseline characteristics of the Woodlawn Study participants by gender, from data collected during childhood. These measures were selected to demonstrate early adversity and social/behavioral maladaptation that may influence later participation in risk behaviors and development of related problems.

Based on the information provided by the participants' mothers, the majority of boys (84.0%) lived in a household with total annual income between \$2,000 and \$9,999 (59.6% in a household with income between \$2,000 and \$5,999, and 24.4% with income between \$6,000 and \$9,999). Relatively small percentages resided in a household with income of less than \$2,000 (9.2%), and with income of \$10,000 or more (6.8%). For girls, the total annual family income distribution was similar: 85.3% lived in a household with income between \$2,000 and \$5,999 (including 55.7% with income \$2,000-\$5,999, and 29.6% with income \$6,000-\$9,999), 6.1% with income less than \$2,000, and 8.7% with income of \$10,000 or more. Furthermore, 56.3% of Woodlawn boys and 50.6% of girls lived in impoverished households. Families of 34.2% of boys and 30.8% of girls received welfare. More

than half of the boys' and girls' mothers or surrogates (60.0% and 56.6% respectively) had less than 12 years of formal education. Over half of the boys (60.1%) and girls (56.1%) did not live in a two-parent household. While families of 13.4% of boys did not move since their birth, 42.6% moved one to two times, 34.1% three to four times, and 9.9% reported moving five or more times. These percentages were fairly similar among girls, with families of 15.6% never having moved, 45.9% having moved one to two times, 30.1% three to four times, and 8.2% five or more times. Among the mothers of boys, 17.4% reported feeling sad and blue and 37.7% feeling nervous, tense, or on edge fairly or very often. In turn, 16.8% of the girls' mothers reported feeling sad and blue and 36.1% feeling nervous, tense, or on edge fairly to very often. Looking at classroom adaptation and behavior, fairly similar

Table 1

*Baseline characteristics of the Woodlawn cohort in 1966/67*

	Men	Women
Total household income (1966/67)		
Under \$2,000	9.2%	6.1%
\$2,000-\$5,999	59.6%	55.7%
\$6,000-\$9,999	24.4%	29.6%
\$10,000 or more	6.8%	8.7%
Poverty index (% below poverty level)	56.3%	50.6%
Welfare receipt (% yes)	34.2%	30.8%
Mother's or caretaker's education (% <12 years)	60.0%	56.6%
Two-parent household (% no)	60.1%	56.1%
Family mobility (times moved birth to age 6)		
Never	13.4%	15.6%
1-2 times	42.6%	45.9%
3-4 times	34.1%	30.1%
5 or more times	9.9%	8.2%
Mother feeling sad and blue (% fairly to very often)	17.4%	16.8%
Mother feeling nervous, tense, on edge (% fairly to very often)	37.7%	36.1%
First grade aggressive behavior (% maladapting)	38.7%	24.8%
First grade restless behavior (% maladapting)	39.3%	25.2%
First grade immature behavior (% maladapting)	40.8%	33.3%



	Men	Women
First grade conduct (% unsatisfactory)	9.3%	4.1%

Note: *n*'s range from 514 to 606 for men and from 518 to 636 for women

percentages of Woodlawn boys were rated by their first grade teachers as aggressive (38.7%), restless (39.3%), and immature (40.8%). Among girls, 24.8% were rated as aggressive, 25.2% as restless, and 33.3% as immature. In addition, 9.3% of boys and 4.1% of girls were assessed to have unsatisfactory conduct.

#### 4.2 Descriptive Statistics

Table 2 presents means and standard deviations for the variables used in structural equation modeling, as well as the results of independent sample *t*-tests used to examine gender differences.

**Early context and adaptation.** Among early context variables, there was a relatively small, but statistically significant gender difference for total family income ( $p=.048$ ). On average, boys were being raised in households with lower income relative to girls ( $M=5.47$  and  $M=5.16$  respectively). In contrast, there were no significant male-female differences for the Woodlawn Study participants on mother's education, household type, or number of times the family moved since participant's birth. Boys and girls also did not differ significantly with regard to their mothers' mental health, including the average frequency of feeling sad and blue, and the average frequency of feeling nervous, tense, or on edge. Relative to girls, boys were on average rated as more aggressive ( $M=0.70$  for boys and  $M=0.39$  for girls,  $p<.001$ ), restless ( $M=0.73$  for boys and  $M=0.44$  for girls,  $p<.001$ ), and immature ( $M=0.74$  for boys and  $M=0.57$  for girls,  $p=.002$ ) by their first grade teachers. Furthermore, boys

demonstrated poorer classroom conduct than girls ( $M=1.54$  for boys and  $M=1.11$  for girls,  $p<.001$ ).

**Adolescence.** Significant male–female differences were observed on all adolescent variables selected for inclusion in the structural equation model. Specifically, relative to girls, boys were on average more frequent lifetime users of beer or wine ( $M=2.56$  for boys and  $M=1.83$  for girls,  $p<.001$ ), and hard liquor or whiskey ( $M=1.20$  for boys and  $M=0.79$  for girls,  $p<.001$ ). This trend was also true for lifetime marijuana use ( $p<.001$ ), with average frequency for boys ( $M=2.35$ ) surpassing that of girls ( $M=1.40$ ). Adolescent girls reported lower average lifetime frequency of engaging in sexual intercourse than boys ( $M=0.87$  and  $M=1.65$  respectively,  $p<.001$ ). Furthermore, girls reported using birth control more frequently than their male counterparts ( $M=0.77$  and  $M=1.61$  respectively,  $p<.001$ ).

**Young adulthood.** In young adulthood significant male-female differences were identified in all four alcohol and drug problem areas. Specifically, men had higher average scores relative to women on extensive and prolonged use ( $M=0.51$  and  $M=0.28$  respectively,  $p=.001$ ), physical and mental health effects ( $M=0.61$  and  $M=0.30$  respectively,  $p<.001$ ), social and functional effects ( $M=0.52$  and  $M=0.29$  respectively,  $p<.001$ ), and signs of addiction ( $M=0.90$  and  $M=0.42$  respectively,  $p<.001$ ). In young adulthood, the average number of risky sexual behaviors for women ( $M=0.69$ ) was significantly lower than that of their male counterparts ( $M=0.99$ ),  $p<.001$ . Furthermore, men had significantly fewer social bonds in young adulthood than women ( $M=2.92$  and  $M=2.59$  respectively,  $p<.001$ ).

**Midlife.** Similar to young adulthood, men had higher average scores relative to women in all four midlife alcohol and drug problem areas, including extensive and prolonged use ( $M=0.51$  and  $M=0.26$  respectively,  $p<.001$ ), physical and mental health effects ( $M=0.41$  and  $M=0.16$  respectively,  $p<.001$ ), social and functional effects ( $M=0.91$  and  $M=0.40$  respectively,  $p<.001$ ), and signs of addiction ( $M=0.72$  and  $M=0.36$  respectively,  $p<.001$ ). In midlife, the average number of risky sexual behaviors for women ( $M=0.64$ ) was significantly lower than that of their male counterparts ( $M=0.90$ ),  $p<.001$ .

Table 2

*Means, standard deviations, and gender differences for variables used in structural equation modeling*

	Men	Women	
	<i>M, SD</i>	<i>M, SD</i>	<i>t (p-value)</i>
<b>Early context and adaptation</b>			
Total family income in 1966/67 (0-9) <sup>a</sup>	5.47, 2.64	5.16, 2.72	1.98 (.048)
Mother's education (in years) (0-22) <sup>b</sup>	9.46, 2.38	9.35, 2.34	0.86 (.392)
Household type (two-parent/other) (0-1)	0.60, 0.49	0.56, 0.50	1.40 (.160)
Family mobility (times moved since participant's birth) (0-9)	2.38, 1.77	2.21, 1.76	1.69 (.092)
Mother feeling sad and blue (0-3)	0.86, 0.90	0.85, 0.88	0.22 (.823)
Mother feeling nervous, tense, on edge (0-3)	1.44, 1.00	1.41, 0.99	0.39 (.694)
First grade aggressiveness (0-3)	0.70, 1.01	0.39, 0.79	5.81 (<.001)
First grade restlessness (0-3)	0.73, 1.06	0.44, 0.88	5.22 (<.001)
First grade immaturity (0-3)	0.74, 1.02	0.57, 0.93	3.07 (.002)
First grade conduct (0-3)	1.54, 0.78	1.11, 0.76	8.95 (<.001)
<b>Adolescence</b>			

	Men	Women	
	<i>M, SD</i>	<i>M, SD</i>	<i>t (p-value)</i>
Lifetime frequency of beer or wine use (0-5)	2.56, 1.78	1.83, 1.62	5.66 (<.001)
Lifetime frequency of hard liquor or whiskey use (0-5)	1.20, 1.63	0.79, 1.27	3.71 (<.001)
Lifetime frequency of marijuana or hashish use (0-5)	2.35, 2.04	1.40, 1.75	6.62 (<.001)
Lifetime frequency of engaging in sexual intercourse (0-2)	1.65, 0.60	0.87, 0.86	13.87 (<.001)
Current frequency of birth control use (0-2) <sup>c</sup>	1.61, 0.68	0.77, 0.92	13.47 (<.001)
<b>Young Adulthood</b>			
Alcohol and drug problems: Extensive and prolonged use (0-4)	0.51, 1.09	0.28, 0.86	3.48 (.001)
Alcohol and drug problems: Physical and mental health effects (0-6)	0.61, 1.21	0.30, 0.88	4.53 (<.001)
Alcohol and drug problems: Social and functional effects (0-5)	0.52, 1.08	0.29, 0.85	3.72 (<.001)
Alcohol and drug problems: Signs of addiction (0-6)	0.90, 1.46	0.42, 1.10	5.77 (<.001)
Number of risky sexual behaviors (0-5)	0.99, 0.90	0.69, 0.68	5.79 (<.001)
Number of social bonds (0-5) <sup>d</sup>	2.92, 1.45	2.59, 1.24	3.72 (<.001)
<b>Midlife</b>			
Alcohol and drug problems: Extensive and prolonged use (0-3)	0.51, 0.98	0.26, 0.76	4.00 (<.001)
Alcohol and drug problems: Physical and mental health effects (0-2)	0.41, 0.71	0.16, 0.48	5.65 (<.001)
Alcohol and drug problems: Social and functional effects (0-5)	0.91, 1.59	0.40, 1.15	5.08 (<.001)
Alcohol and drug problems: Signs of addiction (0-5)	0.72, 1.46	0.36, 1.15	3.75 (<.001)
Number of risky sexual behaviors (0-5)	0.90, 0.76	0.64, 0.61	5.23 (<.001)

<sup>a</sup> higher values represent lower family income; <sup>b</sup> higher values represent lower education; <sup>c</sup> higher values represent less frequent birth control use; <sup>d</sup> higher values represent fewer bonds/lower overall integration

Table 3 presents frequencies for individual young adult bonds used in mediation analyses, along with gender differences based on chi-square tests for independence. Significant male-female differences were identified for

marriage/cohabitation ( $p<.001$ ), and custodial parenthood ( $p<.001$ ). Based on the obtained frequencies, 58.3% of men and 69.6% of women were not married or living with a partner in young adulthood. In addition, 25.3% of women and 65.0% of men reported not having a child living at home. There were no significant gender differences for current employment, religious service attendance, or social organization membership.

