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# Correlates and Predictors of Risky Sexual Partnering

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**Correlates and Predictors of Risky Sexual Partnering**

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of

Philosophy at Virginia Commonwealth University

by

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**Acknowledgement**

The author would like to sincerely thank the members of the dissertation committee for their support and guidance. She is especially grateful for their commitment and responsiveness given our ambitious timeframe. She would also like to express her profound gratitude to her family who generously accepted relocating to this foreign environment, offered much love and encouragement throughout the process, and did not complain (too much) about weekend absences, laundry on the floor, or dishes in the sink.

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**Abstract**



**CORRELATES AND PREDICTORS OF RISKY SEXUAL PARTNERING**


By Jennifer A. Nield, Ph.D.


A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

Virginia Commonwealth University, 2013.


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**Introduction:** Sexually Transmitted Diseases, including HIV/AIDS, continue to be a major

burden in the United States.  Sexual partnering behaviors contribute to the spread of STDs.

Sexual concurrency has been shown to exponentially increase STD prevalence in populations.

Serial monogamy with short periods between sexual partners also introduces risk.

**Methods:** We identified sexually active men and women from the 2006-2010 National Survey of

Family Growth (NSFG) and used sub sets for each particular study. Sexual partnering was

defined as being concurrent, serially monogamous or monogamous in the previous year.

Polytomous logistic regression models were developed to evaluate the associations between age of sexual debut among adult men, age of menarche and discordant heterosexual identity and behavior among all women and sexual partnering patterns. Descriptive, mediation, subpopulation and stratified analyses were also conducted.

**Results:** Sexual debut < 15 and 15-17 years was associated with concurrency (adjusted odds ratio (aOR)$_{<15}$: 2.19; 95% Confidence Interval (CI): 1.36-3.55; aOR $_{15-17}$: 1.69; 95% CI: 1.04-2.75).  This association was mediated by lifetime number of partners (further adjusted for lifetime partners: OR$_{<15}$: 1.26; 95% CI: 0.74-2.22; OR$_{15-17}$: 1.13; 95% CI: 0.67-1.92).   Age of menarche was not associated with subsequent concurrent sexual partnering (adjusted odds ratio (aOR)$_{early}$: 1.09; 95% Confidence Interval (CI): 0.57-2.09; aOR$_{average}$: 1.13; 95% CI: 0.64-1.99) or serial monogamy (aOR$_{early}$: 0.75; 95% CI: 0.41-1.38; aOR$_{average}$: 0.71; 95% CI: 0.39-1.29). A subanalysis among currently unmarried women did not alter this relationship. Heterosexually discordant women who had both male and female partners in the previous year were 5.5 times as likely to report having a concurrent relationship (95% CI: 2.77-11.09) and 2.43 times as likely to report engaging in serially monogamous relationships (95% CI: 1.19-4.97) with their male partners than concordant women.

**Conclusions:** Sexual partnering behaviors are potentially modifiable and reducing risky partnerships will contribute to a decrease in STD acquisition and transmission. Our findings have

important implications.  Clinically, they support the provision of comprehensive services, regardless of sexual identity. For policy, they confirm the need for early, inclusive and thorough sexual and reproductive health programming for our youth, in particular focusing on the benefits of lifetime partner reduction.

## Chapter 1: Background

The United States Institute of Medicine noted: "Sexually Transmitted Diseases (STDs) are hidden epidemics of enormous health and economic consequence in the United States. All Americans have an interest in STD prevention because all communities are impacted by STDs and all individuals directly or indirectly pay for the costs of these diseases."[1]  In 2010, 1.7 million new cases of STDs were reported in the United States.  Nearly 50,000 new cases of HIV infection were also reported in 2009 in the 46 states with confidential name-based HIV infection reporting. Over 33,000 people throughout the U.S. were newly diagnosed with AIDS.[2]  While the CDC estimates that there are approximately 1.2 million people currently living with HIV/AIDS in the United States, 20% of these people are unaware that they are infected.[2]

Some disadvantaged population groups, particularly racial and sexual minorities, are at increased risk for STDs.  CDC surveillance reports from 2010 show that HIV continues to disproportionately affect sexual minorities (particularly MSM); rates of gonorrhea and hepatitis B are higher among people of color and TB is more prevalent among minorities and the homeless.  Figure 1.1 below illustrates the disparity between new HIV infections by gender and ethnicity.[2]



*Source: CDC*
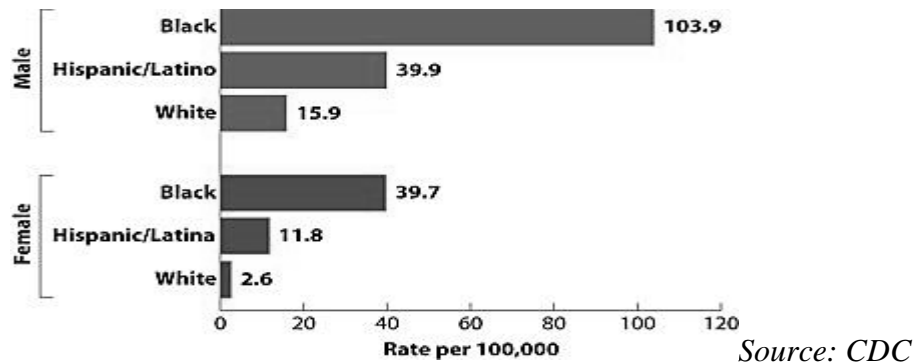
**Figure 1.1  Estimated Rate of New HIV Infections (2009)**

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*Concurrency[1]: A review of the literature and current state of the science*

Sexual partnering behaviors, including concurrent sexual partnerships may be important factors in the spread of HIV and other STDs.[3-6] A concurrent sexual partnership is a "partnership that overlap(s) in time, rather than follows another sequentially and disjointedly".[7] Although there is a robust body of research on this phenomenon, there is still no standard conceptualization of sexual partnering. For example, previous studies have looked at a broad definition of partnering like concurrency versus non-concurrency,[8-10] index concurrency versus perceived partner concurrency,[11] or different conceptual meanings of concurrency, like reactive, transitional, compensatory or experimental variations.[12]

Such partnerships are thought to accelerate the spread of HIV transmission through a sexual network faster than the same number of sequential partnerships without overlap.[4] Concurrent partnerships, particularly in generalized epidemics of STDs, are risky due to the potential combination of highly connected sexual networks and asymptomatic infections. In the case of HIV, the virus is most infectious—and most likely to be transmitted- during the early weeks or months after infection, when the newly infected person is both asymptomatic as well as clinically undetectable for HIV.[13] When new infections occur within a connected network, HIV and other STDs can spread quickly due to the high infectivity level and the silent nature of the acute infection. Risk is even present for people who have only one sexual partner if that partner connects them to a larger sexual network through sexual concurrency.

Mathematical models[3,14] demonstrate the potential role of concurrent sexual partnerships in promoting transmission of STDs. Figure 1.2 below illustrates the increasing numbers of HIV

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[1]   While polygyny may also be included in international definitions of concurrency; given that this series of studies will be conducted among an American sample, we will not include polygyny as a facet of concurrent sexual partnerships here.

infections estimated and their distribution, at the end of a 5-year simulation for each level of

concurrency in a heterosexual population. Each panel represents the results of 100 simulations

run at a specified level of concurrency. The x-axis illustrates the number of HIV-infected

individuals at the end of each simulated run and the y-axis shows the percentage of runs. Panel 1

represents sequential monogamy, and panels 2-10 represent increasing levels of concurrency.

The concurrency index, [kappa], which indicates the average number of concurrent partnerships

per partnership in the population, is shown in the upper right corner of each panel.[3]  Thus, as the

concurrency index increases, so does the number of HIV- infected individuals.
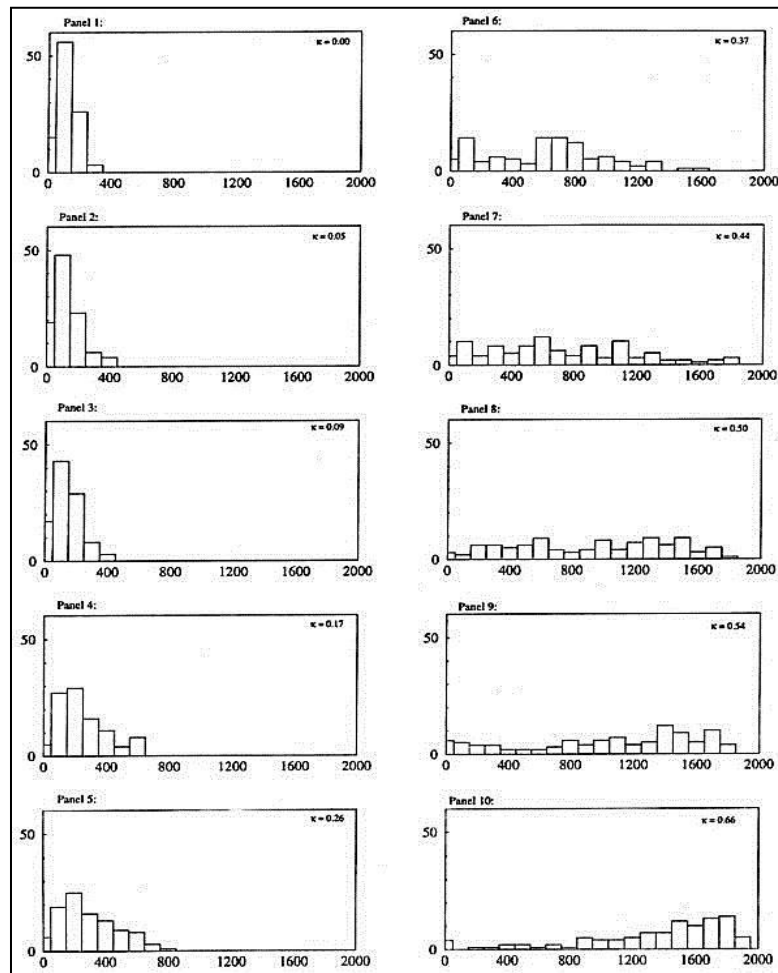


**Figure 1.2  Concurrency Modeling**[3]

Figure 3 below represents the mean final size of an HIV epidemic as a function of concurrency. Each observation represents the mean of 100 runs under the same value for the concurrency index [kappa]. The full distribution of epidemic size under each scenario is shown in Figure 1.3.[3]



**Epidemic size by concurrency**

$log(\#Inf) = 4.7 + 4.1 K$
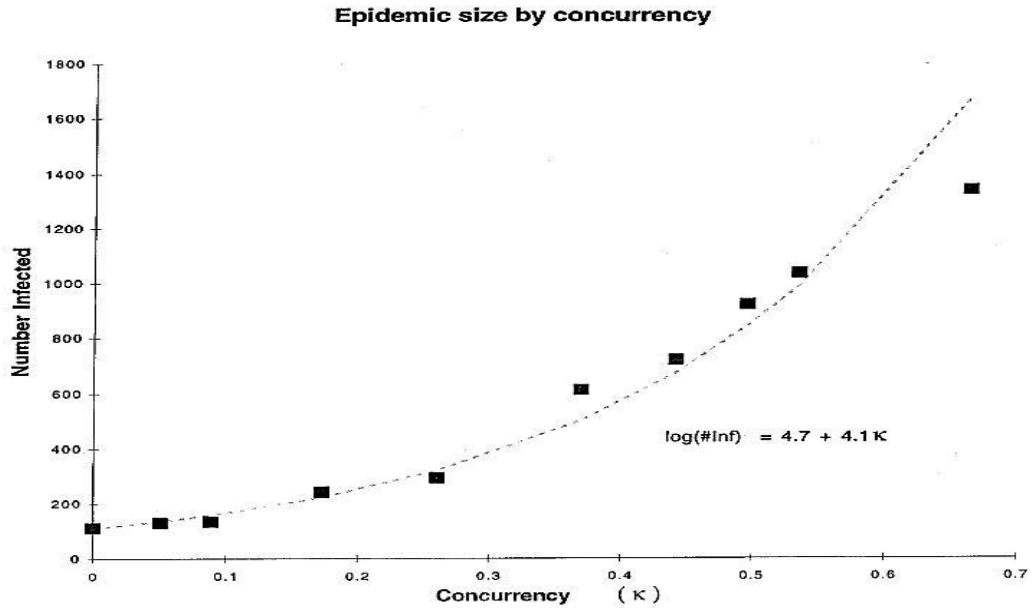
**Figure 1.3. Epidemic size by levels of concurrency in a population**[3]

Empirical studies have also demonstrated associations between concurrent sexual partnering with transmission of chlamydia[15] and syphilis[16], which supports the theory that concurrent partnering is a risky behavior that opens the doorway to sexual disease transmission. Associations between concurrent sexual partnerships and sexual risk for HIV and other STDs have been reported in studies conducted among African-American adults, women and young adults in the United States,[8,17-21] among general population samples in Africa,[22-24] and among men who have sex with men in China.[25]

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Correlates of concurrency include single marital status,[17,18] younger age at first sexual intercourse,[4,17,21,26] having a sexual partner who also engages in sexual concurrency,[27] and drug or alcohol intoxication during sexual intercourse.[28] Concurrency's relation to income, education, and wealth varies by gender and ethnicity, with poor and minority women being more likely to engage in, or have a partner who engages in concurrency, than men at equal social disadvantage.[8,20,28,29] In fact, previous research has shown that men in the higher income and education brackets are more likely than those in the lower brackets to engage in concurrency.[18,30] Additional correlates of concurrency that are unique to men include incarceration within the past year[31] and history of sexual intercourse with a same sex partner. [18]

Measurement of concurrency has been defined differently across many studies, creating challenges to interpretation of outcomes as well as in making comparisons across studies. A review of the literature details five different methods that have been used to measure concurrency: the date method, the direct question approach, the use of coital diaries, the use of proxy measures and questions pertaining to the index subjects' perceived or known partner's concurrency.[32] The date method seeks to establish the dates of partnership intervals and then to calculate the overlap (or gap) between those intervals. While this approach can enable researchers to establish prevalence and duration of any existing overlap, and typically is believed to be less prone to social desirability bias, to estimate prevalence of concurrency with this method, the study questionnaire must include a start date and end date for each partner, which may require additional questions, which can lead to missing data. Further, to be able to estimate intensity of overlap, questions ought to ask about frequency of sex, an approach not implemented in most surveys. The direct question approach is perhaps the most basic approach, with a single question about additional partners during a sexual relationship. While this approach can

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minimize missing data due to recall, it cannot provide an estimate of overlap duration and may be affected by social desirability bias. Coital diaries are another method to collect this information and provide a prospective, daily survey of sexual behavior. However they can be both time and cost intensive, limiting implementation to very small sample sizes, which limits generalizability as well as the power to detect significant differences. Proxy measures, for example asking if a respondent has had more than one partner in the previous week or three months, are prone to misclassification since multiple partners may be reported who do not actually overlap in time. Partner concurrency can be assessed either by enrolling and directly asking the index respondents' sexual partners or by asking the index subject about their knowledge or perception of their partner's concurrency. This is one of the most difficult approaches to operationalize since enrolling partners is challenging, time consuming and has a limited success rate and index partners may not be aware of partner concurrency. Research has demonstrated very poor agreement in couples' studies of perceived partner's concurrency.[27]

These issues prompted the UNAIDS Reference Group on Estimates Modeling and Projections in 2009 to develop and recommend a standard definition of concurrency so that consistent comparisons across studies and over time can be made in the future.[33,34] In brief, UNAIDS recommended that concurrency be measured by assessing the start and end dates of a person's last three partnerships during the past year and calculating the number of ongoing partnerships the person had exactly six months before the date of the interview.