Table 3

*Frequencies and gender differences for young adult social bonds*

	Men	Women	
	%	%	$\chi^2$ (p-value)
Married/living with a partner			13.02 (<.001)
Yes	41.7%	30.4%	
No	58.3%	69.6%	
Custodial parent			151.48 (<.001)
Yes	35.0%	74.7%	
No	65.0%	25.3%	
Employed			1.44 (.229)
Yes	65.1%	61.3%	
No	34.9%	38.7%	
Religious service attendance			2.24 (.135)
≥once per week	26.4%	30.8%	
<once per week	73.6%	69.2%	
Organization membership			1.74 (.187)
≥1 organization	39.3%	43.5%	
0 organizations	60.7%	56.5%	

Note: n's for men ranged from 453 to 456 and for women from 493 to 496

### 4.3 Findings: Structural Equation Modeling

#### 4.3.1 Measurement models

Measurement structure was examined separately for men and women. Table 4 shows standardized factor loadings for all indicators on their respective latent variables, by gender.

**Male measurement model.** The male measurement model had an acceptable fit to the data as indicated by several fit indices. Specifically, relative chi-square was within the acceptable range of 5 or below ( $\chi^2/df=1.65$ ). Comparative fit index was well above the recommended cut-off point of 0.90 (CFI=0.98). Root mean square error of approximation was also within the acceptable range of  $\leq 0.05$  (RMSEA=0.03). The adequacy of fit indices suggested that the measurement model was appropriate given the observed variance-covariance matrix. All factor loadings were statistically significant ( $p \leq .001$ ), with magnitudes greater than 0.400. For men, the indicators with factor loadings lowest in magnitude included childhood household income (standardized factor loading=0.493), and mother's frequency of feeling nervous, tense, or on edge (standardized factor loading=0.488).

Table 4

*Standardized factor loadings for indicators on latent variables in male and female measurement models*

	Standardized factor loading	
	Men ( $n=606$ )	Women ( $n=636$ )
<b>Early context and adaptation</b>		
Family SES		
Total family income (1966/67)	0.493	0.500
Mother's education (in years)	0.530	0.524
Mother's mental health		
Feeling sad and blue	0.822 <sup>+</sup>	0.932 <sup>+</sup>
Feeling nervous, tense, on edge	0.488	0.502
First grade classroom adaptation/behavior		
Aggressiveness	0.786	0.718
Immaturity	0.708	0.635
Restlessness	0.911	0.933
Conduct	0.550	0.541
<b>Adolescence</b>		
Substance use		
Lifetime frequency use of beer or wine	0.827	0.870
Lifetime frequency use of hard liquor or		

	Standardized factor loading	
	Men ( <i>n</i> =606)	Women ( <i>n</i> =636)
whisky	0.722	0.755
Lifetime frequency use of marijuana	0.742	0.705
Sexual behavior		
Lifetime frequency of engaging in sexual intercourse	0.973	1.070
Current use of birth control	0.544	0.516
<b>Young adulthood</b>		
Alcohol and drug problems		
Extensive and prolonged use	0.863	0.909
Physical and mental health effects	0.855	0.851
Social and functional effects	0.882	0.866
Signs of addiction	0.894	0.888
<b>Midlife</b>		
Alcohol and drug problems		
Extensive and prolonged use	0.960	0.969
Physical and mental health effects	0.888	0.881
Social and functional effects	0.915	0.948
Signs of addiction	0.945	0.931

+*p*=.001; all others *p*< .001

***Female measurement model.*** The female measurement model was judged to have an acceptable fit to the data based on the selected fit indices ( $\chi^2/\text{df}$ =1.92, CFI=0.97, RMSEA=0.04). For women, all factor loadings were statistically significant (*p*≤.001), with magnitudes equal to or greater than 0.500. The factor loadings with lowest magnitude in the female measurement model included childhood household income (standardized factor loading=0.500), and mother's frequency of feeling nervous, tense, or on edge (standardized factor loading=0.502).

#### 4.3.1 Structural models

Before examining the structural models, multiple-group analysis was conducted to test for gender differences in the latent measurement structure. The results indicated a significant decline in model fit between the unconstrained and

constrained measurement models ( $\chi^2=31.40$ ,  $df=14$   $p=.005$ ). Because the underlying measurement structure was significantly different for men and women, separate models were generated for each gender.

**Male structural model.** The male structural model demonstrated adequate fit to the data ( $\chi^2/df=1.65$  CFI=0.97, and RMSEA=0.03). Significant paths and correlations in the male model are shown in Figure 3.

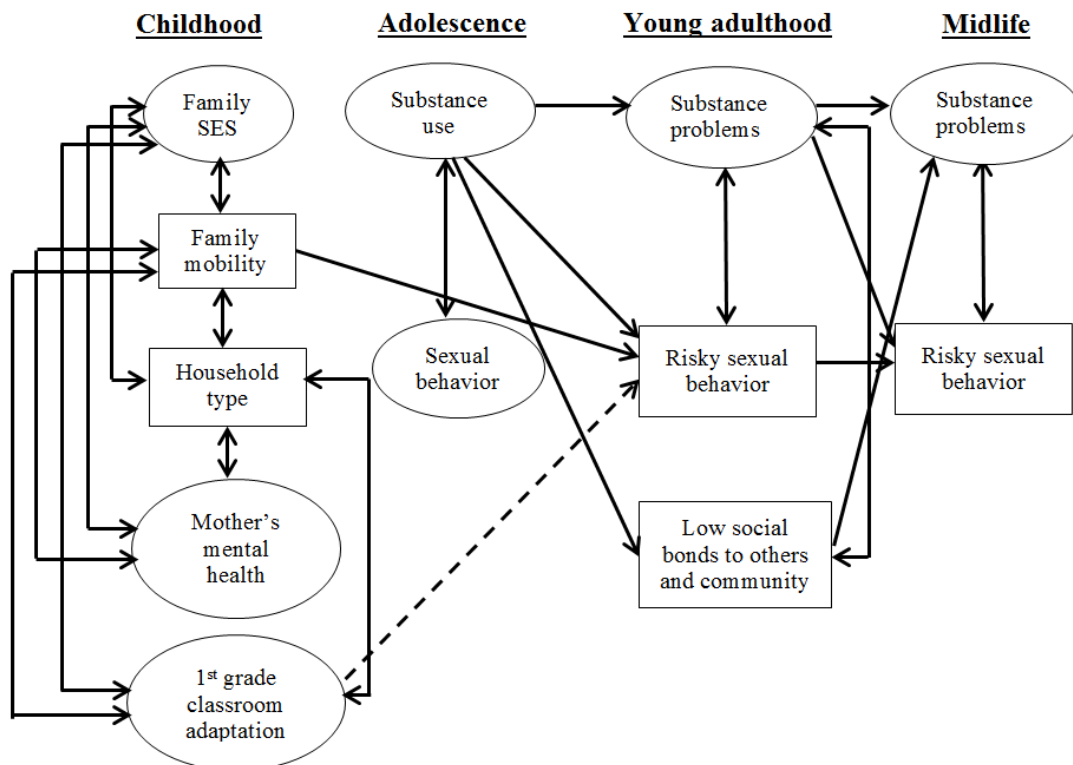


Figure 3. Male structural model depicting significant ( $p<.05$ ) correlations and paths. Solid lines represent positive paths and correlations. Dashed lines represent negative paths.

**Aim 1.** The purpose of Aim 1 was to examine how substance involvement relates to risky sexual behavior over the life course. Unstandardized and standardized regression weights for structural paths in the male model are presented in Table 5. The results indicated that after taking into account the potential effect of early context and adaptation (including family SES, family mobility, household type, mother's



mental health, and first grade classroom adaptation) on subsequent substance use–risky sexual behavior interrelationships, greater adolescent substance use was associated with increased involvement in risky sexual behavior in young adulthood ( $\beta=0.209, p=.005$ ). In addition, greater young adult substance problems (including symptoms of alcohol and drug abuse and/or dependence) predicted greater midlife risky sexual behavior ( $\beta=0.201, p=.001$ ).

Adolescent substance use was also indirectly associated with midlife risky sexual behavior, partly through young adult substance involvement and young adult risky sexual behavior. Specifically, as shown in Table 5, greater adolescent substance use predicted greater substance problems in young adulthood ( $\beta=0.245, p<.001$ ), which were in turn associated with greater involvement in midlife risky sexual behavior as described above. The standardized indirect effect for the adolescent substance use–young adult substance problems–midlife risky sexual behavior pathway was 0.049. Young adult risky sexual behavior was also a positive predictor of midlife risky sexual behavior ( $\beta=0.172, p=.003$ , standardized indirect effect=0.036).

Within-life stage correlations for men are presented in Table 6. In adolescence, greater substance use was significantly associated with greater sexual activity ( $r=0.451, p<.001$ ). In young adulthood greater substance problems were correlated with increased involvement in risky sexual behavior ( $r=0.321, p<.001$ ). Furthermore, midlife substance problems were positively associated with midlife risky sexual behavior ( $r=0.264, p<.001$ ).

*Aim 2 H2a.* The purpose of Aim 2 H2a was to examine whether weak young

adult social integration, as indicated by fewer young adult social bonds, constituted a pathway between adolescent substance use and midlife risky sexual behavior. As hypothesized, greater adolescent substance use predicted fewer social bonds in young adulthood among men ( $\beta=0.214, p<.001$ ). However, young adult social bonding/integration was not significantly associated with midlife risky sexual behavior ( $\beta=-0.044, p=.433$ ).

Table 5

*Parameter estimates for paths in the male structural model including unstandardized coefficients (b) with standard errors and standardized coefficients ( $\beta$ )*

	<i>b (SE)</i>	$\beta$	<i>p-value</i>
<b>Early context and adaptation variables</b>			
Family SES → Adolescent substance use	0.001 (0.045)	0.001	.997
Family SES → Adolescent sexual behavior	0.013 (0.015)	0.078	.400
Family SES → Young adult substance problems	0.044 (0.033)	0.108	.187
Family SES → Young adult risky sexual behavior	-0.001 (0.028)	-0.003	.966
Family SES → Young adult social bonds	0.011 (0.045)	0.018	.801
Family SES → Midlife substance problems	-0.014 (0.049)	-0.022	.771
Family SES → Midlife risky sexual behavior	-0.052 (0.030)	-0.160	.084
Mother's mental health → Adolescent substance use	-0.109 (0.158)	-0.058	.489
Mother's mental health → Adolescent sexual behavior	0.039 (0.052)	0.062	.448
Mother's mental health → Young adult substance problems	-0.134 (0.109)	-0.086	.218
Mother's mental health → Young adult risky sexual behavior	-0.037 (0.099)	-0.025	.706
Mother's mental health → Young adult social bonds	-0.026 (0.158)	-0.011	.871
Mother's mental health → Midlife substance problems	0.167 (0.170)	0.069	.325

	<i>b (SE)</i>	$\beta$	<i>p</i> -value
Mother's mental health → Midlife risky sexual behavior	0.129 (0.091)	0.103	.157
Family mobility → Adolescent substance use	0.049 (0.041)	0.075	.233
Family mobility → Adolescent sexual behavior	0.009 (0.013)	0.044	.477
Family mobility → Young adult substance problems	-0.018 (0.028)	-0.034	.508
Family mobility → Young adult risky sexual behavior	0.072 (0.025)	0.141	.004
Family mobility → Young adult social bonds	-0.024 (0.041)	-0.029	.554
Family mobility → Midlife substance problems	0.004 (0.043)	0.005	.918
Family mobility → Midlife risky sexual behavior	0.019 (0.024)	0.044	.423
Household type → Adolescent substance use	0.150 (0.184)	0.064	.414
Household type → Adolescent sexual behavior	0.012 (0.060)	0.015	.846
Household type → Young adult substance problems	-0.072 (0.130)	-0.037	.578
Household type → Young adult risky sexual behavior	-0.058 (0.114)	-0.032	.611
Household type → Young adult social bonds	0.257 (0.184)	0.087	.162
Household type → Midlife substance problems	0.151 (0.197)	0.050	.443
Household type → Midlife risky sexual behavior	0.004 (0.111)	0.003	.968
1 <sup>st</sup> grade classroom adaptation → Adolescent substance use	0.327 (0.173)	0.123	.059
1 <sup>st</sup> grade classroom adaptation → Adolescent sexual behavior	-0.019 (0.055)	-0.021	.733
1 <sup>st</sup> grade classroom adaptation → Young adult substance problems	-0.014 (0.117)	-0.006	.906
1 <sup>st</sup> grade classroom adaptation → Young adult risky sexual behavior	-0.283 (0.109)	-0.136	.010
1 <sup>st</sup> grade classroom adaptation → Young adult social bonds	0.293 (0.173)	0.087	.092
1 <sup>st</sup> grade classroom adaptation → Midlife substance problems	0.080 (0.183)	0.023	.664
1 <sup>st</sup> grade classroom adaptation → Midlife risky sexual behavior	0.134 (0.098)	0.076	.172
<b>Adolescent variables</b>			

	<i>b</i> ( <i>SE</i> )	$\beta$	<i>p</i> -value
Adolescent substance use → Young adult substance problems	0.203 (0.056)	0.245	<.001
Adolescent substance use → Young adult risky sexual behavior	0.164 (0.058)	0.209	.005
Adolescent substance use → Young adult social bonds	0.270 (0.081)	0.214	<.001
Adolescent sexual behavior → Young adult risky sexual behavior	0.080 (0.161)	0.034	.618
<b>Young adult variables</b>			
Young adult substance problems → Midlife substance problems	0.558 (0.087)	0.362	<.001
Young adult substance problems → Midlife risky sexual behavior	0.159 (0.049)	0.201	.001
Young adult risky sexual behavior → Midlife risky sexual behavior	0.144 (0.048)	0.172	.003
Young adult social bonds → Midlife substance problems	0.184 (0.055)	0.181	<.001
Young adult social bonds → Midlife risky sexual behavior	-0.023 (0.029)	-0.044	.433

*Other findings.* Among significant direct paths involving early context and adaptation/behavior variables for men (Table 5), greater family mobility predicted greater involvement in young adult risky sexual behavior ( $\beta=0.141$ ,  $p=.004$ ), while poorer first grade classroom adaptation/behavior was associated with decreased involvement in young adult risky sexual behavior ( $\beta=-0.136$ ,  $p=.010$ ). Additionally, greater young adult substance problems and weaker young adult social integration were both associated with greater midlife substance problems ( $\beta=0.362$ ,  $p<.001$  and  $\beta=0.181$ ,  $p<.001$ , respectively). For within-life stage correlations (Table 6) significant ( $p<.050$ ) positive associations were found among all early context and adaptation variables with the exception of mother's mental health and first grade classroom adaptation. In young adulthood, social bonding/integration was not significantly associated with risky sexual behavior ( $r=-0.009$ ,  $p=.859$ ). However,

having fewer social bonds was related to greater substance problems in this life stage ( $r=0.206, p<.001$ ).

Table 6

*Correlations for variables within each life stage in the male structural model*

	Correlation	<i>p</i> -value
<b>Early context and adaptation variables</b>		
Family SES $\leftrightarrow$ Family mobility	0.277	<.001
Family SES $\leftrightarrow$ Household type	0.585	<.001
Family SES $\leftrightarrow$ Mother's mental health	0.222	.002
Family SES $\leftrightarrow$ 1 <sup>st</sup> grade adaptation	0.106	.037
Family mobility $\leftrightarrow$ Household type	0.243	<.001
Family mobility $\leftrightarrow$ Mother's mental health	0.140	.020
Family mobility $\leftrightarrow$ 1 <sup>st</sup> grade adaptation	0.153	<.001
Household type $\leftrightarrow$ Mother's mental health	0.170	.006
Household type $\leftrightarrow$ 1 <sup>st</sup> grade adaptation	0.152	<.001
Mother's mental health $\leftrightarrow$ 1 <sup>st</sup> grade adaptation	-0.019	.746
<b>Adolescent variables</b>		
Adolescent substance use $\leftrightarrow$ Adolescent sexual behavior	0.451	<.001
<b>Young adult variables</b>		
Young adult substance problems $\leftrightarrow$ Young adult risky sexual behavior	0.321	<.001
Young adult substance problems $\leftrightarrow$ Young adult social bonds	0.206	<.001
Young risky sexual behavior $\leftrightarrow$ Young adult social bonds	-0.009	.859
<b>Midlife variables</b>		
Midlife substance problems $\leftrightarrow$ Midlife risky sexual behavior	0.264	<.001

**Female structural model.** The fit of the female model was adequate as demonstrated by several fit indices, including  $\chi^2/df=1.76$ , CFI=.97, and RMSEA=.04. Significant paths and correlations in the female model are shown in Figure 4.

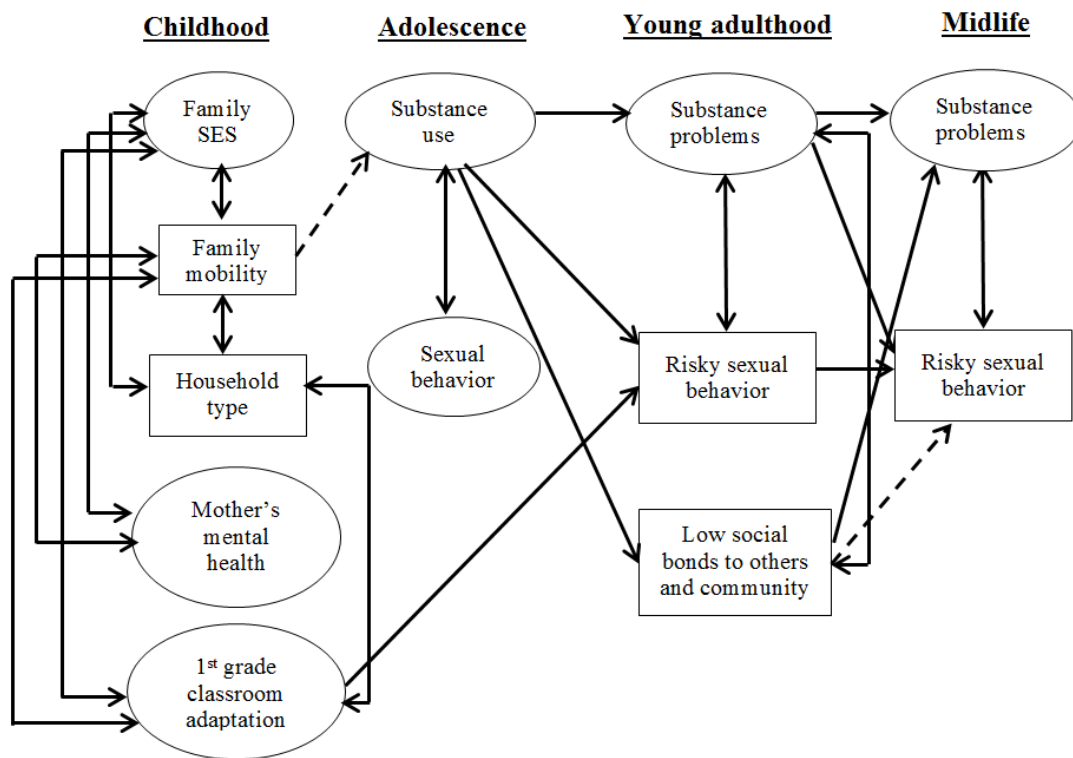


Figure 4. Female structural model depicting significant ( $p<.05$ ) correlations and paths. Solid lines represent positive paths and correlations. Dashed lines represent negative paths.

*Aim 1.* Unstandardized and standardized regression weights for structural paths in the female model are shown in Table 7. Just as in the male model, early context and adaptation variables were included to take into account their potential role in shaping the substance use–sexual behavior interrelationships. Among women, greater adolescent substance use was significantly associated with increased young adult risky sexual behavior ( $\beta=0.149$ ,  $p=.028$ ). Additionally, greater young adult

substance problems predicted greater involvement in midlife risky sexual behavior ( $\beta=0.144, p=.008$ ).

Among women, adolescent substance use was also associated with midlife risky sexual behavior in part through young adult substance problems and young adult risky sexual behavior. Specifically, as shown in Table 7, greater adolescent substance use predicted greater substance problems in young adulthood ( $\beta=0.162, p=.012$ ), which in turn predicted greater involvement in midlife risky sexual behavior as indicated above. The standardized indirect effect for the adolescent substance use–young adult substance problems–midlife risky sexual behavior pathway in the female model was 0.023. Young adult risky sexual behavior was also a positive predictor of midlife risky sexual behavior ( $\beta=0.209, p<.001$ ), with standardized indirect effect of 0.031.

Within-life stage correlations for women are presented in Table 8. In adolescence, greater substance use was correlated with greater sexual activity ( $r=0.379, p<.001$ ). In young adulthood, greater substance problems were related to increased involvement in risky sexual behavior ( $r=0.311, p<.001$ ). Finally, substance problems were also positively associated with risky sexual behavior in midlife ( $r=0.296, p<.001$ ).

*Aim 2 H2a.* In the female model, greater adolescent substance use predicted having fewer social bonds in young adulthood ( $\beta=0.156, p=.013$ ) (Table 7). Weaker young adult social integration was significantly associated with less involvement in midlife risky sexual behavior ( $\beta=-0.099, p=.042$ ). The standardized indirect effect for

the adolescent substance use–young adult social bonding–midlife risky sexual behavior pathway was -0.015.