While the current NSFG does not follow this guideline, the 2006-2010 round was conducted prior to the issuance of the guidance and there are numerous previous studies that have used the same variables to construct sexually concurrency, which provides a body of work to which comparisons can be made, at least for the bi-level parameter measuring concurrency,

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among this population.   In addition, critiques of the UNAIDS recommendation have included the fact that this measure has several sources of error including  uncertainty due to date precision (dates are often collected as month/year, ignoring days), the potential for missing dates (one for each date), uncertainty associated with retrospective reporting, and truncation bias (if the most recent three partners are within the 6 month retrospective window), which may allow for substantial uncertainty and error in the resulting estimate.[35,36] Calculating this indicator is also technically challenging, even if the primary data are collected correctly.[37]

*Discordant sexual orientation identity and reported sexual behaviors*

Sexuality is a complex construct suggested to be made up of sexual orientation identity, sexual behaviors and sexual attractions.[38-42]  In his seminal work, Worthington defined sexual orientation identity, which refers to a person's "acceptance and recognition (of their own) sexual orientation". In order for an individual to come to terms with their sexual orientation identity, it is thought that they must make their way through a nuanced and complex process that has been called "sexually identity development.[43]  This process involves not only a person's self - perception as a sexual being but also involves, as Worthington wrote,  "dimensions of sexual identity that reflect a person's sexual values, sexual needs, preferred modes of sexual expression, preferences for characteristics of sexual partners, and preferences of sexual activities." [43]

Previous literature has shown that estimates of lifetime same-sex behavior among women may range between 8-20% and that between 1.4 to 4.3% of all women may be women who have sex with women (WSW), either based on same sex behavior or sexual orientation identity.[44]  In a recent study using the NSFG, some form of same-sex sexual behavior was reported by 12% of women aged 25–44 in the previous 12 months, which is twice the proportion of men in this age

group reporting same sex activities.[45]  These results indicate that there may be significant disconnect between self-reported sexual orientation and same sex behaviors.

Discordant sexual identity and behavior is a situation in which people report one sexual identity (i.e. heterosexual) and different sexual behaviors (i.e. same sex or bisexual behaviors) or divergent sexual attraction. People may report discordant identity and behavior for many reasons, including internalized heterosexism/ homophobia,[46,47] or self-perceived "majority" sexual orientation identity. Among men, the physical positioning of actors in regard to certain same-sex sexual roles has been reported to be correlated with self-report of heterosexual identity.[48-51] Among women, little research has been done to describe this phenomenon, although some qualitative studies examine concepts of "heteroflexibility",[52] and the theoretical exploration of a supposed "plasticity" of female sexual attraction and behavior.[53]

*Hypothesized relationship to poor health behaviors and outcomes among women who have sex with women and men but who self-identify as heterosexual*

Prior research has shown that, compared to women who have sex with men only (WSMO), WSW are unduly affected by a variety of psychosocial and physical health issues.[54-56] A considerable body of literature has demonstrated that WSW may be disproportionately affected by mood disorders and increased psychological distress, in particular reporting higher levels of depression and anxiety.[57-62]  Various studies have also shown that WSW tend to abuse alcohol and illicit substances to a greater degree than WSM, and they also have an elevated risk of alcohol and drug dependency disorders.[63-68]  In addition, compared with WSM, WSW have higher rates of tobacco use and longer histories as smokers.[65,67-69]

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STDs are a particularly worrisome health outcome among WSW. A review of prior research on the sexual health of WSW reveals that, depending upon the particular population and STD being studied, up to 44% of WSW have a lifetime history of one or more STDs.[70-75] The current literature is in disagreement over the rates of STDs among WSW versus their WSM counterparts. While some studies have shown significantly lower rates of STDs among WSW.[72,74] others have found increased rates of STDs compared with WSM.[75,76]

In terms of mental health, previous studies have observed that WSW were more than three times as likely to have a clinical diagnosis compared to WSM, particularly being affected by depression, anxiety, and post-traumatic stress disorder (PTSD).[57-62] Further, in a two recent studies, WSW were more likely to have a history of suicide attempt(s) [77] and increased psychiatric treatment.[62] Increased rates of mental health diagnoses among women, in particular WSW, may be a product of psychosocial and physical stressors-- such as leading a marginalized life, hiding one's sexuality, facing verbal, emotional, or physical abuse, or stigma—that are compounded among sexual minorities.[55,56,78] Previous studies suggest that health disparities are less likely to be related to the gender of one's sexual partner, but may be more related to stigma and/or homophobia that WSW experience, irrespective of whether they have sex with both women and men.[56,76]

Finally, it is notable that the number of women reporting either sexual minority identities or discordant sex behavior has been increasing in recent years. In the 2002 National Survey of Family Growth, 4.4% of American women 15-44 years of age reported having a female sex partner in the previous 12 months;[79] by the current round of the NSFG (2006-2010), 15% of female respondents reported having had a female sexual partner in the past year.[45]

The aforementioned statistics suggest that sexual norms for women may be shifting in important ways. Previous research has documented the growing acceptance of female same-sex sexuality—and the "plasticity" of female sexuality in modern society.[53,80]  This fluidity may have farther reaching implications for women's sexual health. As Levant et al. have suggested, "When sexual norms are in a state of flux, with emergent norms existing alongside traditional norms, women may receive conflicting messages about appropriate sexual behavior. This may create confusion and embarrassment which could lead to inconsistency in the use of good sexual health practices such as birth control, gynecological health care, and prevention, testing, and treatment of sexually transmitted infections."[81]

*Why concurrency especially matters in this population*

Typically, in epidemiologic studies, the focus is on individual risk. However, when examining sexual partner concurrency, the context of partnerships must be considered. According to Morris et al, "in partnerships, there are two types of risk – of acquiring infection and transmitting infection – and two types of individuals – the person who practices concurrency and the partners of that person. Concurrency theory predicts that concurrency increases the risk of transmission from the person who practices it, and it raises the risk of acquisition to the partners of that person. If the index case practices concurrency, their risk is … increased simply by the number of partners they have, not by the concurrency per se." [37] Therefore, in terms of concurrency's effect on transmission of STDs, including HIV, the correlation of interest is between index case concurrency and their partner's infection or disease status not the index case's concurrency and their own STD/HIV status.[82] In other words, concurrency creates a risk for the partner, not the index case. In terms of STD transmission, the concept of concurrency is critical in that it highlights the fact that those characteristically thought of as ''low risk',

including those with only one partner and WSW, may be actually be at an elevated risk if they are linked to a larger sexual network.[82]

While much research has been done to examine HIV risk factors among Gay, Bisexual and Other Men Who Have Sex with Men (MSM) both in the United States and abroad, and several studies have been undertaken to understand risk factors and correlates of HIV among transgender people, the focus is typically on male to female transgender people rather than on female to male. However, the literature has noted that assuming that WSW are at a low risk of STDs, including HIV, is faulty in that this line of thinking does not take into account other potential risk factors like injecting drug use, unprotected heterosexual sex, with either MSW or MSM or male IDU, or exchanging sex for drugs or money. [44,74] Further, a substantial body of literature notes that, contrary to traditionally held beliefs, WSW are at significant risk of contracting STDs, particularly herpes simplex virus type 1 and 2 (HSV-1 and HSV-2),[83] human papillomavirus (HPV),[84-86] chlamydia and gonorrhea,[71,73,74,87] trichomoniasis,[88] syphilis,[89] hepatitis A[90] and bacterial vaginosis.[90-92] While women who self-report as bisexual or WSMW are at the highest risk for acquiring these STDs, even more so than self-identified heterosexual or WSMO (women who have sex with men only), women who have sex with women only are also at risk and are less likely to be counseled to have Papanicolaou tests (pap smears)[84,90,93-95] or other clinical screening, including screening for HIV.[96]

It is also important to note the dearth of information made specifically available to sexual minority women. On the CDC website with links to specific topics, groups at risk listed include African Americans; gay, bisexual and other men who have sex with men (MSM), Latinos, persons aged fifty and older, transgender people, women and youth; however sexual minority

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women are fully absent, with the section on women primarily discussing heterosexual and IDU transmission.

Finally, there is a small but compelling body of literature that has documented that women who self-identify as "lesbian", but who are also sexually active with men, often demonstrate increased sexual risk-taking behavior.[93] In two previous studies among women attending STD clinics, WSMW had an increase in HIV-related risk behavior, including sex with gay or bisexual men, use of injection drugs and crack cocaine, and exchange of sex for drugs or money.[75,97] The College Alcohol Study, which was comprised of more than 14,000 randomly selected college students in the United States, also demonstrated that WSMW were more likely to report multiple sex partners than women who only had sex with men. [98] However, there is scant literature examining the relationship between women who self-identify as heterosexual but who also have same-sex partners.

*Gaps and unanswered questions in the science*

Although there has been increasing interest in defining and understanding sexual partnering behaviors, there are still critical gaps in the current science. While associations between concurrent sexual partners and sexual risk for HIV and other STDs have been reported, many have been limited to specific populations[24,30,99] been of small sample size,[100] or focused narrowly on the conceptual framework of sexual concurrency versus monogamy alone [8-10], ignoring the role of serial monogamy which some studies suggest may have important implications for the spread of sexually transmitted diseases.[10,100,101] Psychosocial, structural, and biological elements of concurrency, including possible links between early menarche and discordant sexual identity and behavior, continue to be absent from the literature.

The studies in this dissertation examined the correlates and predictors of risky sexual behavior patterns among American adults. The first study enhances the knowledge base by including a well-defined definition of sexual partner concurrency as well as by including a hypothesized intermediate level of partnering defined as "serial monogamy".

The second study explored biosocial determinants of health that were hypothesized to enhance the risk of women later in life related to sexual partnering. This study is novel in that no previous research had specifically looked at the potential link between age at menarche among girls and later sexual partnering patterns.

The final study is particularly innovative in that it considered the increased risks for risky patterns of sexual partnering among American women who self-report as heterosexual but who also reported same sex behaviors in the previous year. While there is scant literature regarding sexual minority women at all, there is a small but compelling body of literature that documents that women who self-identify as "lesbian," but are also sexually active with men, have increased sexual risk behaviors and poorer health outcomes. However, there is nothing previous to this paper that examines associations between discordant sexual orientation identity and same sex behavior among women who self-identify as heterosexual and opposite sex partner concurrency.

*Overarching Conceptual Framework*

This dissertation was guided by a conceptual framework based on the Theory of Planned Behavior (TPB), embedded within individual characteristics as well as taking into account the broader structural, social and environmental context. The Theory of Planned Behavior (TPB)[102] is an expansion of Fishbein and Ajzen's Theory of Reasoned Action[103] including behaviors that are under a person's perceived control. TPB can be conceptualized as a map of the relationship

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between a person's attitudes, intentions, and behaviors. In this framework, a person's behavior is predicted by the person's intentions. Intentions are based on three factors: one's attitude toward the behavior, perceived control over the behavior (i.e. "self-efficacy"), and subjective norms. Of these, perceived behavioral control is the only one believed to directly influence behavior.

Attitude toward the behavior is a person's positive or negative opinion of performing the behavior. Subjective norms are perceptions of social expectations of a behavior or the influence of others' opinions about a behavior. Perceived behavioral control encompasses a person's belief in how feasible it will be to perform a certain behavior. These beliefs can encompass both external factors such as time and money and internal factors such as ability and confidence. [102] These individual beliefs, attitudes and motivations are further couched within a sphere that encompasses unique individual features, including psychological, biological and personal characteristics. The individual variables at both these levels are embedded within and influenced by external, ecological factors over which the individual has little or no control but which exert great influence over the individual's attitudes, beliefs, opportunities and choices.
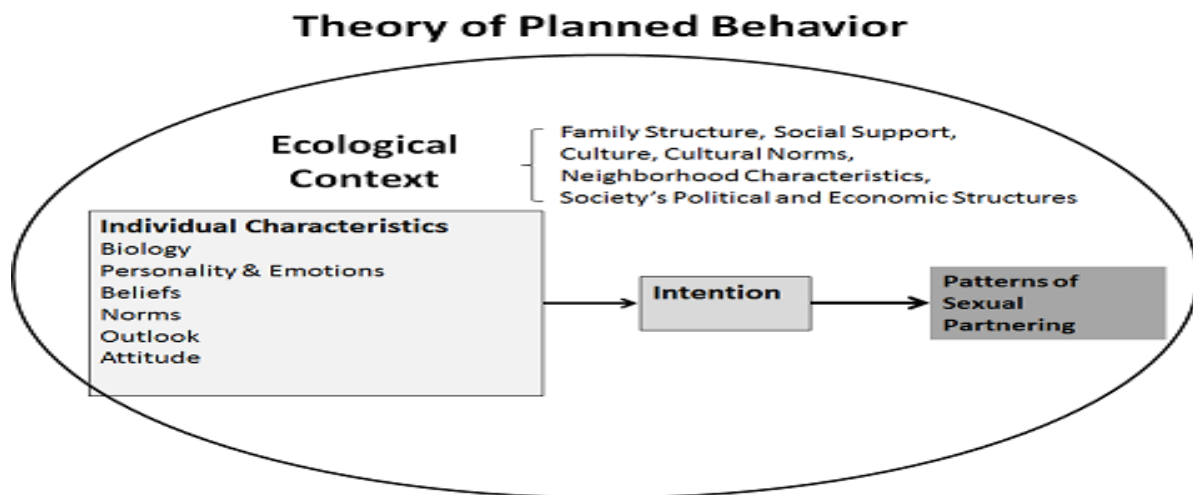


**Figure 1.4  The Theory of Planned Behavior**
( Adapted from Fishbein and Ajzen)[102]

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While sexual partnerships are the result of individual decisions to form or dissolve partnerships, these decisions and the resulting behaviors, are influenced by a myriad of both internal and external factors. We hypothesized that, depending upon the nature of the determinant, different individual biological, psychosocial, and demographic individual characteristics would exert their influence within the ecological context to either facilitate or simply be strongly associated with sexual partnering behavior in adulthood.