Table 7

*Parameter estimates for paths in the female structural model including unstandardized coefficients (b) with standard errors and standardized coefficients ( $\beta$ )*

	<i>b (SE)</i>	$\beta$	<i>p</i> -value
<b>Early context and adaptation variables</b>			
Family SES → Adolescent substance use	-0.037 (0.035)	-0.095	.281
Family SES → Adolescent sexual behavior	0.008 (0.014)	0.041	.577
Family SES → Young adult substance problems	-0.020 (0.022)	-0.066	.356
Family SES → Young adult risky sexual behavior	0.006 (0.019)	0.021	.754
Family SES → Young adult social bonds	0.034 (0.035)	0.068	.332
Family SES → Midlife substance problems	0.048 (0.033)	0.106	.144
Family SES → Midlife risky sexual behavior	0.017 (0.017)	0.069	.324
Mother's mental health → Adolescent substance use	0.225 (0.124)	0.130	.069
Mother's mental health → Adolescent sexual behavior	0.112 (0.058)	0.133	.053
Mother's mental health → Young adult substance problems	-0.077 (0.078)	-0.058	.323
Mother's mental health → Young adult risky sexual behavior	-0.050 (0.071)	-0.041	.477
Mother's mental health → Young adult social bonds	0.042 (0.127)	0.019	.741
Mother's mental health → Midlife substance problems	0.198 (0.111)	0.101	.075
Mother's mental health → Midlife risky sexual behavior	0.085 (0.063)	0.078	.175
Family mobility → Adolescent substance use	-0.077 (0.034)	-0.141	.023
Family mobility → Adolescent sexual behavior	-0.027 (0.015)	-0.102	.077
Family mobility → Young adult substance problems	-0.022 (0.021)	-0.051	.313



	<i>b (SE)</i>	$\beta$	<i>p</i> -value
Family mobility → Young adult risky sexual behavior	-0.005 (0.019)	-0.013	.800
Family mobility → Young adult social bonds	-0.005 (0.035)	-0.007	.892
Family mobility → Midlife substance problems	-0.005 (0.030)	-0.009	.860
Family mobility → Midlife risky sexual behavior	-0.011 (0.017)	-0.031	.528
Household type → Adolescent substance use	0.148 (0.140)	0.076	.292
Household type → Adolescent sexual behavior	0.076 (0.060)	0.080	.208
Household type → Young adult substance problems	0.018 (0.088)	0.012	.836
Household type → Young adult risky sexual behavior	-0.038 (0.079)	-0.028	.629
Household type → Young adult social bonds	0.006 (0.144)	0.002	.968
Household type → Midlife substance problems	-0.136 (0.128)	-0.062	.290
Household type → Midlife risky sexual behavior	0.004 (0.071)	0.003	.958
1 <sup>st</sup> grade classroom adaptation → Adolescent substance use	-0.201 (0.142)	-0.086	.159
1 <sup>st</sup> grade classroom adaptation → Adolescent sexual behavior	0.027 (0.059)	0.024	.643
1 <sup>st</sup> grade classroom adaptation → Young adult substance problems	0.124 (0.090)	0.070	.168
1 <sup>st</sup> grade classroom adaptation → Young adult risky sexual behavior	0.233 (0.083)	0.141	.005
1 <sup>st</sup> grade classroom adaptation → Young adult social bonds	0.070 (0.146)	0.024	.631
1 <sup>st</sup> grade classroom adaptation → Midlife substance problems	0.020 (0.128)	0.008	.876
1 <sup>st</sup> grade classroom adaptation → Midlife risky sexual behavior	-0.112 (0.073)	-0.076	.126
<b>Adolescent variables</b>			
Adolescent substance use → Young adult substance problems	0.125 (0.049)	0.162	.012
Adolescent substance use → Young adult risky sexual behavior	0.106 (0.048)	0.149	.028
Adolescent substance use → Young adult social bonds	0.200 (0.081)	0.156	.013
Adolescent sexual behavior → Young adult risky sexual behavior	0.040 (0.080)	0.027	.619

	<i>b</i> ( <i>SE</i> )	$\beta$	<i>p</i> -value
<b>Young adult variables</b>			
Young adult substance problems → Midlife substance problems	0.509 (0.075)	0.343	<.001
Young adult substance problems → Midlife risky sexual behavior	0.118 (0.044)	0.144	.008
Young adult risky sexual behavior → Midlife risky sexual behavior	0.187 (0.044)	0.209	<.001
Young adult social bonds → Midlife substance problems	0.121 (0.043)	0.136	.004
Young adult social bonds → Midlife risky sexual behavior	-0.049 (0.024)	-0.099	.042

*Other findings.* Among significant direct paths involving early context and adaptation/behavior variables for women, greater family mobility predicted less adolescent substance use ( $\beta=-0.141, p=.023$ ), and poorer first grade classroom adaptation was associated with greater involvement in young adult risky sexual behavior ( $\beta=0.141, p=.005$ ) (Table 7). Furthermore, greater young adult substance problems and fewer young adult social bonds were both associated with greater midlife substance problems ( $\beta=0.343, p<.001$  and  $\beta=0.136, p=.004$ , respectively). For within-life stage correlations (Table 8) significant ( $p<.050$ ) positive associations were found among all early context and adaptation variables with the exception of household type and mother's mental health, and mother's mental health and first grade adaptation. In young adulthood, social bonding/integration was not significantly associated with risky sexual behavior ( $r=0.006, p=.892$ ). However, low social integration was related to greater substance problems in this life stage ( $r=0.184, p<.001$ ).

Table 8

*Correlations for variables within each life stage in the female structural model*

	Correlation	<i>p</i> -value
<b>Early context and adaptation variables</b>		
Family SES $\leftrightarrow$ Family mobility	0.309	<.001
Family SES $\leftrightarrow$ Household type	0.553	<.001
Family SES $\leftrightarrow$ Mother's mental health	0.172	.006
Family SES $\leftrightarrow$ 1 <sup>st</sup> grade adaptation	0.152	.002
Family mobility $\leftrightarrow$ Household type	0.199	<.001
Family mobility $\leftrightarrow$ Mother's mental health	0.217	<.001
Family mobility $\leftrightarrow$ 1 <sup>st</sup> grade adaptation	0.123	.005
Household type $\leftrightarrow$ Mother's mental health	0.098	.056
Household type $\leftrightarrow$ 1 <sup>st</sup> grade adaptation	0.107	.013
Mother's mental health $\leftrightarrow$ 1 <sup>st</sup> grade adaptation	0.106	.055
<b>Adolescent variables</b>		
Adolescent substance use $\leftrightarrow$ Adolescent sexual behavior	0.379	<.001
<b>Young adult variables</b>		
Young adult substance problems $\leftrightarrow$ Young adult risky sexual behavior	0.311	<.001
Young adult substance problems $\leftrightarrow$ Young adult social bonds	0.184	<.001
Young risky sexual behavior $\leftrightarrow$ Young adult social bonds	0.006	.892
<b>Midlife variables</b>		
Midlife substance problems $\leftrightarrow$ Midlife risky sexual behavior	0.296	<.001

#### **4.4 Findings: Mediation Analysis for Individual Young Adult Bonds**

**Men.** Aim 2 H2b involved examining individual young adult social bonds as potential mediators of the association between adolescent substance use and midlife risky sexual behavior. Among men, adolescent substance use was positively associated with midlife risky sexual behavior ( $b=0.074, p=.005$ ). Based on the steps outlined in the analysis plan, young adult marriage/cohabitation, custodial parenthood, employment, social organization membership, and religious attendance were first tested separately in simple mediation involving adolescent substance use, the selected young adult bond, and midlife risky sexual behavior, on imputed datasets, using a combination of logistic and linear regression. As shown in Table 9, greater adolescent substance use was associated with increased odds of being unmarried/not living with a partner in young adulthood ( $OR=1.196, p=.003$ ). In turn, being unmarried/not cohabitating in young adulthood predicted less involvement in midlife risky sexual behavior ( $b=-0.168, p=.037$ ). While adolescent substance use was significantly related to absence of custodial parenthood ( $OR=1.129, p=.039$ ), the latter was not a significant predictor of midlife risky sexual behavior. Although greater adolescent substance use was associated with greater likelihood of being unemployed in young adulthood ( $OR=1.197, p=.006$ ), the latter was not significantly associated with risky sexual behavior in midlife. Adolescent substance use was not significantly associated with young adult organizational membership, nor was the latter a significant predictor of midlife sexual risk. While greater adolescent substance use predicted increased odds of not attending church at least once weekly

in young adulthood ( $OR=1.272, p<.001$ ), young adult religious service attendance was not significantly associated with midlife risky sexual behavior.

Because both regression paths involving young adult marriage/cohabitation as a potential mediator of the adolescent substance use–midlife risky sexual behavior association were statistically significant, marriage/cohabitation was subsequently retested in models adjusting for early context and adaptation variables as well as young adult substance problems and young adult risky sexual behavior. The association between adolescent substance use and young adult marriage/cohabitation was significant ( $OR=1.198, p=.004$ ) after accounting for total family income, mother's education, family mobility, mother's mental health, and first grade aggression. The association between young adult marriage/cohabitation and midlife risky sexual behavior was also significant ( $b=-0.161, p=.041$ ) after adjusting for early context and adaptation variables, and for young adult substance problems and risky sexual behavior. Coefficients from the adjusted analyses were used to conduct the Sobel test of indirect effect, result of which was not statistically significant ( $z=-1.687, p=0.092$ ).

Table 9

*Parameter estimates for the associations between adolescent substance use and individual young adult social bonds (odds ratios) and individual young adult social bonds and midlife risky sexual behavior (unstandardized coefficients and standard errors) among men (n=606)*

	Adolescent substance use → Young adult social bond		Young adult social bond → Midlife risky sexual behavior <sup>a</sup>	
<b>Young adult social bonds</b>	<i>OR</i>	<i>p</i> -value	<i>b</i> ( <i>SE</i> )	<i>p</i> -value
Not married/cohabiting	1.196	.003	-0.168 (0.080)	.037
Not a custodial parent	1.129	.039	-0.141 (0.080)	.082
Not employed	1.197	.006	0.037 (0.084)	.656
No social organization membership	1.116	.100	-0.011 (0.078)	.886
Attending religious services less than once weekly	1.272	<.001	0.115 (0.088)	.193

<sup>a</sup>Controlling for adolescent substance use

**Women.** Among women, greater adolescent substance use predicted greater involvement in midlife risky sexual behavior ( $b=0.055$ ,  $p=.009$ ). Following the same procedure for mediation testing as among men, the initial results (shown in Table 10) indicated that greater adolescent substance among women was associated with greater odds of being unmarried/not living with a partner in young adulthood ( $OR=1.161$ ,  $p=.025$ ). In turn, being unmarried/not cohabiting in young adulthood predicted less involvement in midlife risky sexual behavior ( $b=-0.201$ ,  $p=.004$ ). Adolescent substance use was not significantly related to absence of custodial parenthood among women; however, the latter was marginally associated with decreased involvement in midlife risky sexual behavior ( $b=-0.155$ ,  $p=.050$ ). Although greater adolescent substance use was associated with greater likelihood of being unemployed in young

adulthood among women ( $OR=1.149$ ,  $p=.023$ ), the latter was not significantly associated with risky sexual behavior in midlife. Both regression paths involving young adult organizational membership were not significant among women. While greater adolescent substance use predicted increased odds of attending church less than once weekly in young adulthood ( $OR=1.287$ ,  $p=.001$ ), the lack of regular religious participation in young adulthood was not a significant predictor of midlife risky sexual behavior.

Because both regression paths involving young adult marriage/cohabitation as a potential mediator of the adolescent substance use–midlife risky sexual behavior association were statistically significant among women, marriage/cohabitation was subsequently retested in models adjusting for early context and adaptation variables as well as young adult substance problems and young adult risky sexual behavior. The association between adolescent substance use and young adult marriage/cohabitation was significant ( $OR=1.166$ ,  $p=.027$ ) after accounting for total family income, mother’s education, family mobility, mother’s mental health, and first grade aggression. Additionally, the association between young adult marriage/cohabitation and midlife risky sexual behavior was significant ( $b=-0.177$ ,  $p=.009$ ) after adjusting for early context and adaptation variables, and for young adult substance problems and risky sexual behavior. The result of the Sobel test conducted using coefficients from the adjusted analyses was not statistically significant ( $z=-1.706$ ,  $p=.088$ ).

Table 10

*Parameter estimates for the associations between adolescent substance use and individual young adult social bonds (odds ratios) and individual young adult social bonds and midlife risky sexual behavior (unstandardized coefficients and standard errors) among women (n=636)*

	Adolescent substance use → Young adult social bond		Young adult social bond → Midlife risky sexual behavior <sup>a</sup>	
<b>Young adult social bonds</b>	<i>OR</i>	<i>p</i> -value	<i>b</i> ( <i>SE</i> )	<i>p</i> -value
Not married/cohabiting	1.161	.025	-0.201 (0.068)	.004
Not a custodial parent	1.031	.676	-0.155 (0.078)	.050
Not employed	1.149	.023	0.063 (0.064)	.328
No social organization membership	1.041	.507	0.005 (0.058)	.927
Attending religious services less than once weekly	1.287	.001	0.053 (0.068)	.438

<sup>a</sup>Controlling for adolescent substance use

The following chapter provides a brief summary of results and discussion of the findings in the context of extant literature and theory. The discussion also includes a consideration of strengths and limitations of the current study. The final sections describe potential practical implications in the area of public health prevention/intervention, and identify areas for future research.



## Chapter 5: Discussion

### 5.1 Summary of Findings

The current study using data from an urban African American cohort found significant positive associations between adolescent substance use and young adult risky sexual behavior among men and women. Similar results were obtained for the association between young adult substance problems and risky sexual behavior in midlife. Additionally, greater adolescent substance use predicted greater involvement in risky sexual behavior as far as midlife, partly through greater young adult substance problems and greater young adult risky sexual behavior. Substance involvement was also positively correlated with sexual activity and/or risky sexual behavior in all three life stages: adolescence, young adulthood, and midlife among both men and women.

As for the role of social bonding/integration, greater adolescent substance use predicted fewer young adult social bonds among men and women. Interestingly, weaker young adult social bonding/integration was associated with decreased involvement in midlife risky sexual behavior among women only. Among men, the path from young adult social bonding to midlife risky sexual behavior, although in the same direction as among women, was not statistically significant. Considered individually, young adult bonds involving marriage/partnership, custodial parenthood, employment, organizational membership, and religious service attendance were not significant mediators of the adolescent substance use–midlife risky sexual behavior association for either gender.

## **5.2 Aim 1: Associations between Substance Involvement and Risky Sexual Behavior**

Consistent with the hypotheses, the current study found significant positive correlations between substance involvement and sexual behavior and/or risky sexual behavior in all three life stages: adolescence, young adulthood, and midlife for both men and women. Although this investigation did not allow for examining situational or event-specific links between substance involvement and risky sex (i.e., when substance use occurs shortly prior to or during sexual encounters [Leigh & Stall, 1993]), the finding of contemporaneous associations is consistent with the explanations for how substances may affect sexual behavior in the short term. These explanations include substance-related impairment (Dausey & Desay, 2003; Elkington et al., 2010; George & Stoner, 2000; Leigh & Stall, 1993; Palepu, 2005), sex-related substance expectancies (Dermen et al., 1998; Hendershot et al., 2010; Kingree & Thompson, 2007), and survival sex (exchanges of sex for drugs or money) (Bailey et al., 1998; Fullilove et al., 1993; Sanchez et al., 2002; Word & Bowser, 1997), all of which may facilitate sexual risk taking.

Several cross-sectional examinations also revealed that substance involvement was related to sexual activity and risky sexual behavior in adolescence and young adulthood (Dermen et al., 1998; Fullilove et al., 1993; Hendershot et al., 2010; Johnson et al., 2013; Sanchez et al., 2002; Seth et al., 2011; Word & Bowser, 1997). However, there are a number of studies that found limited or lack of support for the link between substance involvement and sexual risk among African Americans (e.g., Cooper et al., 1994; Hallfors et al., 2007; Halpern et al., 2004; Kaestner & Joyce,

2003; Stanton et al., 1993), suggesting that the two behaviors may not be associated in this racial/ethnic group. Given the inconsistencies in evidence on the link between substance involvement and HIV/STI risk, findings from the current study make an important contribution to extant knowledge by indicating that in this cohort of urban African Americans, adolescents who used alcohol and/or marijuana were also likely to engage in sexual activity. Similarly, young adults with symptoms of alcohol and drug abuse and/or dependence were likely to engage in sexual behaviors that may increase the risk of infection with HIV/AIDS and other STIs.

The current study was able to extend the investigation of contemporaneous associations between substance involvement and risky sexual behavior into midlife, as a potentially important stage of continued risk. Much of the existing literature (e.g., Bailey et al., 1998; Johnson et al., 2013; Kingree & Betz, 2003; McEwan et al., 1992; Sanchez et al., 2002; Seth et al., 2011; Word & Bowser, 1997) has focused on earlier parts of the life course, as both adolescence and young adulthood are prime stages for risk taking (Steinberg, 2007). The current results indicate that in this cohort of urban African Americans, both men and women with symptoms of substance abuse and/or dependence in midlife were more likely to engage in risky sexual behavior. These findings are particularly important given that among African Americans, certain types of substance involvement and risky sexual behavior may persist or even intensify throughout adulthood (Corneille et al., 2008; Ensminger et al., in press; Kandel et al., 1997; Myers et al., 2003; NIDA, 2003; Nielsen, 1999); yet relatively little is known about the substance involvement-risky sexual behavior link in this racial/ethnic group beyond adolescence and young adulthood. Finding a

significant association between substance problems and risky sexual behavior in midlife underscores the importance of considering this life stage as an important time of continued risk for transmission of HIV/AIDS and other STIs.

In addition to contemporaneous associations, the current study also found positive prospective associations between adolescent substance use and young adult risky sexual behavior, and between young adult substance problems and midlife risky sexual behavior. These findings are consistent with the study hypotheses, and suggest that the relationships between substance involvement and risky sexual behavior may also operate over time, across the life course, and thus beyond the short-term effects of substances on sexual behavior. Associations between adolescent alcohol and/or marijuana involvement and young adult sexual risk behaviors have been uncovered in several studies (e.g., Berger et al., 2012; Khan et al., 2012; Staton et al., 1999) involving national (e.g., Berger et al., 2012; Khan et al., 2012) and urban community-based samples (e.g., Guo et al., 2002). Adding to the extant evidence, the current findings suggest that urban African American adolescents who use marijuana and/or alcohol may be more likely to engage in risky sexual behavior in young adulthood.

Focusing on earlier stages of the life course, the aforementioned studies did not examine the associations between substance involvement and risky sexual behavior over a larger portion of the life course, beyond the transition from adolescence to young adulthood. Augmenting the previous evidence, the current study demonstrated that symptoms of substance abuse and dependence in young adulthood also predicted risky sexual behavior in midlife. In this urban African American cohort, these findings attest to the lasting nature of the substance

involvement–risky sexual behavior associations over time, suggesting that individuals with substance problems in young adulthood may be at risk for infection with HIV/AIDS or other STIs by engaging in risky sexual behaviors in midlife.

Some evidence suggests that certain early behavioral and/or contextual measures may be partly responsible for later involvement in substance use and risky sexual behavior (Fergusson et al., 2005; Fergusson & Lynskey, 1996; Fergusson & Woodward, 2000; Timmermans et al., 2008). However, the direct prospective associations identified in the current study remained statistically significant even after adjusting for a range of variables intended to capture early social and behavioral maladaptation and contextual adversity. This further suggests that in some cohorts, earlier substance involvement may constitute a risk factor for subsequent involvement in risky sexual behavior.

Examining how substance involvement and risky sexual behavior develop over longer stretches of time may be particularly valuable in groups heavily affected by the HIV/STI epidemic, and thus in need of effective interventions. The current study found evidence of indirect associations between adolescent substance use and midlife risky sexual behavior partly through young adult substance problems and young adult risky sexual behavior among both men and women. Although relatively small in magnitude, these indirect effects are consistent with the study hypotheses, and suggest that young adult risk behavior involvement may link substance use and risky sexual behavior over a considerable portion of the life course. Based on these findings, African Americans who use alcohol and/or marijuana in adolescence may be more likely to develop substance problems in addition to engaging in risky sexual

behavior in young adulthood, both of which may in turn increase involvement in midlife risky sexual behavior.

The finding of indirect effects between adolescent substance use and midlife risky sexual behavior involving young adult substance problems and sexual risk are consistent with the trends describing progression in substance involvement (Flory et al., 2004; Gil et al., 2004; SAMHSA, 2014), and continuity in adult risky sexual behavior (Moilanen et al., 2010; Morrison-Beedy et al., 2008; Scott et al., 2011). For example, in a study focusing on earlier part of the life course, Mason et al. (2010) found that late childhood alcohol use predicted young adult risky sex partly through increase in adolescent alcohol involvement. Although subject to methodological and measurement limitations (Ellickson et al., 2009; Jackson et al., 2012), the results of prospective evaluations also suggest that long-term effects of early substance use interventions on decreasing involvement in adult risky sexual behavior may be facilitated by decreases in substance misuse and problems (e.g., Ellickson, et al., 2009; Griffin et al., 2006). Building on the previous evidence, findings from the current study lend empirical support to the presence of indirect pathways between substance use and risky sexual behavior over longer periods of the life course than previously investigated.

The pathways involving young adult substance problems and young adult risky sexual behavior are also consistent with the major tenets of the age graded theory of informal social control (Laub & Sampson, 1993; Sampson & Laub, 1992), which suggests that involvement in problem behaviors tends to persist over the life course. Through a process aptly named *chimera*, problem or risk behaviors may

undergo both quantitative changes and qualitative shifts over the course of life (Patterson, 1993). Thus, involvement in one type of problem behavior may predict subsequent involvement in conceptually similar or analogous behaviors (Caspi & Moffitt, 1991; Gottfredson & Hirshi, 1990; Sampson & Laub, 1992). Based on the paths uncovered in the current study, involvement in risk behaviors over the life course was found to intensify (e.g., the link between adolescent substance use and young adult substance problems), persist (e.g., the link between young adult risky sexual behavior and midlife risky sexual behavior), and shift (e.g., the link between adolescent substance use and young adult risky sexual behavior).

### **5.3 Aim 2: Young Adult Social Bonds/Integration as Potential Pathways between Adolescent Substance Use and Midlife Risky Sexual Behavior**

Building on the previous evidence regarding the importance of social bonds in regulating involvement in risk/problem behaviors over the life course, the current study examined low overall young adult social bonding/integration as a potential pathway between adolescent substance use and midlife risky sexual behavior.