*Specific aims:*

**Aim 1.** To quantify the relationship between the timing of first heterosexual intercourse and concurrent sexual partnership in adulthood among American men.

Using polytomous logistic regression, we examined the association between early sexual debut among American men and sexual partnering behaviors into later adult life.

> *Hypothesis:* Early age at sexual debut would be associated with concurrent sexual partnerships and serial monogamy, but to a lesser extent with the latter. We further hypothesized that the impact of age at sexual debut may be lessened through time.

**Aim 2.** To determine if age at menarche influences risky sexual partnerships and to see if early age of sexual debut mediates this effect.

Again, we employed multinomial logistic regression to examine the association between precocious puberty among American women and sexual partnering behaviors into later adult life. We also conducted a mediation analysis to examine whether early sexual debut mediated the relationship between early menarche and concurrent sexual partnering later in life.

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*Hypothesis:* An earlier age of puberty, due to biological, social, and structural factors, would have an influence on riskier sexual partnering behavior throughout a woman's lifespan, with attenuating effects by age. Further, we hypothesized that early sexual debut would act as a mediating factor between early menarche and sexual partnering behaviors.

**Aim 3.** To examine the extent to which discordant heterosexual sexual orientation identity and same-sex sexual behavior are related to sexual partnering and other risky behaviors among American women.

We examined the association between discordant sexual orientation identity among heterosexual American women and sexual partnering patterns with men using polytomous regression.

*Hypothesis:* Women reporting discordant sexual orientation identity and sexual partnering behaviors would be more likely to report opposite sex sexual partner concurrency in the previous year than heterosexual women reporting only opposite sex partners.

# Chapter 2: Age of sexual debut and sexual partnering in adulthood among men

**Abstract**

**Purpose:** This study examined the association of sexual debut and sexual partnering among American men aged 21-44 years who participated in the 2006-2010 National Survey of Family Growth.

**Methods:** Age at debut was categorized as <15 years, 15-17 years and ≥18 years to permit comparison with previous research. Sexual partnering was defined as being concurrent, serially monogamous or monogamous in the previous year. Descriptive statistics were obtained. Polytomous logistic regression models were used to evaluate the association between age of sexual debut among men and sexual partnering later in life. Stratified analyses were conducted to determine if the strength of this association would be attenuated over time.

**Results:** Eleven percent reported concurrent partnerships and 6% serial monogamy. Sexual debut < 15 and 15-17 years was associated with concurrency (adjusted odds ratio (aOR)$_{<15}$: 2.19; 95% Confidence Interval (CI): 1.36-3.55; aOR $_{15-17}$: 1.69; 95% CI: 1.04-2.75). This association was mediated by lifetime number of partners (further adjusted for lifetime partners: OR$_{<15}$: 1.26; 95% CI: 0.74-2.22; OR$_{15-17}$: 1.13; 95% CI: 0.67-1.92).

**Conclusions:** Since age of debut before 15 years increases other risks among American men, appropriate sexual health education should be initiated earlier and for those already sexually active, realistic and comprehensive strategies to reduce sexual risks need to be integrated into school and community programming. Irrespective of age at sexual debut, interventions to reduce risky lifetime number of partners may prevent risky sexual behavior in early adulthood and later in life.

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## Introduction

Sexual transmission of disease is an ongoing crisis that entails a high toll among men. In 2010, the Centers for Disease Control and Prevention reported there were nearly 550,000 new cases of STDs among American men; in 2009 75% of the nearly 26,000 new AIDS diagnoses and 77% of the 48,000 new HIV cases were among men.[2]

The causes of STDs are driven by both contextual and individual factors. One contributing factor to increased incidence of STD is sexual partnering.[3,18] A concurrent sexual partnership is a "partnership that overlaps in time, rather than follows another sequentially."[4] Serial partnering occurs when a person has multiple sex partners but these do not overlap in time.[104] Sexual partnering behaviors are an important factor in the spread of HIV and other STDs.[3,14-16]

One potentially modifiable risk factor for sexual partnering in adulthood is age at sexual debut. In the United States, the average age for first vaginal intercourse is 17.1 years among men [105] with 90% of youth sexually active by age 19.[106] Early sexual debut is associated with having concurrent sexual partners in adolescence.[10,100,107] Research examining the link between debut and long-term outcomes in men is scant, even though early sexual behaviors may establish a pattern for later ones.[108,109] Early age of sexual debut has been shown to predict a larger number of partners later in life[100,106] and extramarital sex among men.[110] Nonetheless, the association between concurrency or serial monogamy in adulthood and age of first sexual intercourse remains largely undefined.

Using a nationally representative sample, we examined the relationship between timing of first heterosexual intercourse and concurrent sexual partnership in adulthood among men.

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This research extends the literature in several ways. Most research to date on age of sexual debut has been conducted among women[111-113] despite the fact that men typically have a younger sexual debut and report higher levels of sexual risk-taking.[114] Second, this paper conceptualizes sexual partnering along a three-level continuum: concurrent sexual partnering, serial monogamy, and monogamous relationships.

Our hypothesis was that age at sexual debut would be associated with concurrent sexual partnerships and serial monogamy in adulthood, but to a lesser extent with the latter. Further, we hypothesized that the impact of age at sexual debut would be significant, but that its effects would be lessened over time. Lastly, we believed that the association between age at sexual debut might be mediated through the number of lifetime sexual partners.

**Methods**

*Data Source and Sample*

The study used data from the continuous 2006-2010 cycle of the National Survey of Family Growth (NSFG). The NSFG collects data on reproductive and family health among men and women aged 15 to 44 years living in households in the United States. The NSFG sampling framework has been described in detail elsewhere.[99] Trained female interviewers conducted in-person interviews in respondents' homes from June 2006 to June 2010. Computer Assisted Personal Interview (CAPI) and Audio Computer Assisted Self-Interviewing (ACASI) were used for sensitive questions about sexual behaviors and drug use. The public use data files released in January 2012 included 10,403 interviews of men.[99]

*Eligibility Criteria*

The sample included men 21 to 44 years of age who reported having had at least one female partner in the previous 12 months. The study considered respondents aged 21 years of age or older as adults. There were 2,730 men ineligible due to age and 1,177 ineligible because they did not report a female sexual partner in the previous year. We also excluded men with missing data on key variables (n=429). The remaining 6,067 men (weighted N= 40,377,309) were eligible for the current study.

*Operational Definition of Timing of Sexual Debut*

Men were asked, ''Have you ever had sexual intercourse with a female (sometimes this is called making love, having sex, or going all the way)?'' If yes, they were then asked for the month and year of this first intercourse and age at that time. Age at first sexual intercourse was categorized as <15 years, 15-17 years and ≥18 years. We considered those in the 15-17 year old age group to be "average" age of sexual debut, those in the 18 year old and above age group served as the referent group and those in the ≤15 years of age and below group were considered to have an early debut. In addition, the NSFG captured information on the relationship to first partner at first sex, ranging from married, engaged, cohabitating, going steady, going out once in a while, just friends or "something else". We anticipated that relationship to first partner may be relevant since earlier sexual debut is associated with problems developing intimate relationships with others, which may, later in adulthood, lead to multiple sexual partners. We therefore dichotomized this variable into "having some existing relationship" or "something else".

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*Definition of Monogamy, Serial Monogamy and Concurrent Sexual Partnerships*

Each respondent was asked about the number of partners they had had vaginal sex with in the previous 12 months. For each of the partners reported, the date in months and year of first and last sexual intercourse were asked, and except for any partners identified as currently married to or cohabitating with the respondent, whether or not the partner was "current". The ACASI interview asked respondents how many sexual partners they had (over the lifetime and in prior 12 months). For up to three discrete opposite sex sexual partners in the past year, the month and year of the first and last vaginal sexual intercourse were reported.

Sexual partnerships were conceptualized in three categories: monogamy, serial monogamy, and concurrency. Monogamy was defined as reporting one sex partner over the course of the previous 12 months. Serial monogamy was defined as more than one sex partner over the past 12 months but with no overlap of first/ last sex dates of any other partners. If an earlier partnership ended, and then continued at a later month, they were included in this definition as well. Concurrency was defined as more than one partner in the past 12 months with an overlap of current partner first sex date and previous partner(s) last sex date. Respondents reporting a monogamous relationship in the previous 12 months served as the referent group.

*Potential Confounders*

There are associations between social structures, such as peers, family, schools, and the media, and the timing of first sex.[115] These are correlated with differences in age of sexual debut, and ethnicity and gender mediate these factors to some extent.[106] Among men, higher income has been positively associated with concurrency, regardless of ethnicity.[18]

Among men, being neither married nor cohabitating,[18,30,116] being intoxicated during sexual intercourse,[9,18] having been incarcerated,[18,31] having a non-monogamous female sex partner,[18,27] and history of sexual intercourse with a same sex partner[18] have been associated with concurrency. Further, marital status (being unmarried versus being married), younger age at time of interview, early age when first entering into marriage, long duration of marriage, absence from home and separation from spouse have been found to be associated with a higher probability of having concurrent partners.[18,28]

Potential confounders considered were expanded to analyze sociodemographic variables, including current and childhood socioeconomic measures. Demographic variables of interest included self-reported race/ethnicity (White, non-Hispanic, African-American, non-Hispanic, Hispanic, or Other ethnicity, non-Hispanic), age at interview (categorized as 21-24 years, 25-29 years, 30-34 years, 35-39 years, or 40-44 years), respondent's educational attainment (less than high school, high school graduate, or at least some college), current household income as a percentage of the federal poverty level (FPL) (<100% FPL, 100-199% FPL, ≥200% FPL), relationship status (never married, currently married or cohabitating, or formerly married) and urbanicity (conceptualized as living in center city of a metropolitan area, living outside a city but within the metropolitan area or outside a metropolitan area).

To understand environmental factors during adolescence, respondents were asked about the highest level of education that their parents had attained. Parental education level was characterized as "less than high school", "high school graduate" or "at least some college or more". "Living situation", or the make-up and relationships of household members, has been shown to be a predictor for adolescent and young adult risk behaviors.[117] Respondents were

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asked about their living situation at the age of 14; this was dichotomized into living with both biologic parents or biologic mother and stepfather versus having a different living situation.

*Sexual History Variables*

We conceptualized number of lifetime sexual partners as a potential intermediary variable. Because number of sexual partners in the previous 12 months was used to define the outcome variable, the lifetime number of sexual partners was used to evaluate the role of this variable on the findings. From previous literature,[45] we know that six partners is roughly the median split for lifetime number of sexual partners among American men so, after examining the distribution of number of sexual partners, we chose to use the median split of this sample as well.

*Analytic Approach*

All analyses accounted for the complex sampling design and weighting of the NSFG using SUDAAN.[99] Multinomial logistic regression models[118] were developed to evaluate the association between age at sexual debut and sexual partnering, adjusting for sociodemographic, childhood and sexual history characteristics. Multinomial logistic regression yields more precision and power than simple dichotomous analysis and allows the comparison of each level of sexual partnering to the referent group one at a time, using separate logistic models for each comparison.[119] Variables that altered the estimate quantifying the association between age at sexual debut and sexual concurrency by more than 10% were retained. To evaluate the extent to which the impact of age at sexual debut diminishes with time, analyses were stratified by age (categorized as 21 to 30 years or 31 to 44 years). Lifetime number of sexual partners was assessed as an intermediary variable by including it in the regression model after adjusting for all

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other material confounders.  Adjusted odds ratios (aOR) and 95% confidence intervals (CI) were derived from these models.

**Results**

Table 2.1 shows the characteristics of the sample stratified by sexual partnering in adulthood. Eleven percent reported concurrent sexual partnerships and 6% serially monogamous relationships in the twelve months prior to interview. Among those reporting concurrency with female partners in the prior 12 months, 51.7% were White, 24.3% were African-American, 19.1% were Hispanic and 4.9% were classified as Other ethnicity.  Among those reporting serial monogamy, 59.5% were White, 14.1% were African-American, 23.3% were Hispanic and 3.2% were Other ethnicity.  Among those reporting only monogamous relationships in the previous year, 65.0% were White, 10.2% were African-American, 18.4% were Hispanic and 6.4% were Other ethnicity.  Those in monogamous relationships were less likely to report living in city centers (29.9%) relative to those reporting serial monogamy (39.7%) or concurrency (40.8%). More men reporting monogamy reported living with both biological parents at age 14 (79.2% of monogamous; 70.1% sexual concurrent relationships). Distribution of mother's education and father's education did not vary greatly by sexual partnering in adulthood.

*Sexual History*

Median lifetime partners in the sample was 6 (IQR: 3-14); being highest among concurrent men (15; IQR: 7-30), followed by serial monogamists (11; IQR: 6-20) and monogamists (5; IQR: 2-12). Those in concurrent relationships were more likely to report having had more than two sex partners in the previous year than those practicing serial monogamy (62.6% versus 26.4%). The trend was also present for men reporting having had a non-

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monogamous female sex partner in the past twelve months with 52.7% of those practicing concurrency, 40.8% practicing serial monogamy and 4.2% in monogamous relationships perceiving this behavior. While infrequent, 5.0% of men reporting sexual concurrency and 3.9% of serial monogamists and 3.3% of monogamists reported ever having had sexual experience with another man.