Consistent with the concept of cumulative disadvantage (Dannefer, 2003; Sampson & Laub, 1997), in this urban African American cohort, adolescent boys and girls who engaged in greater substance use had fewer young adult social bonds. These results are in line with previous reports of the negative effects of adolescent substance use on adult role functioning (e.g., Brook et al., 1999; Newcomb, 1997), and suggest that adolescent substance involvement may interfere with successful transition into young adult roles, and thus formation of age-appropriate bonds to other individuals and to society. Substance using teens may be negatively labeled early on (Downs, Flanagan,

& Robertson, 1985; Downs, Robertson, & Harrison, 1997; Kaplan & Johnson, 1991; Ray & Downs, 1986), potentially resulting in stigma and marginalization, which may restrict future conventional opportunities (Downs et al., 1985; Downs et al., 1997; Kaplan & Johnson, 1991; Paternoster & Iovanni, 1989; Sampson & Laub, 1997). Consequently, these adolescents may find it difficult or even impossible to successfully transition into adult roles and establish social bonds to others and to community. Instead, they may transition into unconventional or marginalized societal subsets, particularly in economically disadvantaged urban areas with already limited opportunities (Kaplan & Johnson, 1991; Sampson & Laub, 1997).

The path from young adult social bonding/integration, measured as a number of social bonds, to midlife risky sexual behavior was statistically significant only among women, in a direction opposite to what was hypothesized based on theory: fewer bonds were associated with less risky sex. Although not statistically significant for men, the direction of the association was the same as for women. Extant literature suggests that the effect of adult social bonds/roles on health and behavior of African Americans may be different relative to White adults (Jager, 2011; Nielsen, 1999; Rushing et al., 1992; Waldron & Jacobs, 1989). Social bonds/roles may become an important source of strain (Agnew, 1992; Nielsen, 1999), particularly when they are perceived as challenging (Jager, 2011). Among urban African Americans who face numerous adversities and disadvantages (Williams & Collins, 2001; Sampson, Morenoff, & Gannon-Rowley, 2002; Wilson, 1991), perceiving certain social roles as challenging or as sources of strain may be particularly likely. For example, employment opportunities available to residents of economically disadvantaged urban



areas have been found to offer low wages, limited stability, and little occupational advancement (Anderson, Halter, & Gryzlak, 2004; Anderson, Halter, Julnes, Schuldt, 2000; McLoyd, 1990; Newman, 1999; Wilson, 1991). In addition, urban African Americans may be particularly likely to experience negative stereotypes and attitudes, as well as racism/discrimination from their employers (Neckerman & Kirschenman, 1991; Wilson, 1991). Marriages or partnerships may be less stable and cohesive when subjected to socioeconomic pressures and strain associated with residing in economically disadvantaged urban areas with relatively few available resources (Fein, 2004; Lichter, Qian, & Mellott, 2006; McLoyd, Cauce, Takeuchi, & Wilson, 2000). Finally, parenting in urban neighborhoods with high crime rates, limited services, and insufficient sources of social and economic supports may be challenging and stressful, adding to daily hassles (McLoyd, 1990; Pinderhughes, Nix, Foster, Jones, & The Conduct Problems Prevention Research Group, 2007; Sampson et al., 2002). In such cases, social bonding and integration could facilitate involvement in risk behaviors as a way of coping with excessive strain (Agnew, 1992), instead of reducing such behaviors through informal social control as suggested by the age-graded theory of informal social control (Sampson & Laub, 1990; Sampson & Laub, 1993). Indeed, it has been proposed that sexual activity and high-risk sex may be used as a way to cope with stressors (Folkman, Chesney, Pollack, & Phillips, 1992), gain control over one's life, achieve diversion, and relieve tension (Bennett & Bauman, 2000).

Yet, the current study found a significant association between fewer young adult social bonds and greater midlife substance problems, suggesting the relevance

of informal social control in the context of substance involvement. Perhaps a viable alternative explanation for the association between weaker young adult social bonding and greater involvement in midlife risky sexual behavior lies in the very nature of risky sexual behavior. Unlike other risk or problem behaviors such as substance use or criminal involvement, high-risk sex is an inherently social behavior requiring involvement of other individuals. Considering this unique caveat, it is possible that fewer young adult social bonds/weaker integration may afford fewer opportunities to meet sexual partners, thus decreasing sexual involvement and high-risk sex over time. The results of the current study suggest that the restriction of social opportunities for meeting partners and engaging in sexual activity corresponding to weaker social integration may be more relevant in decreasing sexual risk for women than for men.

Examined individually, none of the young adult social bonds mediated the association between adolescent substance use and midlife sexual risk for men or women. Either one or both associations involving custodial parenthood, employment, social organization membership, and religious service attendance were not statistically significant in simple mediation models. Adolescent substance use predicted the absence of young adult marriage/cohabitation, which in turn was associated with decreased midlife risky sexual behavior in simple mediation models for both genders. These associations remained significant in models including early context variables as well as young adult substance problems and young adult risky sexual behavior. However, the Sobel test of the indirect effect involving young adult marriage/cohabitation was not statistically significant for either gender.

In the context of the age-graded theory of informal social control, the role of cumulative continuity of disadvantage in facilitating risk behavior involvement over the life course has been hypothesized to be particularly pronounced among economically disadvantaged urban populations (Sampson & Laub, 1997). In breaking down the mediation effects into individual regression paths, it is apparent that the majority of the associations between adolescent substance use and individual young adult social bonds in the current study are consistent with the concept of cumulative disadvantage. Specifically, adolescent substance use was negatively associated with young adult marriage/partnership, custodial parenthood, employment, and religious service attendance among men, and marriage/partnership, employment, and religious service attendance among women. However, with the exception of a positive association between marriage/cohabitation and midlife sexual risk for both genders and, marginally, of custodial parenthood among women, the paths between young adult bonds and midlife risky sexual behavior were not significant. The lack of support for the salience of individual social bonds in regulating midlife risky sexual behavior involvement in this urban African American cohort suggests the need for alternative explanations.

One explanation that may help to understand findings that do not support social control theory perspectives involves a disadvantage-saturation hypothesis (Hannon, 2001; McNulty, 2001). This explanation suggest that urban, predominantly African American areas may be affected by such as high level of social and economic deprivation that any additional disadvantage may have very little impact on opportunity structures, behaviors, and other outcomes (Hannon, 2001; Krivo &

Peterson, 2000). Thus, it is possible that in economically disadvantaged urban areas, additional adversity in the form of absence of adult social bonds may not have much significant impact on future risk or problems behaviors such as risky sex. Such an alternative explanation may be helpful in understanding the lack of significant associations between the absence of young adult social bonds and greater midlife risky sexual behavior in this urban African American cohort.

Another possibility to consider is that the quality of young social bonds may be more important in pathways between adolescent substance use and midlife risky sexual behavior than their mere presence or absence. Despite the potential importance of social bond quality (DeFronzo & Pawlak, 1993; Laub & Sampson, 1993; Sampson & Laub, 1990; Stinson et al., 2008), there is limited guidance on how “quality” should be operationalized. Therefore, examining the quality of bonds could be methodologically challenging, with results varying among studies based on subjective choices of researchers. In additional exploratory analyses, the current study examined several potential quality measures related to young adult marriage/cohabitation (e.g., support from spouse/partner, self-evaluation of marriage/partnership), parenthood (e.g., self-evaluation as parent, frequency of contact with children not living with participants) and employment (e.g., frequency of involuntary unemployment). None of these indicators were significant mediators of the adolescent substance use–midlife risky sexual behavior association. However, these initial results do not preclude the possibility that other dimensions of quality may constitute significant pathways. Additionally, the young adult social bonds were

captured at one moment in time. Perhaps being able to capture transitions involving social bonding over time would have yielded different results.

The African American church has served as the cornerstone of social influence and change in African American communities throughout history and today (Barnes, 2005; Billingsley, 1999; Moore, 1991; Swartz, 2002). Therefore, it is somewhat surprising that religious attendance was not a significant mediator of the adolescent substance use–midlife risky sexual behavior association. Adolescent substance use predicted less frequent religious service attendance in young adulthood; however, the latter was not a significant predictor of midlife sexual risk. Although these trends are slowly beginning to change, traditionally African American churches have been reluctant to discuss or address certain sensitive matters, such as risky sexual behavior and same-sex partnerships with members of their congregations (Collins, Whithers, & Braithwaite, 2007; Ward, 2005). Topics on sexuality, particularly those addressing high-risk sexual behavior, may be taboo in African American churches based on the very nature of religious doctrines (Valentine et al., 2008). Thus, it is possible that attending church regularly may not be protective against sexual risk if such topics are not addressed in formal sermons or informal communications with a pastor. Conversely, not attending church regularly would not necessarily be associated with greater sexual risk.

Young adult marriage/cohabitation did not constitute a significant pathway between adolescent substance use and midlife risky sexual behavior based on the non-significant results of the Sobel test. However, adolescent substance use was a statistically significant predictor of being unmarried/not cohabiting in young

adulthood, and the latter was associated with decreased involvement in midlife risky sexual behavior for both men and women. Conversely, in this urban African American cohort, young adult marriage/cohabitation was related to increased involvement in midlife risky sexual behavior. Marriage and cohabitation are typically associated with presence of mutual trust (Dodoo & Klein, 2007; Hattori, 2014; Rowthorn, 1999), and strong expectation of sexual exclusivity (Dodoo & Klein, 2007; Nock, 1998; Treas & Giesen, 2004). Perhaps fitting with these expectations, condom use tends to be low among those who are married or in relationships (Anderson, Wilson, Doll, Jones, & Barker, 1999; Sheeran et al., 1999; Wayment et al., 2003). Among the Woodlawn Study participants who were married or cohabiting in young adulthood, approximately 74% (including 72% of women and 75% of men) reported no/inconsistent condom use at midlife. It is likely that in many cases this finding would not be a source of concern. However, several factors present in African American communities and discussed below suggest that in some instances, lack of or inconsistent condom use among married or cohabiting couples may substantially increase the risk of infection with HIV/AIDS and other STIs.

Extant literature suggests that sexual networks in African American communities are dense, with complex connections and unique processes occurring within them (Adimora, Schoenbach, & Doherty, 2006; Hallfors et al., 2007; Laumann & Youm, 1999). Two of these processes frequently operating together include assortative mating (greater preference for choosing a partner from the same racial/ethnic group) and dissortative mixing (higher likelihood of selecting a partner from a high-risk grouping) (Hallfors et al., 2007; Laumann & Youm, 1999). Given

the high prevalence of HIV/AIDS and other STIs in African American communities (CDC, 2011a, CDC, 2012a), and a combination of assortative mating and dissortative mixing (Hallfors et al., 2007), African Americans may be at increased risk for infection even with one sexual encounter (Laumann & Youm, 1999). Thus, the risk of infection may be high even for those entering into a relationship or marriage with one partner.

Higher rates of incarceration and mortality affecting African American men are thought to contribute to gender imbalance in African American communities, creating a large female to male ratio (Adimora et al., 2001; CDC, 2011c; El-Bassel, Caldeira, Rugglass, & Gilbert, 2009; Logan et al., 2002). The skewed gender ratio may facilitate concurrent relationships and/or promote bridging between low and high risk partner pools (Adimora et al., 2006). Such gender imbalance also means that men can find another partner easily, potentially diminishing women's power to negotiate protective behaviors and mutually monogamous relationships (Adimora et al., 2006; El-Bassel et al., 2009; Logan et al., 2002).

Sexuality in African American communities is inherently complex and multidimensional (Fullilove, 2001). Accordingly, some researchers (e.g., Wright, 1993) have proposed expanded classification systems to represent sexual behaviors, particularly among African American men, which transcend the traditional sexual identity constructs (e.g., heterosexual, bisexual, and homosexual), and capture various degrees of overlap and the extent of involvement in each. One topic that continues to generate heated debates in the literature and popular media is the so-called "down low" phenomenon used to describe behavior of some African American men who are

married to or dating women, but who occasionally have sexual encounters with other men (Sandfort & Dodge, 2008).

The down low label has been criticized for its stigmatizing effect on African American men and their sexuality (Ford, Whetten, Hall, Kaufman, & Thrasher, 2007; Phillips, 2005; Sandfort & Dodge, 2008), when in fact the lack of concordance between sexual behavior and perceived sexual orientation is not unique to men from this racial/ethnic group (Ford et al., 2007). In reality, it may be difficult to estimate the number of men who are married or in relationships with women, but who also have sexual encounters with other men, as reluctance to disclose such activities may be very high (CDC, 2003; Lichtenstein, 2002; Millet, Malebranche, Mason, & Spikes, 2005). Bisexuality and homosexuality are greatly stigmatized in African American communities as conflicting with the images of Black masculinity and power (Lichtenstein, 2000; Ward, 2005; Wright, 1993). Additionally, some African American men may consider bisexual or homosexual activities as “feminine” or pertaining to White gay culture, thus not identifying their behavior as belonging to either of these categories (Sandfort & Dodge, 2008).

Nondisclosure of bisexual activity may increase the risk of infection not only for the men themselves, but also for their primary female partners (CDC, 2003; Miller et al., 2005). Research shows that African American men who have sex with both men and women may be at greatest risk of HIV infection, relative to African American men who have sex only with women and those who have sex only with men (Brooks, Rotheram-Borus, Bing, Ayala, & Henry, 2003), as undisclosed bisexual behavior often involves unprotected and risky sex (Lichtenstein, 2000; Myers et al.,



2003). In contrast, heterosexual sex constitutes the main route of transmission among African American women (CDC, 2013a). Meanwhile, STI testing rates remain low, as only 58% of African Americans report having ever been tested for HIV (Rountree, Chen, Brown, & Pomeroy, 2009). The combination of the existing evidence as well as unique circumstances and features of sexual networks in African American communities strongly suggest that in some cases the association between marriage/partnership and lack of or inconsistent condom use may be a source of risk for infection with HIV and other STIs.

#### **5.4 Aim 3: Gender as a Moderator of the Associations and Pathways between Substance Involvement and Risky Sexual Behavior over the Life Course**

Because of the underlying differences in measurement structure, male and female structural models were not directly comparable. However, the results for stratified models suggest that substance involvement was prospectively associated with risky sexual behavior among both men and women. Specifically, the associations between adolescent substance use and young adult risky sexual behavior, and young adult substance problems and midlife risky sexual behavior were statistically significant for both genders. Additionally, in both male and female models, greater adolescent substance use predicted increased young adult substance problems, which in turn were associated with greater midlife risky sexual behavior. The standardized indirect effect for adolescent substance use–young adult substance problems–midlife risky sexual behavior pathway was 0.049 for men and 0.023 for women. In addition to the association between adolescent substance use and young adult risky sexual behavior, the latter was also a significant positive predictor of

midlife risky sexual behavior among both men and women. The magnitude of the indirect effect for adolescent substance use–young adult risky sexual behavior–midlife risky sexual behavior pathway was 0.036 for men and 0.031 for women. Examination of within life-stage associations revealed that substance involvement was a significant positive correlate of sexual behavior/risky sexual behavior for both men and women in all three life stages: adolescence, young adulthood, and midlife.

Studies examining gender differences in the associations between substance involvement and risky sexual behavior have identified some differences in risk taking for men and women (e.g., Lavan & Johnson, 2002; Staton et al., 1999; Stueve & O'Donnell, 2005; Tapert et al., 2001). However, the evidence produced by these studies has been somewhat inconsistent regarding direction and patterns. Given that substance involvement and sexual risk behavior measures tend to differ among studies, some of the inconsistency and perhaps even gender differences may be partially attributable to differences in measurement and operationalization. Furthermore, while these investigations considered individual high-risk sexual behaviors separately, the current study evaluated a more comprehensive aggregate risky sexual behavior measure based on the number of reported behaviors, in relation to latent constructs combining multiple substances and focusing on abuse and dependence symptoms in adulthood. Current findings suggest that when more comprehensive measures are used, the interrelationships between substance involvement and risky sexual behavior may exist for both men and women.

The results for stratified models did suggest some gender differences in the pathway involving the overall young adult social bonding/integration. Specifically, in

the female model, having fewer young adult social bonds was prospectively associated with decreased involvement in midlife risky sexual behavior, while among men this path was not significant. Although theories focusing on the importance of social bonds in pathways linking risk behavior involvement over the life course do not preclude gender differences in those mechanisms, they do not specifically address the issue of gender (Mason & Windle, 2002). The evidence of gender differences in the pathway involving the overall social bonding/integration suggests that the latter may constitute a more relevant pathway among women. In this urban African American cohort, women with weak overall young adult social integration were less likely to engage in risky sexual behavior in midlife (or, conversely, that greater young adult social integration among women was associated with greater involvement in midlife risky sexual behavior). Perhaps African American women experience greater strain associated with multiple social roles than men, and thus having fewer young adult bonds means reduced need to use sex as a coping mechanism. It is also possible that, given the evidence of gender imbalance in African American communities, social integration may be more important in creating sexual opportunities for women, while for men these opportunities may be abundant regardless of the integration level. In this case, weak social integration would have more impact on reducing risky sexual behavior over time among women.

While not the focus of the current study, some of the paths between early context variables and subsequent substance and risky sexual behavior involvement differed for men and women. For example, in the male model, first grade social and behavioral maladaptation was inversely associated with young adult risky sexual

behavior, after controlling for other childhood variables as well as adolescent substance use and sexual behavior. This finding suggests that boys demonstrating social and behavioral problems were less likely to engage in risky sexual behavior as young adults. Additionally, male participants with greater early family mobility had greater young adult sex-related risk. Among women, early social and behavioral maladaptation was positively associated with young adult risky sexual behavior, suggesting that poorly adapted girls were more likely to be involved in risky sexual behavior in young adulthood. On the other hand, childhood family mobility among female participants appeared to be protective against adolescent substance use.

Although when examined individually, none of the young adult social bonds were significant mediators of the adolescent substance use–midlife risky sexual behavior association among men or women, some gender differences were evident in individual regression paths involving young adult custodial parenthood in simple (unadjusted) mediation analyses. Specifically, adolescent substance use was significantly associated with absence of custodial parenthood in young adulthood among men, but not among women. This finding suggests that in this African American cohort, substance using adolescent boys were less likely to have a child living in their household in young adulthood. In addition, the absence of young adult custodial parenthood was marginally associated with decreased involvement in midlife risky sexual behavior among women, but not among men. This suggests that women who had a child living in their young adult household were at increased risk for engaging in risky sexual behavior in midlife.

## **5.5 Strengths, Limitations, and Other Considerations**

### ***5.5.1 Study design***

Data for the current examination came from a prospective study of a relatively large, urban, neighborhood-based cohort of African Americans followed for approximately 35 years. Urban African Americans bear a disproportionate burden of HIV/AIDS and other STIs, and thus being able to examine the interrelationships of substance involvement and HIV/STI risk in an all-African American cohort allowed focusing specifically on this racial/ethnic group. The length of the study with multiple waves of data collection enabled examination of the associations between substance involvement and risky sexual behavior not only within the distinct life stages, but also across a substantial portion of the life course. Unlike cross-sectional studies, the prospective design allowed for preservation of temporal ordering to investigate the associations and pathways between earlier substance use and subsequent risky sexual behavior. Although considered among the strongest observational study designs (Song & Chung, 2010), prospective cohort studies present more challenges in making causal inferences relative to well-designed randomized studies. However, in situations where conducting randomized studies would not be feasible or ethical, careful selection of variables and analytical approaches may help to strengthen internal validity. The goal of the current study was to examine the contemporaneous and prospective associations, as well as pathways between substance involvement and sexual behavior/risky sexual behavior over the life course. In an effort to better isolate these associations and pathways, the study adjusted for the effect of multiple, carefully selected variables designed to

capture early contextual adversity and behavioral maladaptation, which have been shown in the extant literature and/or in previous Woodlawn studies to affect life course patterns of involvement in risk or problem behaviors (Ensminger et al., 1982; Ensminger et al., 2002; Farrington et al., 1990; Fergusson et al., 2005; Fergusson & Woodward, 2000; Fothergill et al., 2009; Green et al., 2012).

### 5.5.2 Variables

The ability to include a range of substance involvement measures across the life course is an important strength of the current study. In adolescence, substance involvement was measured as lifetime frequency of alcohol and marijuana use. Alcohol and marijuana are the two most commonly used substances in adolescence (Deas, 2006; Johnston, O'Malley, Bachman, & Schulenberg, 2011; McDermott et al. 2013), which are also frequently investigated in relation to risky sexual behavior. In the Woodlawn Study, the majority (57%) of teens used both alcohol and marijuana, suggesting a substantial overlap in the use of the two substances. Additional drugs were not included in the adolescent substance use measure both to be consistent with the previous Woodlawn studies (e.g., Fothergill & Ensminger, 2006; Green et al., 2012), and because with very low prevalence among Woodlawn adolescents, other drug use did not load well on the latent variable.

In young and mid adulthood, substance problems were based on the CIDI modules (Anthony et al., 1994; Kessler et al., 1994; Kessler & Ustun, 2004) developed at the University of Michigan for the National Center for Statistics. One advantage of the current study was the ability to conduct a comprehensive examination of problematic substance use, by combining abuse and dependence

symptoms for multiple substances using latent variables. Indicators for the latent variables were categorized using appropriate versions of the DSM manual (APA, 1987; APA, 2000). Using multiple, instead of single indicators of substance involvement across the life course allowed for a more realistic modeling approach, as evidence suggests the use of any one drug in isolation is rare (Martinotti et al., 2009; Pressley & McCormick, 2007; Tarter & Mezzich, 1992). Additionally, symptoms of alcohol and drug abuse and/or dependence are frequently interrelated (e.g., Compton et al., 2007; Hasin et al., 2007), with substantial overlap in disorder diagnoses (Dick & Agrawal, 2008; Lejuez et al., 2008). This approach is also consistent with previous Woodlawn work (e.g., Fothergill & Ensminger, 2006).