*Age of debut- Adult Sexual Partnering Relationship*

Table 2.2 shows the association between age at sexual debut and concurrent partnering among men. Table 2.3 shows the association between age at sexual debut and serial partnering among men. Age at sexual debut before age 15 was most common among men reporting concurrent sexual partnerships (31.1%) relative to serial monogamists (23.9%) and men reporting monogamous relationships (16.4%). Men in monogamous relationships were the most likely to report age at sexual debut greater than 18 years (37.6%) followed by serial monogamists (22.5%) and men reporting concurrent relationships (19.0%) (Table 2.1). Men who experienced their sexual debut at less than 15 years of age were 3.76 times as likely to report concurrent partnerships in adulthood (95% CI: 2.63-5.39) and those reporting sexual debut between 15 and 17 years of age 2.16 as likely (95% CI: 1.51-3.09). Adjusting for confounding attenuated, but did not eliminate this association (aOR<15: 2.19; 95% CI: 1.36-3.55; aOR15-17: 1.69; 95% CI: 1.04-2.75). Men who experienced their sexual debut at less than 15 years of age were 2.44 times as likely to report serial monogamy in adulthood (95% CI: 1.57-3.81) and those reporting sexual debut between 15 and 17 years of age twice as likely (OR:1.95; 95% CI: 1.31-2.92). Adjusting for confounding reduced the association such that the 95% confidence intervals included unity for both estimates (aOR<15: 1.47; 95% CI: 0.83-2.62; aOR15-17: 1.50; 95% CI: 0.93-2.41).

Table 2.4 shows that the association between age at debut and concurrency strengthened when stratified by age at interview. Among those 21-30 years of age, sexual debut earlier than 15 was associated with concurrency (aOR: 1.88; 95% CI: 1.02-3.44) as was age at sexual debut between 15 and 17 (aOR: 1.73; 95% CI: 1.05-2.85). For those 31-44 years, the association with concurrency increased for those with a debut under 15 (aOR: 2.65; 95% CI: 1.31-5.36) and age of debut between 15 and 17 years was associated with serial monogamy (aOR:2.17; 95% CI: 1.16-4.05).

*Lifetime Partners as a Mediator in the Age of debut- Adult Sexual Partnering Relationship*

Age of sexual debut and concurrent sexual partnering were associated although this relationship was entirely mediated by lifetime number of partners as seen in Table 2.5. Introducing the number of lifetime sexual partners reduced the estimate of effect such that no association between age of sexual debut and sexual concurrency in adulthood was observed (aOR<15: 1.26; 95% CI: 0.74-2.22; aOR15-17: 1.13; 95% CI: 0.67-1.92). Adjustment for number of lifetime sexual partners also further reduced the estimate of effect of age at sexual debut and serial monogamy toward unity (aOR<15: 0.92; 95% CI: 0.51-1.67; aOR15-17: 1.06; 95% CI: 0.66-1.72).

*Other factors associated with sexual partnering in adulthood*

Table 2.2 also shows the association between other factors and sexually concurrent partnerships in adulthood. There was an increased odds of concurrency among African-American men with an early debut (aOR: 1.89; 95% CI: 1.38-2.60) although no other racial or ethnic group had this association. Table 2.3 shows the association between other factors and serial sexual partnerships in adulthood. There was no association between race and serial monogamy for any

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racial or ethnic group. Current relationship status was associated with both concurrency and serial monogamy as people formerly married at the time of the interview had greater odds than those who were married (concurrency: aOR: 21.84; 95% CI: 13.22-31.38; serial monogamy: aOR: 8.35; 95% CI: 5.21-13.4). Those never married also had a greater odds of non-monogamous sexual partnering relative to those who were married at time of interview (concurrency: aOR: 20.36; 95% CI: 13.22-31.38; serial monogamy: aOR: 5.14; 95% CI: 3.38-7.83). Having a non-monogamous female sexual partner in the previous years was associated with concurrency (aOR: 12.13; 95% CI: 8.35-17.62) and serial monogamy (aOR: 7.31; 95% CI: 5.10-10.47), as was a history of HIV testing (concurrency: aOR: 1.66; 95% CI: 1.20-2.30; serial monogamy: aOR: 1.83; 95% CI: 1.14-2.86).

**Discussion**

Eleven percent of men reported concurrent sexual partnerships and 6% had serially monogamous relationships. Younger age at sexual debut was associated with risky sexual partnering behavior among men in adulthood. However, our findings indicate that this association is entirely mediated by total number of lifetime sexual partners for men. It is likely that the potential for practicing concurrency increases as the number of lifetime sexual partners increases.

Our estimate of concurrent sexual partnerships is slightly higher than other reports.[18] The slight difference may be due to errors in reports of dates of sexual relationships. This misclassification possibility cannot be corrected in these data since the NSFG only collects date information based on month and year and not on day or week and year. Second, our estimates may be different because our sample size includes men from the age of 21 years and previous

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reports limited the sample to men aged 22 years and older. Men in younger cohorts tend to report concurrency more than those in older cohorts so the expanded inclusion criteria may capture more men practicing concurrency.

While the current literature makes the case for concurrent partner reduction, serial monogamy has been underemphasized. Serial monogamy, and the resultant attitudes and associated behaviors, could be a critical factor in the transmission of STDs. Condom nonuse has previously been associated with relationship quality, power, love and trust, particularly among adolescents.[120] While men reporting concurrent sexual partnering may have higher instances of risk behaviors overall, those who engage in serial monogamy may still be at risk given short gap time between partners and potentially reduced use of barrier methods in favor of hormonal contraception or discontinuation of contraception all together.

Previous studies have shown an association between concurrency and having never been married, although less so for those formerly married.[18] Our findings demonstrate this same trend however, when age at sexual debut is included as part of the equation, concurrent men are slightly more likely to report having been formerly married and serial monogamists are slightly more likely to have never been married. For those who were formerly married, this result could illustrate the effect of early sexual debut on earlier entry into marriage. Early formal partnerships have been shown to be less stable than those entered in to at later life and therefore are more likely to dissolve.[110] If this is the case, a pool of adult men with an early debut and a subsequent early marriage that dissolved would make up part of the formerly married cohort. These men would likely have more permissive attitudes towards multiple sexual partnering given their earlier unfavorable experience in a monogamous partnership. Among those never married, serial monogamy may represent active dating and search for an ultimate formal partner. Conversely,

serial monogamy may simply reflect an ambiguous attitude towards formal marriage or cohabitation.

Our a priori hypothesis that the strength of the association between age at sexual debut and sexual partnering patterns in adulthood would be lessened with age at time of interview was not supported. We had hypothesized that the social acceptability of adolescent and premarital intercourse had changed significantly over time. Based on these findings, the social norms of sexual debut at less than 15 years may not have changed for men between the 1980s and 2000s.

Our finding that lifetime number of sexual partners is a mediator of the association between age at sexual debut and sexual concurrency in adulthood has practical implications. Efforts to delay sexual debut are often unsuccessful. In a recent report from the National Campaign to Prevent Teen Pregnancy, over twenty types of interventions were evaluated, and less than half delayed first sex among teens.[121] Main reasons for failure of programs included inadequate implementation period,[122] omission of active skills-building exercises,[123] and focusing on age groups that were older and more likely to be sexually experienced.[121] Furthermore, even successful interventions often only showed a short-term effect that would not make a meaningful difference over the course of a man's lifetime.[124,125]

The findings may inform sexual education interventions among youth. Some existing programs have had a positive impact on the delay of sexual debut among young men[124,126-129] and could be enhanced by our findings. Approaches have included abstinence only programs, comprehensive sex education, HIV/AIDS and other STD focused programs, general youth development interventions and community service learning programs.[121] Long term, early interventions are most successful in reducing sexual risk behaviors.[127,130] Programs offered to

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youth in middle school and younger could boost the number of young men who delay sexual debut and have long lasting protective effects into later adulthood.

For youth who are already sexually active, most existing programs offer few strategies or approaches beyond return to abstinence, improvement in contraceptive use or reduction in frequency of intercourse.[121] Our findings support the inclusion of messages and skill-building activities which focus not only on correct and consistent contraceptive use and secondary abstinence but also on partner reduction, mutual fidelity in romantic relationships, and continued age-appropriate education for older teens and young adults. Addressing the role of serial monogamy may encourage men to engage in less risky behavior, including consistent barrier contraceptive use with female partners even if they are currently the only partner as well as reducing overall number of partners.

*Considerations and strengths*

The analyses may have some limitations to consider. The challenges of accurate measurement of sexual behaviors have been documented.[131] Recall error is possible for first sexual experiences, particularly for individuals whose sexual debut occurred long before their interview. However, in a previous study among young men, while only fair levels of agreement between reported age at first intercourse were documented when interviews were conducted at two separate times, the difference in age was typically of only one year[132] which would not greatly affect the accuracy of age of sexual debut in our study.

As in most surveys, all information was self-reported. Since some of the behaviors, particularly sensitive activities related to sexual practices and partnering and substance use, are stigmatized, there is potential for under-reporting.[131] To limit information bias and under-

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reporting, both CAPI and ACASI were employed. The use of computer-assisted methods in order to enhance response rates and accuracy, especially using ACASI to limit under-reporting when asking sensitive questions, are well supported in the literature.[133,134]

Finally, in this study, overlap of partners is not perfectly measured; in the month, year increments reported, it is possible that partners might not overlap but would be captured in the data as such. This would misclassify more partnerships as "concurrent" than truly were. However, in previous studies comparing the accuracy of similar date comparison methods, relatively high agreement was found between the measures.[8,28]

This study has a number of important strengths. This study was large and nationally representative. Oversampling of minority groups provides confidence that sufficient numbers of minorities were included in the analyses. The use of sampling weights helps to account for non-response bias and improves the extent to which results can be generalized to the U.S. population.

By conceptualizing sexual partnering behavior as a three level variable, we were able to capture not only sexual concurrency but serial monogamy in this study, both of which are associated with the potential for increased transmission and acquisition of STDs. Our findings also add to the knowledge base in that now findings for both men and women across all three sexual partnering patterns may be considered with similar determinants and outcomes.

**Conclusions**

The public health implications of this study are important. Understanding lifetime number of sexual partners on the casual pathway between early age of debut among men and later sexual partnering behaviors in adulthood informs interventions targeting young men. Interventions need to provide thorough sexual health information, including the benefits of

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delaying sexual debut, as well as information on the benefits of limiting partners and mutually monogamous intimate relationships. Since age of debut before 15 years increases other risks among American men, appropriate sexual health education should be initiated earlier among young men to provide them with the tools and information they need. Finally, since many young men are already sexually experienced in their teens, realistic and comprehensive strategies to reduce sexual risks need to be integrated into school and community programming.

**Table 2.1.**
**Respondent Characteristics by Sexual Partnering in the Year Before Interview**

| | Concurrent Partnerships | Serial Monogamy | Monogamy |
|---|---|---|---|
| **N** | 919 | 444 | 4,704 |
| Weighted N | 4,510,631 | 2,462,069 | 33,404,609 |
| | Weighted Percentages | | |
| **Sociodemographic Characteristics** | | | |
| *Age at First Intercourse* | | | |
| < 15 years old | 31.1% | 23.9% | 16.4% |
| 15- 17 years | 49.9% | 53.6% | 46.0% |
| 18 or more years of age | 19.0% | 22.5% | 37.6% |
| *Age at time of interview (years)* | | | |
| 21- 24 years | 25.5% | 33.0% | 12.2% |
| 25-29 years | 25.2% | 29.3% | 20.9% |
| 30-34 years | 18.2% | 17.9% | 20.0% |
| 35-39 years | 16.6% | 13.2% | 23.4% |
| 40-44 years | 14.4% | 6.6% | 23.6% |
| *Race/ethnicity* | | | |
| White, non-Hispanic | 51.7% | 59.5% | 65.0% |
| African-American, non-Hispanic | 24.3% | 14.1% | 10.2% |
| Hispanic | 19.1% | 23.3% | 18.4% |
| Other ethnicity, non-Hispanic | 4.9% | 3.2% | 6.4% |
| *Marital status* | | | |
| Currently married or cohabitating | 12.1% | 29.3% | 80.1% |
| Formerly married | 20.3% | 13.5% | 3.6% |
| Never married | 67.6% | 57.2% | 16.3% |
| *Highest level of education* | | | |
| Less than high school | 21.7% | 20.6% | 19.9% |
| High school | 28.4% | 24.2% | 24.0% |
| At least some college | 49.9% | 55.2% | 56.1% |
| *Income level* | | | |
| <100% Federal Poverty Level | 14.7% | 15.3% | 12.1% |
| 100-199% Federal Poverty Level | 17.6% | 18.9% | 19.3% |
| ≥200% Federal Poverty Level | 67.7% | 65.8% | 68.6% |
| *Urbanicity* | | | |
| Lives in a non-metropolitan area | 15.7% | 20.2% | 21.3% |
| MSA, not center city | 43.4% | 40.1% | 48.8% |
| MSA, center city | 40.8% | 39.7% | 29.9% |
| *Mother's Education* | | | |
| No Mother Figure identified | 1.2% | 0.8% | 0.5% |
| Less than high school | 20.3% | 17.6% | 22.3% |
| High school graduate | 37.3% | 36.3% | 38.1% |
| At least some college | 41.3% | 45.3% | 39.1% |

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| | | | |
|---|---|---|---|
| *Father's Education* | | | |
| No Father Figure identified | 8.7% | 7.9% | 4.6% |
| Less than high school | 21.4% | 17.3% | 23.5% |
| High school graduate | 32.5% | 30.5% | 32.0% |
| At least some college | 37.5% | 44.4% | 39.9% |
| *Lived with 2 biological parents at 14* | 70.1% | 71.6% | 79.2% |
| **Sexual History Variables** | 15.48 | 15.88 | 17.03 |
| *Age at sexual debut (Mean (SE))* | (0.09) | (0.15) | (0.10) |
| *Just met first sex partner at time of intercourse* | 14.9% | 14.6% | 10.2% |
| *Total # of lifetime partners* | | | |
| ≥6 | 87.6% | 80.3% | 50.1% |
| *Total # of partners in previous 12 months* | | | |
| 2 | 34.8% | 73.6% | 0.0% |
| ≥ 2 | 62.6% | 26.4% | 0.0% |
| *Had a non-monogamous female partner in previous year* | 52.7% | 40.8% | 4.2% |
| *Ever had sex with another man* | 5.0% | 3.9% | 3.3% |