The current study also used a diverse set of variables designed to capture sexual behavior throughout the life course, including involvement in high-risk sex. In adolescence, two items measuring sexual behavior included lifetime frequency of engaging in sexual intercourse and current use of birth control. Both of these items have some limitations. For example, the highest category on the variable measuring the frequency of engaging in sexual intercourse was three or more times, which may not necessarily represent high risk, given that it is a lifetime measure and it is unknown whether these encounters were with the same or different partners. However, this item is useful in capturing adolescents who were already sexually active. Extant studies suggest that a male condom has been one of the most common forms of contraception among African American adolescents (e.g., Brown et al, 2011; Clark, Zabin, & Hardy, 1984; Finkel & Finkel, 1975). Thus, even though the frequency of birth control use measure did not capture condom use specifically, it can

be assumed that a condom was used by the teens as a form of birth control at least some of the time.

Research suggests that examining individual high-risk sex behaviors as separate outcomes may not adequately capture the overall sex-related risk (Beadnell et al., 2005; Reiter, 2009; Susser et al., 1998). Thus, in an effort to create a comprehensive adult risky sexual behavior measure, multiple sexual behaviors known to increase the risk of contracting HIV/AIDS and other STIs were combined at both adult life stages. The selection of sexual risk behaviors, including multiple (two or more) sexual partners, no/inconsistent condom use, and exchanging sex for drugs or money is consistent with other investigations of the association between substance involvement and risky sexual behavior (e.g., Berger et al. 2012; Guo et al., 2002; Hutton et al., 2008; Khan et al., 2013; Khan et al., 2012; Kwiatkowski & Booth, 2000; Logan et al., 2002). Furthermore, studies examining risky sexual behavior have frequently combined individual items into composite or aggregate measures (e.g., Bachanas et al., 2002a; Fergus, Zimmerman, & Caldwell, 2007; King et al., 2012; Stiffman, Dorè, Earls, & Cunningham, 1992). Despite the strength of being able to capture multiple risky sexual behavior indicators, additional information not available in the current dataset, including partner's sexual behavior (or riskiness), respondent's and/or partner's same and mixed-sex sexual activity, and more detailed count-type data (e.g., number of times having unprotected intercourse in a given period of time), would have created a more comprehensive measure of sexual risk.

It is important to mention that substance involvement and sexual behavior measures were collected using self-reports. Because these behaviors may be



considered socially undesirable and carry a degree of stigma, it is possible that the participants may have underreported or even denied their involvement in these behaviors. Despite some ongoing debate, results of multiple studies have suggested that self-reports of less socially desirable behaviors, such as substance use, have adequate concordance when compared over time, across studies, or to more objective physical biomarkers (Darke, 1998; Gold, 1970; Rosenfeld & Decker, 1993; Yacoubian & Urbach, 2002). Nonetheless, the associations between these two behaviors may have been underestimated.

To conduct a comprehensive examination of young adult social bonding/integration as a potential pathway between adolescent substance use and midlife risky sexual behavior, the current study used several different social bonds. An important strength of the social bonding/integration measure is that in addition to more common conventional adult bonds such as marriage/partnership, custodial parenthood, employment, and organizational membership, the current study also included bonds that may be of particular importance among American Americans, such as religious service attendance. In addition, the current study examined more than one dimension of social bonding/integration, by testing the overall level of social integration (based on the number or frequency of bonds for each participant), as well as each bond separately.

Several childhood/early context variables were included in the current study based on their theoretical importance, which represents an important strength. These variables were used in the statistical models to adjust for the potential effect of early adversity and social/behavioral maladaptation on subsequent patterns of substance

and risky sexual behavior involvement, and self-selection into or out of conventional roles. While the early context variables were based on the information elicited from participants' mothers, the social/behavioral adaptation measures were collected by the first grade teachers using TOCA, a standardized instrument with previously established validity and reliability (Kellam et al., 1975). Being able to use information about participants' early childhood from two different sources (mothers and first grade teachers), substantially strengthened the early context and adaptation/behavior measure.

#### 5.5.3 Generalizability of the findings

Although helpful in focusing on a population segment most affected by the HIV/AIDS epidemic and exploring intra-cohort variation, using a Chicago neighborhood-based cohort of urban African Americans may limit generalizability of the findings to broader populations. As a group, African Americans born around the year 1960 in the United States have experienced several major social and political events, including the national struggle for equality during the Civil Rights Movement, the violent aftermath of the assassination of Dr. Martin Luther King, the passage of the Civil Rights Act and, more recently, the election and subsequent re-election of the first African American U.S. president. African Americans residing in other major urban areas may, to some extent share similar contextual experiences, particularly with respect to higher-than-average level of disadvantage, such as overt/covert racism and discrimination, residential segregation, exposure to crime and violence, diminished opportunities, and economically impoverished circumstances (Black, Howard, Kim, & Ricardo, 1998; Sampson et al., 2002; Williams, 1999; Williams &

Collins, 2001; Wilson, 1987; Wilson, 1996; Wilson, 2007). Thus, it is possible the results of the current study may generalize to urban African Americans of a similar age group residing in other major metropolitan areas of the U.S. However, without adequate replication, it is less clear whether the findings would be equally applicable to African American cohorts originating in suburban or rural areas, or to those of different ages.

#### 5.5.4 Missing data/attrition

Even with efforts to locate and follow up as many participants as possible, the Woodlawn Study has been subject to attrition. Despite some loss to follow-up, close to 85% of the original cohort provided data through at least one adult assessment, and the attrition analyses revealed no significant differences on many key measures. In order to address missingness in the current study, novel and sophisticated methods were used as recommended in the current literature (Graham, 2009; Royston & White, 2011; White et al., 2011). Specifically, full information maximum likelihood estimation was employed to address missing data in SEM, which helped to retain the full sample and thus avoid the loss of statistical power due to sample reduction, and potential bias due to case deletion. In regression analyses used to examine individual young adult bonds as potential mediators of the adolescent substance use–midlife risky sexual behavior association, the current study used multiple imputations using chained equations (MICE). Unlike older, simpler methods of imputing a single value for each missing data point, MICE estimates a set of plausible values with inclusion of random variation to indicate uncertainty of the estimates. This allowed for the full-

sample estimates to be computed by combining multiple imputed datasets, thus helping to improve power and reduce bias.

## **5.6 Research and Public Health Implications**

The current study makes an important contribution in the area of substance involvement and risky sexual behavior over the life course of urban African Americans, with several potential intervention implications. In disadvantaged urban neighborhoods disproportionately burdened by problems related to substance use and HIV/STIs, the results suggest that interventions to address substance involvement at any stage of life may have both immediate and long-term effects on decreasing risky sexual behavior – an important modifiable risk factor for HIV/AIDS and other STIs. Prevention efforts to reduce adolescent substance use may also have an indirect effect on decreasing risky sexual behavior as far across the life course as midlife, by decreasing young adult substance problems and risky sexual behavior among African American men and women. Given the associations between adult substance problems and sex-related risk, substance abuse treatment programs in urban areas with predominantly African American participants should either continue to offer or, if not yet available, incorporate components that focus on screening for, preventing, and if needed reducing risky sexual behavior.

In July 2012, the FDA approved the first drug designed to reduce the risk of infection with HIV in adults as part of the preexposure prophylaxis (PrEP). Current CDC guidelines recommend that PrEP be used “as one prevention option for adult heterosexually active men and women who are at substantial risk for HIV acquisition,” and “as one prevention option for adult injection drug users (IDU) at

substantial risk of HIV acquisition” (CDC, 2014, p. 9). The finding of significant prospective and contemporaneous associations between substance problems and risky sexual behavior suggests that adult African Americans experiencing alcohol and drug abuse and/or dependence symptoms may constitute an important high-risk population segment. Perhaps these individuals could benefit from PrEP as an additional way to reduce their risk of HIV infection. However, more research is likely needed to better understand the potential for drug interactions.

While interventions aimed at reducing substance use among African American youth may positively affect young adult bonds to others and to society, the results of the current study suggest that greater social integration among young adult women may in fact facilitate subsequent involvement in risky sexual behavior. Based on these preliminary results and pending replication in other studies, public health interventions aiming to decrease HIV/STI risk behaviors and related infections may need to consider the potential importance of sex-related risk among African American women with multiple social bonds, i.e., those well integrated into the society/community. Additionally, public health interventions should not overlook the possibility of potentially heightened risk for infection with HIV and other STIs stemming from lack of or inconsistent condom use among married or cohabiting African American couples. Given the multitude of factors that may increase the risk of HIV/STI infection in urban areas, even within relationships and marriages, public health messages that encourage HIV/STI testing should be tailored to married or cohabiting individuals and couples.

## **5.7 Future Research Directions**

To build on and expand the current findings, future studies should extend the examination of associations and pathways between substance involvement and risky sexual behavior past early midlife to investigate their potential relevance in later stages of the life course. The current study was unable to examine situational or event-specific associations between substance involvement and sexual risk, focusing instead on global associations. Because results may differ depending on the type of associations examined, future investigations should include information on sexual behavior patterns under the influence of substances.

The current investigation did not examine other potentially important aspects of social bonding, such as transitions and changes in social bonds over time, different patterns and combinations of bonds, and diverse dimensions of bond/attachment strength and quality, all of which should be tested in future studies exploring the pathways between substance involvement and risky sexual behavior over the life course. Subsequent investigations could augment the current findings by including more specific indicators of risky sexual behavior in adolescence and additional measures of risky sexual behavior in adulthood. This could include information on partner behavior and riskiness, sexual orientation and partner preferences, and more nuanced data involving number of risky events.

Although certain factors such as temporal ordering and the ability to adjust for early context strengthened the internal validity of the current study, this investigation was limited in its ability to test causal relationships. Future studies should examine potential causal relationships using methods better suited to testing causality in

observational studies, such as propensity score matching (Rosenbaum, 2009; Rosenbaum & Rubin, 1983). Finally, replication of the current study is needed to determine if similar results are found in different contexts and with diverse samples of African Americans. More recent cohorts should also be examined as HIV/AIDS was not a major issue for this cohort during adolescence.

# Appendices

## Appendix I: University of Maryland Institutional Review Board Approval



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DATE: October 9, 2013

TO: Kerry Green, PhD  
FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [336802-4] Substance Use and Psychological Problems Among African Americans into Midlife

REFERENCE #: 09-0413

SUBMISSION TYPE: Amendment/Modification

ACTION: APPROVED

APPROVAL DATE: October 9, 2013

EXPIRATION DATE: May 22, 2014

REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # 5

Thank you for your submission of Amendment/Modification materials for this project. The University of Maryland College Park (UMCP) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure which are found on the IRBNet Forms and Templates Page.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of May 22, 2014.

Please note that all research records must be retained for a minimum of three years after the completion of the project.



If you have any questions, please contact the IRB Office at 301-405-4212 or [irb@umd.edu](mailto:irb@umd.edu). Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.



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DATE: May 9, 2014

TO: Kerry Green, PhD  
FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [336802-5] Substance Use and Psychological Problems Among African Americans into Midlife

REFERENCE #: 09-0413

SUBMISSION TYPE: Continuing Review/Progress Report

ACTION: APPROVED

APPROVAL DATE: May 9, 2014

EXPIRATION DATE: May 22, 2015

REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # 5

Thank you for your submission of Continuing Review/Progress Report materials for this project. The University of Maryland College Park (UMCP) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure which are found on the IRBNet Forms and Templates Page.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of May 22, 2015.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact the IRB Office at 301-405-4212 or [irb@umd.edu](mailto:irb@umd.edu). Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.

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