**Table 2.2.**
**Association between age at first intercourse and concurrent sexual partnerships in adulthood**

| | | Concurrent Partnerships | | |
| | | n=919 | | |
| | | Weighted n= 4,510, 631 | | |
| | weighted % | Crude Odds Ratio (95% CI†) | Adjusted Odds Ratio* (95% CI) | Adjusted Odds Ratio** (95% CI) |
|---|---|---|---|---|
| **Age at first intercourse** | | | | |
| <15 years old | 31.10% | 3.76 (2.63-5.39) | 1.26 (0.74-2.215) | 2.19 (1.36-3.55) |
| 15- 17 years | 49.90% | 2.16 (1.51-3.09) | 1.13 (0.67-1.92) | 1.69 (1.04- 2.75) |
| ≥18 years | 19.00% | 1.00 | 1.00 | 1.00 |
| *Age at time of interview* | | | | |
| 21- 24 years | 25.10% | 3.50 (2.33-5.25) | 1.32 (0.70-2.50) | 0.89 (0.50-1.59) |
| 25-29 years | 25.60% | 1.88 (1.25-2.83) | 0.96 (0.52-1.78) | 0.75 (0.41-1.36) |
| 30-34 years | 18.10% | 1.45 (0.97-2.16) | 1.23 (0.65-2.31) | 1.17 (0.63-2.15) |
| 35-39 years | 16.80% | 1.20 (1.75-1.91) | 1.12 (0.57-2.17) | 1.13 (0.58-2.20) |
| 40-44 years | 14.30% | 1.00 | 1.00 | 1.00 |
| *Race/Ethnicity* | | | | |
| African-American, non-Hispanic | 24.30% | 2.51 (1.92-3.28) | 1.85 (1.32-2.58) | 1.89 (1.38-2.60) |
| Hispanic | 19.10% | 1.22 (0.94-1.58) | 1.49 (1.01-2.20) | 1.34 (0.92-1.96) |
| Other ethnicity, non-Hispanic | 4.90% | 1.06 (0.53-2.12) | 1.88 (0.76-4.67) | 1.56 (0.65-3.75) |
| White, non-Hispanic | 51.70% | 1.00 | 1.00 | 1.00 |
| *Current Relationship Status* | | | | |
| Never Married | 67.90% | 28.22 (18.79-42.37) | 20.84 (13.13-33.10) | 20.36 (13.22-31.38) |
| Formerly Married | 19.40% | 31.54 (19.86-50.08) | 21.00 (12.35-35.72) | 21.84 (12.77-37.35) |
| Currently Cohabitating/ Married | 12.70% | 1.00 | 1.00 | 1.00 |
| *Educational Attainment* | | | | |
| < High School | 21.70% | 0.96 (0.65-1.40) | | |
| High School | 28.40% | 1.13 (0.83-1.36) | | |
| ≥Some College | 49.90% | 1.00 | | |
| *Household Income* | | | | |
| <100% FPL^ | 14.70% | 1.09 (0.76-1.57) | | |
| 100-200% FPL | 17.60% | 0.83 (0.62-1.12) | | |
| >200% FPL | 67.70% | 1.00 | | |
| *Urbanicity* | | | | |
| MSA, center city | 40.80% | 1.94 (1.38-2.73) | | |
| MSA, suburbs | 43.40% | 1.25 (0.91- 1.72) | | |
| Non-MSA | 15.70% | 1.00 | | |
| *Employment Status* | | | | |
| Unemployed | 5.10% | 1.45 (0.93-2.25) | | |
| Employed a bit of both [FT/PT] | 18.10% | 1.73 (1.19-2.524) | | |

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| | | | | |
|---|---|---|---|---|
| Part Time [PT] | 6.90% | 1.31 (0.92-1.87) | | |
| Full Time [FT] | 69.90% | 1.00 | | |
| *Mother's Highest Education* | | | | |
| No mother figure | 1.20% | 1.55 (0.30-8.07) | | |
| < High School | 20.30% | 0.78 (0.56-1.08) | | |
| High School | 37.30% | 0.83 (0.64-1.08) | | |
| ≥Some College | 41.30% | 1.00 | | |
| *Father's Highest Education* | | | | |
| No father figure | 8.70% | 1.56 (1.04-2.330 | | |
| < High School | 21.40% | 0.86 (0.63-1.17) | | |
| High School | 32.50% | 0.95 (0.70-1.31) | | |
| ≥ Some College | 37.50% | 1.00 | | |
| *Parental Living Situation at Age 14* | | | | |
| Did not live with both biological parents at age 14 | 29.86% | 1.37 (1.06-1.78) | | |
| *Relationship with first partner* | | | | |
| Just met/ something else | 14.91% | 1.34 (0.95-1.90) | | |
| Some existing Relationship | | 1.00 | | |
| *Lifetime Number of Partners* | | | | |
| ≥ 6 | 87.60% | 6.12 (4.19-8.94) | 5.76 (3.37-9.84) | |
| 1-5 | 12.40% | 1.00 | | |
| Non-monogamous female partner | 52.70% | 23.45 (16.91-32.52) | 12.04 (8.17-17.73) | 12.13 (8.35-17.62) |
| Ever same sex activity | 5.00% | 1.49 (0.89-2.48) | | |
| Ever had HIV test | 66.37% | 1.75 (1.35-2.26) | 1.40 (1.01-1.94) | 1.66 (1.20-2.30) |
| STD in past year | 4.60% | 1.97 (1.20-3.24) | | |
| Ever been jailed | 16.50% | 1.67 (1.31-2.13) | 0.93 (0.67-1.31) | 1.13 (0.80-1.59) |
| Jailed in past year | 15.40% | 2.88 (1.97-4.21) | 1.90 (1.07-3.37) | 1.73 (0.97-3.10) |
| Binge drinking | | | | |
| in past year | 80.20% | 2.47 (1.55-3.94) | 1.75 (0.74-2.45) | 1.42 (0.78-2.61) |
| not in past year | 12.60% | 1.14 (0.70-1.85) | 0.82 (0.45-1.49) | 0.78 (0.42-1.43) |
| non drinker | | 1.00 | | 1.00 |
| Used any drugs in past year | 42.30% | 2.63 (2.05-3.39) | 0.93 (0.67-1.28) | 0.99 (0.71-1.37) |
| *Norms variables* | | | | |
| Its ok for unmarried 18yo to have sex | 75.70% | 1.97 (1.41-2.75) | 1.06 (0.70-1.62) | 1.11 (0.72-1.72) |
| Its ok for unmarried 16yo to have sex | 27.80% | 1.98 (1.48-2.64) | | |

† CI: Confidence Interval; ^ FPL: Federal Poverty Level

\* adjusted for age at interview, ethnicity, marital status, lifetime no. of partners, non-monogamous female partner, ever jailed, jailed in previous 12 months, HIV testing history and norms around sex at 18

\*\* adjusted for age at interview, ethnicity, marital status, non-monogamous female partner, ever jailed, jailed in previous 12 months, HIV testing history and norms around sex at 18--removing no. of lifetime partners

**Table 2.3. Association between age at first intercourse and serial sexual partnerships in adulthood**

| | | n=444 Weighted n= 2,462,069 | | |
|---|---|---|---|---|
| | weighted % | Crude Odds Ratio (95% CI†) | Adjusted Odds Ratio* (95% CI) | Adjusted Odds Ratio** (95% CI) |
| **Age at first intercourse** | | | | |
| < 15 years old | 23.90% | 2.44 (1.57-3.81) | 0.92 (0.51-1.67) | 1.47 (0.83-2.62) |
| 15- 17 years | 53.60% | 1.95 (1.31-2.92) | 1.06 (0.66-1.72) | 1.50 (0.93-2.41) |
| ≥ 18 years | 22.50% | 1.00 | 1.00 | 1.00 |
| *Age at time of interview* | | | | |
| 21- 24 years | 34.10% | 12.50 (7.72-20.23) | 6.38 (3.33-12.25) | 4.77 (2.47-9.19) |
| 25-29 years | 29.20% | 5.68 (3.52-9.18) | 3.62 (2.04-6.42) | 3.02 (1.69-5.40) |
| 30-34 years | 18.20% | 3.85 (2.21-6.73) | 3.51 (1.87-6.59) | 3.36 (1.80-6.29) |
| 35-39 years | 13.00% | 2.42 (1.43-4.08) | 2.30 (1.28-4.16) | 2.34 (1.32-4.17) |
| 40-44 years | 5.50% | 1.00 | 1.00 | 1.00 |
| *Race/Ethnicity* | | | | |
| African-American, non-Hispanic | 14.10% | 1.35 (0.90-2.01) | 1.07 (0.70-1.63) | 1.03 (0.67-1.57) |
| Hispanic | 23.30% | 1.32 (0.92-1.90) | 1.57 (1.09-2.28) | 1.38 (0.95-2.02) |
| Other Ethnicity, non-Hispanic | 3.20% | 0.59 (0.31-1.13) | 0.97 (0.50-1.88) | 0.85 (0.42-1.72) |
| White, non-Hispanic | 59.50% | 1.00 | 1.00 | 1.00 |
| *Current Relationship Status* | | | | |
| Never Married | 57.90% | 10.33 (7.51-14.20) | 7.17 (4.79-10.75) | 5.14 (3.38-7.83) |
| Formerly Married | 12.90% | 9.46 (5.96-15.02) | 6.57 (4.00-10.81) | 8.35 (5.21-13.40) |
| Currently Cohabitating/ Married | 29.10% | 1.00 | 1.00 | 1.00 |
| *Educational Attainment* | | | | |
| <High School | 20.60% | 0.89 (0.56-1.42) | | |
| High School | 24.20% | 0.91 (0.61-1.36) | | |
| ≥Some College | 55.20% | 1.00 | | |
| *Household Income* | | | | |
| <100% FPL^ | 15.30% | 1.25 (0.80-1.95) | | |
| 100-200% FPL | 18.90% | 0.95 (0.64-1.41) | | |
| >200% FPL | 65.80% | 1.00 | | |
| *Urbanicity* | | | | |
| MSA, center city | 39.70% | 1.45 (0.96-2.21) | | |
| MSA, suburbs | 40.10% | 0.89 (0.60- 1.31) | | |
| Non- MSA | 20.20% | 1.00 | | |
| *Employment Status* | | | | |
| Unemployed | 4.80% | 1.55 (0.85-2.81) | | |
| Employed a bit of both [FT/PT] | 22.50% | 2.33 (1.57-3.47) | | |

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| | % | | | |
|---|---|---|---|---|
| Part Time [PT] | 7.80% | 1.60 (0.96-2.67) | | |
| Full Time [FT] | 64.80% | 1.00 | | |
| *Mother's Highest Education* | | | | |
| No mother figure | 8.00% | 1.1 (0.19-6.39) | | |
| <High School | 17.60% | 0.64 (0.40-1.00) | | |
| High School | 36.30% | 0.76 (0.55-1.04) | | |
| ≥Some College | 45.30% | 1.00 | | |
| *Father's Highest Education* | | | | |
| No father figure | 7.90% | 1.30 (0.67-2.54) | | |
| <High School | 17.30% | 0.61 (0.41-0.91) | | |
| High School | 30.50% | 0.78 (0.56-1.09) | | |
| ≥Some College | 44.40% | 1.00 | | |
| *Parental Living Situation at Age 14* | | | | |
| Did not live with both biological parents at age 14 | 28.39% | 1.35 (0.97-1.99) | | |
| *Relationship with first partner* | | | | |
| Just met/ something else | 14.59% | 1.39 (0.90-2.14) | | |
| Some existing Relationship | | 1.00 | | |
| *Number of Lifetime Partners* | | | | |
| ≥ 6 | 80.30% | 3.71 (2.34-5.88) | 3.43 (2.04-5.78) | |
| 1-5 | 19.70% | 1.00 | | |
| Non- monogamous female partner | 40.80% | 14.88 (11.09-19.96) | 7.42 (5.13-10.73) | 7.31 (5.10-10.47) |
| Ever same sex Activity | 3.90% | 1.17 (0.46-2.97) | | |
| Ever HIV test | 63.08% | 1.61 (1.08-2.41) | 1.41 (0.91-2.19) | 1.83 (1.14-2.86) |
| Treated for STD | 7.60% | 3.49 (1.75-6.96) | | |
| Ever been jailed | 8.10% | 1.50 (0.99-2.27) | 0.82 (0.51-1.30) | 0.97 (0.60-4.57) |
| Jailed in past year | 14.80% | 2.96 (1.86-4.70) | 2.12 (1.20-3.77) | 1.95 (1.07-3.54) |
| *Binge drinking* | | | | |
| in past year | 83.90% | 3.60 (1.83-7.08) | 1.76 (0.93-3.34) | 1.67 (0.86-3.24) |
| not in past year | 10.80% | 1.33 (0.61-2.88) | 1.01 (0.48-2.13) | 1.04 (0.49-2.17) |
| non drinker | | 1.00 | | 1.00 |
| Used any drugs in past year | 50.90% | 3.93 (2.88-5.36) | 1.59 (1.13-2.25) | 1.56 (1.10-2.20) |
| *Norms variables* | | | | |
| Its ok for unmarried 18yo people to have sex | 79.60% | 2.51 (1.68-3.75) | 1.27 (0.82-1.95) | 1.23 (0.79-1.90) |
| Its ok for unmarried 16yo people to have sex | 29.10% | 2.16 (1.55-3.01) | | |

† CI: Confidence Interval; ^ FPL: Federal Poverty Level

* adjusted for age at interview, ethnicity, marital status, lifetime no. of partners, non-monogamous female partner, ever jailed, jailed in previous 12 months, HIV testing history and norms around sex at 18

** adjusted for age at interview, ethnicity, marital status, non-monogamous female partner, ever jailed, jailed in previous 12 months, HIV testing history and norms around sex at 18--removing no. of lifetime partners

**Table 2.4.**
**Association between age at first intercourse and concurrent sexual partnering stratified by age at interview**

| | **Concurrent Partnerships** | | | | **Serial Monogamy** | | | |
|---|---|---|---|---|---|---|---|---|
| **Age (in years) at first intercourse among Men 21-30 years of age at interview (n=2,487)** | | | | | | | | |
| | **n=492** | | | | **n=262** | | | |
| | **Weighted n= 2,286,557** | | | | **Weighted n=155,738** | | | |
| | **%** | **cOR† (95%CI^)** | **aOR‡* (95% CI)** | **aOR** (95% CI)** | **%** | **cOR (95%CI)** | **aOR* (95% CI)** | **aOR** (95% CI)** |
| < 15 | 27.60% | 2.76 (1.73-4.38) | 0.97 (0.48-1.94) | 1.88 (1.02-3.44) | 25.40% | 1.95 (1.03-3.67) | 0.80 (0.33-1.92) | 1.42 (0.61-3.31) |
| 15- 17 | 52.70% | 2.06 (1.29-3.29) | 1.07 (0.62-1.87) | 1.73 (1.05-2.85) | 49.10% | 1.48 (0.85-2.56) | 0.80 (0.45-1.40) | 1.22 (0.67-2.22) |
| ≥ 18 | 19.70% | 1.00 | 1.00 | 1.00 | 25.50% | 1.00 | 1.00 | 1.00 |
| **Age (in years) at first intercourse among Men 31-44 years of age at interview (n=3,580)** | | | | | | | | |
| | **n=427** | | | | **n=182** | | | |
| | **Weighted n=2,224,074** | | | | **Weighted n=904,690** | | | |
| | **%** | **cOR† (95%CI^)** | **aOR‡* (95% CI)** | **aOR** (95% CI)** | **%** | **cOR (95%CI)** | **aOR* (95% CI)** | **aOR** (95% CI)** |
| < 15 | 34.60% | 4.73 (2.70-8.27) | 1.79 (0.86-3.72) | 2.65 (1.31-5.36) | 21.40% | 3.11 (1.52-6.34) | 1.17 (0.50-2.72) | 1.52 (0.70-3.32) |
| 15- 17 | 47.10% | 2.18 (1.28-3.71) | 1.23 (0.57-2.63) | 1.68 (0.85-3.32) | 61.40% | 3.02 (1.62-5.60) | 1.74 (0.86-3.55) | 2.17 (1.16-4.05) |
| ≥ 18 | 18.20% | 1.00 | 1.00 | 1.00 | 17.20% | 1.00 | 1.00 | 1.00 |

†: cOR= Crude Odds Ratio

‡: aOR=Adjusted Odds Ratio

^: CI= Confidence Interval

* Adjusted for race/ ethnicity, marital status, HIV testing history, age of sexual debut, no. of lifetime partners, having a non-monogamous female partner, ever having been jailed, binge drinking in past year and use of any drug in past year

** adjusted for all the preceding except number of lifetime sexual partners

**Table 2.5.  Association between age at first intercourse and concurrent sexual partnering stratified by number of partners**

| | Concurrent Partnerships | | | Serial Monogamy | | |
|---|---|---|---|---|---|---|
| **Average lifetime number of partners (≤5 partners) n= 2,514** | | | | | | |
| | **n=97** | | | **n=92** | | |
| | **Weighted n=559,496** | | | **Weighted n=486,233** | | |
| | **%** | **cOR† (95% CI^)** | **aOR‡* (95% CI)** | **%** | **cOR (95% CI)** | **aOR* (95% CI)** |
| **Age at first intercourse** | | | | | | |
| less than 15 years old | 8.70% | 1.93 (0.84-4.42) | 1.97 (0.86-4.53) | 11.10% | 2.16 (0.71-6.56) | 2.06 (0.66-6.43) |
| 15- 17 years | 51.10% | 2.04 (0.98-4.25) | 2.08 (0.99-4.38) | 42.80% | 1.49 (0.70-3.17) | 1.43 (0.65-3.13) |
| 18 years or older | 40.20% | 1.00 | 1.00 | 46.10% | 1.00 | 1.00 |
| **Greater than average lifetime number of partners (6 or more)  n=3,553** | | | | | | |
| | **n=822** | | | **n=352** | | |
| | **Weighted n= 3,951,135** | | | **Weighted n=1,975,836** | | |
| | **%** | **cOR (95% CI)** | **aOR* (95% CI)** | **%** | **cOR (95% CI)** | **aOR* (95% CI)** |
| **Age at first intercourse** | | | | | | |
| less than 15 years old | 34.30% | 1.45 (0.96-2.19) | 1.18 (0.66-2.11) | 27.10% | 1.10 (0.67-1.79) | 0.83 (0.46-1.50) |
| 15- 17 years | 49.80% | 0.99 (0.66-1.50) | 1.00 (0.57-1.75) | 56.30% | 1.07 (0.71-1.63) | 0.97 (0.60-1.57) |
| 18 years or older | 16.00% | 1.00 | 1.00 | 16.70% | 1.00 | 1.00 |

† cOR= Crude Odds Ratio

‡ aOR=Adjusted Odds Ratio

^ CI= Confidence Interval

* Adjusted for race/ ethnicity, marital status, lifetime number of partners, non-monogamous female partner, having been jailed in the  previous 12 months, and norms around sexual activity among youth.

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**Chapter 3:  Age at menarche and risky sexual partnerships in adulthood : Does a biosocial model explain any associations?**

**Abstract**

**Purpose:** This study examined the association of menarcheal age and subsequent sexual partnering among American women aged 21-44 years from the 2006-2010 National Survey of Family Growth (NSFG).

**Methods:** Menarcheal age was defined as "early" (≤11 years of age), "average" (12-14), or "late" (≥15). Sexual partnering was defined as being concurrent, serially monogamous or monogamous in the previous year. Polytomous logistic regression models were developed to evaluate the association between age of menarche and sexual partnering. Mediation, subpopulation and stratified analyses were also conducted.

**Results:** Nearly 6% reported concurrent partnerships and over 4% serial monogamy. Age of menarche was not associated with subsequent concurrent sexual partnering (adjusted odds ratio $(aOR)_{early}$: 1.09; 95% Confidence Interval (CI): 0.57-2.09; $aOR_{average}$: 1.13; 95% CI: 0.64-1.99) or serial monogamy ($aOR_{early}$: 0.75; 95% CI: 0.41-1.38; $aOR_{average}$: 0.71; 95% CI: 0.39-1.29). Stratified analysis by age at interview did not influence the association between early menarche and concurrency (Among 21-30 year olds: $aOR_{early}$: 1.82; 95% CI: 0.74-3.50; among 31-44 year olds: $aOR_{early}$: 0.79; 95% CI: 0.34-1.80) or between menarche and serial monogamy (Among 21-30 year olds: $aOR_{early}$: 0.68; 95% CI: 0.26-1.75; among 31-44 year olds: $aOR_{early}$: 0.88; 95% CI: 0.37-2.12). A subanalysis among currently unmarried women did not alter this relationship. Age at sexual debut did not mediate the age at menarche- sexual partnering relationship.

**Conclusions:** Early menarche is not a risk factor for sexual partnering in adulthood. However, menarche provides an opportunity for education that can aid young women to delay sexual debut and limit number of partners.

**Introduction**

In the United States, girls are ten times as likely to experience precocious puberty than boys.[135] The average age of menarche for U.S. girls is 12.5 years.[136] Age at puberty is linked with subsequent sexual debut.[137] The process of physically maturing has direct and indirect effects on the onset and patterns of sexual behavior during adolescence.[137] Increases in androgens cause changes in sexual motivation and behavior and increase opportunities for sexual activity by signaling sexual maturity.[138] Those who mature earlier begin sexual activity earlier.[139] Women who have an earlier sexual debut are more likely to engage in risky sexual partnering behaviors, with effects present even later into adulthood.[26] Age at menarche is associated with Human Papillomavirus (HPV) infection among adult women and this relationship has been mediated by age of sexual debut.[140]

Concurrent sexual partnerships "overlap in time, rather than following one another sequentially or disjointedly".[7] Such partnerships accelerate the spread of sexually transmitted diseases (STD) due to highly connected sexual networks.[7] Serial monogamy, partnerships that do not overlap but follow in succession, may also introduce STD risk. Many STDs are asymptomatic and have long latent infectious periods. Infectious periods vary; they may be as long as fifteen months (chlamydia) and as short as two months (gonorrhea).[141] Gaps between sexual relationships that are shorter than the infectious period may make serial partnering as likely to transmit STDs as concurrent partnerships,[142] particularly when partners feel that they have "safe" relationships because they are temporally monogamous.

While there have been studies linking earlier puberty with timing of sexual debut,[139] and earlier sexual debut with subsequent sexual partnering behavior among women,[136] there is scant

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literature investigating these three factors simultaneously and differentiating serial monogamy. The purpose of this study was to examine the extent to which age at menarche influences risky sexual partnerships in later life. Earlier menarche is associated with earlier sexual debut.[139] Earlier sexual debut is associated with risky sexual behaviors, although the effects are attenuated over time.[26] We hypothesized that an earlier age of puberty would have an influence on riskier sexual partnering behavior throughout a woman's lifespan, also tempering by advancing age. Age at sexual debut was considered a potential mediator between age at menarche and sexual partnerships.

**Methods**

This study was exempt for human subjects review because the public use data file did not contain personal identifiers.

*Data Source and Sample*

The National Survey of Family Growth (NSFG) 2006 to 2010 was used for this study. The NSFG collects data on American men and women civilians aged 15 to 44. The sampling framework has previously been described.[99] Trained female interviewers conducted interviews in respondents' homes. Computer Assisted Personal Interview (CAPI) and Audio Computer Assisted Self-Interviewing (ACASI) were used for sensitive questions. The public use dataset released in January 2012 included over 12,000 interviews of women.[99]

*Eligibility*

The sample included women 21 to 44 years of age who reported their first menstrual period and at least one opposite sex partner in the previous year. Women who gave no

information on age at menarche or whose reported age was either above their current age or below six years of age, were excluded from the analysis.  There were 2,705 women ineligible due to age, 1,246 ineligible because they did not report a male sexual partner in the previous year and 22 because they did not meet the criteria for menarcheal age.  Women who reported unreliable dates of sexual partners (i.e. any of the "first dates" of sexual partnering were later than "last dates" of sexual partnering with a particular mate) were also excluded (n=45) as were those with missing data on key variables (n=321).  The remaining 7,962 women were eligible.

*Sexual Partnerships*

In the ACASI, each respondent was asked the number of opposite sex partners they had had vaginal sex with in the previous 12 months, as well as over their lifetime.  For up to three discrete male sexual partners in the past year, the month and year of the first and last sexual intercourse were reported. Sexual partnerships in the previous year were conceptualized as monogamous; serially monogamous; and concurrent. Monogamy was one sex partner; serial monogamy was having more than one sex partner but no temporal overlap of partners and concurrency was more than one partner with an overlap of current partner first sex date and previous partner[s] last sex date.

*Operational definition of age at menarche*

Age at menarche was determined by the age the respondent had their first menstrual period.  Age at menarche was categorized as: <12 years of age ("early"), 12-14 years of age ("average") and > 14 years of age ("late") for comparison to previous research.

We considered sociodemographic, childhood and sexual history factors associated with age at menarche and/or sexual partnering behavior as potential confounders.

Age of menarche for minority girls is generally earlier than that of White girls.[143] This difference by ethnicity may be driven by environmental, biological and social factors.[143,144] Differential patterns of sexual partnering concurrency by ethnicity also exist, with higher reported concurrency among minorities.[17] Ecological differences and racial disparities may contribute to a skewed sex ratio in disadvantaged communities that may influence biological and behavioral patterns.[8,28,29] For these reasons, race/ethnicity was considered a potential confounder.

Women currently in formal relationships are less likely than unmarried peers to have outside male partners.[17,28] Thus current relationship status, defined as "never married", "formerly married" (e.g. divorced, widowed or separated) or "currently married or cohabitating", was considered a potential confounder.

Additional demographic variables included age at the time of interview (categorized as 21-24 years, 25-29 years, 30-34 years, 35-39 years, or 40-44 years), educational attainment (categorized as less than high school, high school graduate or at least some college), and income as a percentage of the Federal Poverty Level (<100% FPL, 100-199% FPL, or ≥200%).

Factors related to family structure and childhood stress[145,146] may influence the timing of puberty among women. Parental instability, in particular the absence of the biological father, has also been associated with early menarche.[147] The presence of a non-biological father figure may accelerate the rate of pubertal development among girls, even moreso than absence of any father

figure.[147] We hypothesized that the relationship of father figure would be associated not only with age at menarche but also with attitudes and norms related to sexual partnering behavior. The absence of a biological father, or presence of a non-biologically related father figure, was determined by who the respondent thought of as the man who mostly raised her, and defined as "biological father", "step father/other father figure" or "no father figure". Household make up was measured by living situation at age fourteen (dichotomized as having lived with two biological parents or at least the biological mother and step father versus some other arrangement). Since parental education can serve as a proxy for the family's economic and social position,[136] both mother's and father's educational attainment were considered and characterized as "less than high school", "high school graduate" or "at least some college".

Sexual history variables included age at debut, number of lifetime opposite sex partners (categorized as <5 or ≥ 5), and number of opposite sex partners in the previous year (categorized as 1, 2, or ≥ 3). To determine age at debut, women were asked, if they had ever had vaginal sexual intercourse with a man. If yes, they were then asked for the month and year and their age at the time of first intercourse. To permit comparison to previous literature,[112] age at debut was categorized as <15 years, 15-17 years and ≥18 years.

*Analytic Approach*

All analyses accounted for the complex sampling design and weighting of the NSFG. The distribution of potential confounders was evaluated by age at menarche. Polytomous logistic regression models were used to evaluate the association between age of menarche and three levels of sexual partnering, adjusting for sociodemographic, childhood and sexual history characteristics. Confounders were evaluated using the change-in-estimate strategy. Variables that

altered the odds ratio for the association between age at menarche and sexual concurrency by more than 10% were retained.   To examine the impact of age at sexual debut and later sexual partnering among the two marital status groups most likely to report concurrency,[17,29] additional analyses were stratified by currently unmarried women alone. To evaluate the extent to which the impact of age at sexual debut diminishes with time, additional analyses were stratified by age.  To permit comparison to previous literature,[112] age at time of interview was categorized as two groups: 21-30 years and 31-44 years.  Adjusted odds ratios and 95% confidence intervals were derived from the models.

A mediation analysis was conducted to assess if the relationship between menarche and adult sexual partnering was mediated by age of sexual debut. Early sexual debut has been associated with having more lifetime sexual partners, less consistent condom use, sexual activity with older partners, and higher likelihood of and longer duration of having a male partner who has other sexual partners.[148] We hypothesized that a model including age of sexual debut would obscure the association between age of menarche and later sexual partnering. Two models were developed and we observed, quantitatively, any changes in direction or magnitude of association when the model was run with and without age of debut.

**Results**

Table 3.1 shows the characteristics of the sample stratified by age at menarche. Twenty-two percent reported experiencing early menarche, about 11% reported experiencing a late age of menarche and ~67% reported an average age of menarche.   Mean age of menarche was 12.5 years (SD=1.68).  The age cohort distribution varied by timing of menarche ($x^2_{df8}$=2.92, p-value=0.0058).  Those reporting early menarche were more likely to report having never been

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married (22.0%) compared with those reporting average (18.8%) or late menarche (16.2%) ($x^2_{df4}$=2.9, p-value=0.0258).  Women with an average age of menarche (59.9%) were more likely than those with late (53.0%) or early (53.4%) maturation to be in the highest income bracket. More late maturers reported living with both biological parents at age 14 (78.9%) relative to those at early menarche (71.8%).  The distribution of respondent's and parental education level did not vary greatly by age of menarche.

*Sexual History*

Median lifetime partners in the sample was 4 (IQR: 1.3-7.3); being highest among concurrent women (11; IQR: 6.7-20.9), followed by serial monogamists (7; IQR: 4.4-13.1) and monogamists (3; IQR: 1.1-6.4).  The mean age of sexual debut was 17.3 years of age (SD=3.4). Age at sexual debut before age 15 was most common among women reporting early menarcheal age (23.4%) relative to average maturers (12.6%) and women reporting late menarche (3.7%). Early maturers were more likely than average or late maturers to report five or more lifetime sexual partners (51.3% versus 47.5% and 41.0% respectively).

*Predictors of Adult Sexual Partnering Relationships*

Table 3.2 shows the association between potential predictors of adult sexual partnering. Age of menarche was not associated with either concurrency (adjusted odds ratio(aOR)$_{early}$: 1.09; 95% CI: 0.57-2.09; aOR$_{average}$: 1.13; 95% CI: 0.64-1.99) or serial monogamy (aOR$_{early}$: 0.75; 95% CI: 0.41-1.38; aOR$_{average}$: 0.71; 95% CI: 0.39-1.29).  Age at menarche and subsequent sexual partnering in adulthood was not mediated by age of sexual debut (for concurrent participants (aOR$_{early}$: 1.26; 95% CI: 0.68-2.36; aOR$_{average}$: 1.22; 95% CI: 0.70-2.11) and for serial monogamists (aOR$_{early}$: 0.73; 95% CI: 0.41-1.31; aOR$_{average}$: 0.68; 95% CI: 0.38-1.20).

The youngest age cohort was nearly four times as likely as the oldest to report serial monogamy (95% CI: 2.15-7.30) and nearly three times as likely to report concurrency (95% CI: 1.66-5.01). Those aged 25-29 years were over three times as likely as the oldest cohort to report serial monogamy (95% CI: 1.82-5.60) and nearly three times as likely to report concurrency (95% CI: 1.54-4.49). There were no associations for other age cohorts. Formerly married women were eighteen times as likely currently married or cohabiting women to report serial monogamy (95% CI: 10.51-30.91) and more than thirteen times as likely to report concurrency (95% CI: 8.53-21.02). Never married women were over nine times as likely as those in a co-residential relationship to report serial monogamy (95% CI: 5.73-14.40) and nearly eight times as likely to report concurrency (95% CI: 5.26-11.14). Women with an early sexual debut were 1.62 times as likely to report being in a current relationship (95% CI: 1.08-2.43); there was no association with serial monogamy. Women with an average debut were half as likely as those with an older debut to report serial monogamy (95% CI: 0.40-0.84). Those with a greater than average lifetime number of partners were 3.74 times and 8.92 times as likely to report serial monogamy or concurrency, respectively. Drinking, particularly binge drinking in the past year, was associated with both concurrency (aOR$_{binge}$: 3.47, 95% CI: 2.14-5.61; aOR$_{drinker}$: 2.12, 95% CI: 1.37-3.27) and serial monogamy (aOR$_{binge}$: 3.14, 95% CI: 1.67-5.92; aOR$_{drinker}$: 2.51, 95% CI: 1.29-4.86). Those reporting illicit drug use in the past year were also nearly 1.57 times as likely to engage in serial monogamy (95% CI: 1.16-2.13) and nearly twice as likely to report concurrency (95% CI: 1.35-2.51).

Table 3.3 shows that the association between age at menarche and sexual partnering in adulthood did not change when stratified by age at interview. For those 21-30 years of age, early menarche was associated with neither concurrency (aOR: 1.82; 95% CI: 0.74-4.50) nor serial

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monogamy (aOR:0.68; 95% CI: 0.26-1.75).   Among women 31-44 years, early menarche was also not associated with either concurrency (aOR: 0.79; 95% CI: 0.34-1.80) or serial monogamy (aOR: 0.88; 95% CI: 0.37-2.12).   When analyzing the potential role of age of sexual debut as a mediator between age at menarche and sexual partnering behaviors in adulthood, there was no change in the estimate of association (aOR$_{concurrency}$:1.26; 95% CI: 0.68-2.36; aOR$_{serial\ monogamy}$: 0.73; 95% CI: 0.41-1.31) indicating that age of debut does not mediate that relationship.

Table 3.4 shows the association between age at menarche and sexual partnering in adulthood when analyzing only currently unmarried women.   Early menarche was neither associated with concurrency (aOR:0.95; 95% CI: 0.47-1.92) nor serial monogamy (aOR:0.84; 95% CI: 0.49-1.43).   Among only those currently unmarried, there was no change in the estimate of association (aOR$_{concurrency}$:1.07; 95% CI: 0.54-2.11; aOR$_{serial\ monogamy}$: 0.78; 95% CI: 0.47-1.31) indicating that age of debut does not mediate that relationship.

**Discussion**

Six percent of women reported engaging in concurrent sexual partnerships in the previous year and more than 4% had serially monogamous relationships.   Younger age of menarche was not associated with risky sexual partnering behavior among women in adulthood.

Our results differ from previous findings in that while early menarche was associated with early debut, this relationship did not subsequently mediate the menarche- sexual partnering relationship as anticipated.   One explanation for not finding the anticipated association is biological in nature.   Testosterone is an important hormone in predicting age of debut.   Girls with higher testosterone are more likely to transition to first coitus than others.[138]   Biologically, increases in DHEA, testosterone (T), and estradiol are thought to trigger feelings of sexual

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attraction.[149]  Over the course of a woman's reproductive lifetime, androgens, especially T, decrease.[150]  This decline may mean that while hormones influence an early menarche, their influence may only be felt for a short time during young adulthood and are less likely to influence sexual behaviors later in life.  It is possible that we did not see differences in age group because we only selected adult women; further studies should include younger cohorts to see if this hypothesized early temporal effect is only evidenced proximate to menarche.

Our data support the importance of considering not only concurrency but also serial monogamy as risky behaviors.  The prevalence of concurrency in the United States has been estimated from 5.7% to 12% among adult American women.[17,28]  Concurrent sexual partnering has been associated with transmission of chlamydia,[15] gonorrhea,[151] and syphilis[16].  Serial monogamy, while potentially perceived as a less risky option, may in fact introduce greater risk if the gap period between partners is shorter than the infectious period for STIs[152] and if temporal monogamy leads to reduced barrier method use. Our findings show that most of the gap periods for serial monogamists were indeed within the infectivity period of most STIs. Sexual partnering behaviors are driven not only by individual attitudes but also by community norms and ecological factors.  Ecological factors, like the disproportionate incarceration rate among minorities, and structural violence, like institutionalized racism, may create sex ratio imbalances which influence community norms to be more permissive of multiple or concurrent partnering. Lower marriage rates among minorities may also be part of the reason for racial disparities given the higher concurrency rates in general among unmarried women.[17,28]

Our finding regarding the association between early menarche and early debut is consistent with the literature.[139]  Early maturers were more likely to report early age of sexual debut as compared to their average and late maturing peers.  Conversely, sexual debut has been

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shown to be later for those with later menarche or puberty and earlier for those with higher testosterone levels among both sexes.[153] Our study is also consistent with previous studies documenting the average time gap of 60 days for serial monogamists in the U.S.[152] In a study conducted among 18- to 39-year-olds, most (59%) of the gaps between partnerships were six months or less; thus, the majority of the population seeking new partners found a new partner within the infectious period for chlamydia, gonorrhea, syphilis, HSV, HPV, and HIV infections.[152] Our study supports this finding with 85% reporting gaps of six months or less and 52.7% reporting gaps of three months or less; nearly one out of five reported a gap of a month or less among serial monogamists.

Early pubertal timing among women has been associated with depression and anxiety[139], substance abuse,[154] eating pathology,[155] body dissatisfaction,[156] externalizing behavior,[139] risky sexual behavior,[147] and abortion.[157] However, the effects of early pubertal timing for individual psychosocial problems seem to be limited to adolescence.[158] Attenuation of effects may result from two concurrent processes: decreased psychosocial delinquency over time for early maturers and catch-up by on-time and late maturers.[158] Thus, the negative psychosocial consequences of early puberty may only be relevant for younger cohorts.

In terms of the larger socio-environmental context, the effects of early puberty may also only be significant in adolescence and very early adulthood. The peer socialization process links early puberty with subsequent development of peer relationships.[159] As children move into adolescence, peers become increasingly important. Adolescents spend increasingly more time with friends and romantic partners and become more influenced by both their behaviors and attitudes. Girls who mature early tend to seek out friends whom they perceive as similar to themselves in maturity, primarily older girls and boys and other early developers.[159]

Relationships with older boys lead to earlier sexual activity.[160] Association with older peers, who are more likely to engage in non-normative behaviors than same age peers, may encourage earlier sexual debut and acceptance of non-normative sexual behaviors. However, as young adults mature, the importance of peers may diminish and among more mature women, the role of family may be more influential. This shift could explain why early maturers would have risky sexual behavior in adolescence but that these behaviors would decrease over time.

*Strengths and considerations*

Some limitations should be noted. All data were self-reported, which may introduce social desirability or recall bias. However, the use of trained interviewers and confidential computer reporting likely reduce the extent of these biases in this study. Recall error is also possible for first sexual experiences, particularly for individuals whose sexual debut occurred long before their interview. However, age of sexual debut is likely to be memorable among women and since it was reported in age in years, likely to be accurate in the NSFG data. Accurate measurement of sexual behaviors is challenging[131] and there is potential for under-reporting of stigmatized behaviors. To limit information bias and under-reporting, both CAPI and ACASI were employed to enhance response rates and accuracy.[133,161]

Overlap of partners is not perfectly measured. Nonetheless, the accuracy of using similar date comparison methods to determine concurrency versus direct questioning have shown high agreement in previous studies so this approach is likely to provide a good estimate of the true prevalence of concurrency.[28]

This study has a number of important strengths. Menarcheal age has been previously associated with age of sexual debut but never studied in relation to sexual partnering in

adulthood. Data came from a large, nationally representative population-based study, with a response rate of 80% among women. Further, minority groups were oversampled, and sampling weights were used improving generalizability to the general U.S. population. Menarcheal age is considered to be accurately reported, even later in adulthood.[162] Even 30 years after menarche, 55% of women recalled their age at menarche to within half a year and 79% to within 1 year.[162]

**Conclusions**

Although our findings did not demonstrate a relationship between age of menarche and later sexual partnering, early menarche is associated with earlier sexual debut which produces a host of risky behaviors and negative outcomes. Future studies need to account for potential flaws in these methods since a lack of finding does not rule out a mediating effect.

**Table 3.1. Characteristics of women by age of menarche**

| | Late Menarche | Average Menarche | Early Menarche |
|---|---|---|---|
| **N** | 886 | 5,118 | 1,958 |
| Weighted N | 4,576,989 | 28,072,418 | 9,501,745 |
| | | Weighted percentages* | |
| **Sociodemographic Variables** | | | |
| *Age at time of interview (years)* | | | |
| 21- 24 years | 13.0 | 15.4 | 18.6 |
| 25-29 years | 17.6 | 21.9 | 23.8 |
| 30-34 years | 20.5 | 18.6 | 20.9 |
| 35-39 years | 21.3 | 22.8 | 19.0 |
| 40-44 years | 27.6 | 21.3 | 17.7 |
| *Race/ethnicity* | | | |
| White, non-Hispanic | 59.9 | 65.9 | 57.8 |
| African-American, non-Hispanic | 15.4 | 12.3 | 16.8 |
| Hispanic | 18.1 | 15.4 | 20.2 |
| Other, non-Hispanic | 6.6 | 6.4 | 5.2 |
| *Marital status* | | | |
| Currently married or cohabitating | 73.9 | 72.1 | 68.5 |
| Formerly married | 9.9 | 9.1 | 9.5 |
| Never married | 16.2 | 18.8 | 22.0 |
| *Highest level of education* | | | |
| Less than high school | 18.4 | 13.7 | 19.4 |
| High school graduate | 27.4 | 22.3 | 27.7 |
| At least some college | 54.1 | 63.9 | 52.9 |
| *Income level* | | | |
| <100% Federal Poverty Level | 20.6 | 18.2 | 22.2 |
| 100-199% Federal Poverty Level | 26.4 | 22.0 | 24.4 |
| ≥200% Federal Poverty Level | 53.0 | 59.9 | 53.4 |
| **Childhood Characteristics** | | | |
| *Lived with 2 biological parents or biological mom and stepdad at age 14* | 78.9 | 77.4 | 71.8 |
| *Man who raised respondent* | | | |
| Raised mostly by biological father | 76.1 | 77.9 | 70.8 |
| Raised by non-biological father | 16.3 | 15.3 | 20.3 |
| No father figure | 7.6 | 6.8 | 8.9 |
| *Mother's Education* | | | |
| No Mother figure identified | 0.2 | 0.4 | 0.7 |
| Less than high school | 26.8 | 23.0 | 25.0 |
| High school graduate | 33.9 | 34.2 | 35.2 |
| At least some college | 39.0 | 42.4 | 39.1 |
| *Father's Education* | | | |

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| | | | |
|---|---|---|---|
| No father figure | 7.6 | 6.8 | 8.9 |
| Less than high school | 26.9 | 22.0 | 23.7 |
| High school graduate | 27.4 | 30.7 | 32.2 |
| At least some college | 38.1 | 40.5 | 35.2 |
| **Sexual History Variables** | | | |
| *Age at sexual debut* | | | |
| <15 years of age | 3.7 | 12.6 | 23.4 |
| 15-17 years of age | 39.3 | 46.5 | 44.3 |
| 18 years or older | 57.0 | 40.9 | 32.3 |
| *Had some relationship with 1st sexual partner* | 93.8 | 95.3 | 91.4 |
| *Total # of lifetime partners* | | | |
| ≥5 | 41.0 | 47.5 | 51.3 |
| *Total # of partners in previous 12 months* | | | |
| 1 | 91.2 | 90.2 | 88.6 |
| 2 | 6.7 | 6.2 | 7.8 |
| 3 or more | 2.1 | 3.6 | 3.5 |

* percentages may not total 100% due to rounding

**Table 3.2. Predictors of concurrent sexual partnerships in adulthood**

| | Concurrent Partnerships n=602 Weighted n=2,408,826 | | | Serial Monogamy 458 Weighted n=1,835,857 | | |
|---|---|---|---|---|---|---|
| | % | Crude Odds Ratio (95% CI†) | Adjusted Odds Ratio* (95% CI) | % | Crude Odds Ratio (95% CI) | Adjusted Odds Ratio* (95% CI) |
| **Age at Menarche** | | | | | | |
| 11 or younger | 26.0 | 1.77 (1.09-2.86) | 1.09 (0.57-2.09) | 24.8 | 0.99 (0.58-1.61) | 0.75 (0.41-1.38) |
| 12-14 | 66.7 | 1.51 (0.93-2.44) | 1.13 (0.64-1.99) | 62.7 | 0.83 (0.48-1.42) | 0.71 (0.39-1.29) |
| 15 and older | 7.3 | 1.00 | 1.00 | 12.5 | 1.00 | 1.00 |
| **Sociodemographic Variables** | | | | | | |
| *Age at time of interview* | | | | | | |
| 21-24 years | 28.6 | 3.75 (2.30-6.11) | 2.88 (1.66-5.01) | 34.6 | 4.90 (2.98-8.07) | 3.96 (2.15-7.30) |
| 25-29 | 30.2 | 2.68 (1.65-4.34) | 2.63 (1.54-4.49) | 30.7 | 2.95 (1.73-5.04) | 3.20 (1.82-5.60) |
| 30-34 | 18.5 | 1.74 (0.97-3.12) | 1.80 (0.97-3.37) | 9.9 | 0.99 (0.61-1.60) | 1.11 (0.66-1.84) |
| 35-39 | 11.0 | 0.90 (0.50-1.61) | 0.89 (0.46-1.72) | 13.6 | 1.20 (0.64-2.25) | 1.27 (0.65-2.49) |
| 40-44 years | 11.8 | 1.00 | 1.00 | 11.2 | 1.00 | 1.00 |
| *Race/Ethnicity* | | | | | | |
| White, non-Hispanic | 62.7 | 1.00 | 1.00 | 60.7 | 1.00 | 1.00 |
| African-American, non-Hispanic | 26.5 | 2.16 (1.63-2.85) | 1.36 (0.99-1.87) | 22.0 | 1.83 (1.26-2.64) | 1.14 (0.75-1.72) |
| Hispanic | 8.2 | 0.47 (0.30-0.76) | 0.78 (0.44-1.38) | 12.7 | 0.75 (0.47-1.19) | 1.00 (0.59-1.71) |
| Other Ethnicity, non-Hispanic | 2.7 | 0.42 (0.23-0.79) | 0.44 (0.22-0.87) | 4.6 | 0.75 (0.39-1.41) | 0.72 (0.39-1.34) |
| *Current Relationship Status* | | | | | | |
| Never Married | 53.9 | 14.40 (10.18-20.35) | 7.66 (5.26-11.14) | 57.0 | 18.76 (12.09-29.13) | 9.09 (5.73-14.40) |
| Formerly Married | 27.1 | 15.25 (10.28-22.62) | 13.39 (8.53-21.02) | 27.5 | 18.79 (10.94-32.29) | 18.03 (10.51-30.91) |
| Currently Cohabitating/Married | 19.0 | 1.00 | 1.00 | 15.5 | 1.00 | 1.00 |
| *Respondent's education* | | | | | | |
| Less than High School | 16.1 | 1.11 (0.82-1.51) | | 13.1 | 0.79 (0.53-1.16) | |
| High School Graduate or Equivalent | 27.7 | 1.25 (0.90-1.74) | | 23.7 | 0.93 (0.69-1.25) | |
| Some College or more | 5.3 | 1.00 | | 4.6 | 1.00 | |
| *Household Income* | | | | | | |
| <100% FPL | 27.3 | 1.87 (1.34-2.60) | 1.05 (0.72-1.54) | 30.1 | 2.06 (1.41-3.00) | 1.27 (0.79-2.04) |
| 100-200% FPL | 25.8 | 1.43 (1.05-1.95) | 1.06 (0.71-1.59) | 23.5 | 1.29 (0.93-1.80) | 1.00 (0.67-1.48) |
| >200% FPL | 46.9 | 1.00 | 1.00 | 46.5 | 1.00 | 1.00 |

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**Childhood Variables**

*Mother's Highest Education*

| | | | | | | |
|---|---|---|---|---|---|---|
| No mother figure | 0.5 | 0.95 (0.29-3.17) | | 0.7 | 1.14 (0.38-3.40) | |
| Less than High School | 19.5 | 0.69 (0.47-1.02) | | 16.9 | 0.51 (0.33-0.79) | |
| High School Graduate | 33.3 | 0.83 (0.62-1.11) | | 28.0 | 0.59 (0.42-0.84) | |
| Some College or more | 46.7 | 1.00 | | 54.4 | 1.00 | |

*Father's Highest Education*

| | | | | | | |
|---|---|---|---|---|---|---|
| No father figure | 10.3 | 1.50 (1.01-2.21) | | 12.6 | 1.49 (0.86-2.56) | |
| Less than High School | 4.4 | 0.75 (0.51-1.13) | | 2.4 | 0.43 (0.29-0.64) | |
| High School Graduate | 33.7 | 1.11 (0.75-1.62) | | 28.0 | 0.75 (0.54-1.05) | |
| Some College or more | 38.3 | 1.00 | | 46.9 | 1.00 | |

*Did not live with biological parents* — 36.9 — 30.9

*Presence of biological father*

| | | | | | | |
|---|---|---|---|---|---|---|
| Raised by non-biological male figure | 31.0 | 2.59 (1.90-3.54) | | 14.5 | 0.97 (0.72-1.31) | |
| Raised without father figure | 10.3 | 1.96 (1.34-2.87) | | 12.6 | 1.92 (1.14-3.22) | |
| Raised by biological father | 58.7 | 1.00 | | 72.9 | 1.00 | |

**Sexual History Factors**

*Age of sexual debut*

| | | | | | | |
|---|---|---|---|---|---|---|
| < 15 years | 29.9 | 4.38 (3.00-6.39) | 1.62 (1.08-2.43) | 19.8 | 1.81 (1.16-2.81) | 0.84 (0.51-1.38) |
| 15-17 years | 48.1 | 2.02 (1.51-2.70) | 0.88 (0.63-1.25) | 43.6 | 1.13 (0.81-1.57) | 0.58 (0.40-0.84) |
| 18 or older | 22.0 | 1.00 | 1.00 | 36.5 | 1.00 | 1.00 |

*Relationship with first partner*

| | | | | | | |
|---|---|---|---|---|---|---|
| Just met/ something else | 11.1 | 2.30 (1.55-3.41) | | 12.0 | 2.50 (1.47-4.23) | |
| Some existing relationship | 88.9 | 1.0 | | 88.0 | 1.00 | |

*Number of lifetime partners*

| | | | | | | |
|---|---|---|---|---|---|---|
| ≥ 5 lifetime partners | 92.6 | 16.29 (9.45-28.08) | 8.92 (4.88-16.30) | 79.1 | 4.98 (3.40-7.31) | 3.74 (2.48-5.63) |
| 1-4 lifetime partners | 7.4 | 1.00 | 1.00 | 20.9 | 1.00 | 1.00 |
| *Ever had HIV test* | 80.1 | 1.75 (1.20-2.56) | | 75.6 | 1.34 (0.92-1.95) | |
| *STD Treatment past year* | 14.0 | 4.80 (3.00-7.66) | | 7.5 | 2.37 (1.51-3.73) | |

**Other Risk Factors**

*Binge drinking*

| | | | | | | |
|---|---|---|---|---|---|---|
| in past year | 70.3 | 8.16 (4.99-13.36) | 3.47 (2.14-5.61) | 64.3 | 6.61 (3.73-11.72) | 3.14 (1.67-5.92) |
| not in past year | 24.8 | 2.88 (1.75-4.73) | 2.12 (1.37-3.27) | 30.1 | 3.12 (1.65-5.89) | 2.51 (1.29-4.86) |
| non drinker | 4.9 | 1.00 | 1.00 | 5.6 | 1.00 | 1.00 |
| *Used any drugs in past year* | 41.3 | 4.98 (3.80-6.52) | 1.84 (1.35-2.51) | 33.8 | 3.66 (2.82-4.74) | 1.57 (1.16-2.13) |

* adjusted for age at interview, race, marital, income, lifetime # partners, age at debut, alcohol and drug use;    † CI: Confidence Interval

**Table 3.3. Predictors of adult sexual partnering stratified by age at interview**

| | **Concurrent Partnerships** | | | | **Serial Monogamy** | | |
|---|---|---|---|---|---|---|---|
| | **Age 21-30 years at interview (n=3,385 )** | | | | | | |
| | n=352 | | | | n=293 | | |
| | Weighted n=1,415,580 | | | | Weighted n= 1,198,493 | | |
| | **%** | **Crude Odds Ratio (95% CI†)** | **Adjusted Odds Ratio* (95% CI)** | **Adjusted Odds Ratio** (95% CI)** | **%** | **Crude Odds Ratio (95% CI)** | **Adjusted Odds Ratio* (95% CI)** | **Adjusted Odds Ratio* * (95% CI)** |
| **Age at menarche** | | | | | | | |
| < 11 | 25.9 | 2.32 (1.14-4.74) | 1.82 (0.74-4.50) | 2.10 (0.87-5.05) | 24.6 | 0.69 (0.33-1.48) | 0.68 (0.26-1.75) | 0.63 (0.27-1.49) |
| 12-14 years | 70.2 | 2.43 (1.20-4.93) | 2.04 (0.88-4.72) | 2.19 (0.94-5.06) | 62.8 | 0.68 (0.35-1.34) | 0.67 (0.30-1.50) | 0.63 (0.30-1.34) |
| 15 or + | 3.9 | 1.00 | 1.00 | 1.00 | 12.6 | 1.00 | 1.00 | 1.00 |
| | **Age 31-44 years at interview (n=4,577 )** | | | | | | |
| | n= 250 | | | | n= 165 | | |
| | Weighted  n=993,246 | | | | Weighted n=637,364 | | |
| | **%** | **Crude Odds Ratio (95% CI)** | **Adjusted Odds Ratio* (95% CI)** | **Adjusted Odds Ratio** (95% CI)** | **%** | **Crude Odds Ratio (95% CI)** | **Adjusted Odds Ratio* (95% CI)** | **Adjusted Odds Ratio** (95% CI)** |
| **Age at first menarche** | | | | | | | |
| < 11 | 26.1 | 1.28 (0.64-2.56) | 0.79 (0.34-1.80) | 0.94 (0.39-2.27) | 25.3 | 1.21 (0.50-2.91) | 0.88 (0.37-2.12) | 0.94 (0.42-2.11) |
| 12-14 years | 61.8 | 0.92 (0.46-1.86) | 0.70 (0.30-1.61) | 0.78 (0.35-1.71) | 62.4 | 0.91 (0.39-2.11) | 0.84 (0.36-1.93) | 0.84 (0.38-1.86) |
| 15 or + | 12.0 | 1.00 | 1.00 | 1.00 | 12.3 | 1.00 | 1.00 | 1.00 |

* adjusted for age of sexual debut, race, marital status, income, # of lifetime partners, alcohol use and drug use in previous year;

** adjusted for all preceding taking age of debut out of the model

† CI: Confidence Interval

**Table 3.4.** Associations between age at menarche and sociodemographic characteristics of note and concurrent sexual partnerships in adulthood among currently unmarried women

| | Concurrent Partnerships n=602 Weighted n=2,408,826 | | | Serial Monogamy n=458 Weighted n=1,835,857 | | |
|---|---|---|---|---|---|---|
| | % | Crude Odds Ratio (95% CI†) | Adjusted Odds Ratio* (95% CI) | % | Crude Odds Ratio (95% CI) | Adjusted Odds Ratio* (95% CI) |
| **Age at Menarche** | | | | | | |
| 11 or younger | 21.9 | 1.23 (0.70-2.17) | 0.95 (0.47-1.92) | 25.2 | 0.87 (0.51-1.50) | 0.84 (0.49-1.43) |
| 12-14 | 70.9 | 1.58 (0.90-2.79) | 1.32 (0.69-2.52) | 63.2 | 0.87 (0.51-1.50) | 0.82 (0.48-1.42) |
| 15 and older | 7.2 | 1.00 | 1.00 | 11.6 | 1.00 | 1.00 |
| **Sociodemographic Variables** | | | | | | |
| *Age at time of interview* | | | | | | |
| 21-24 years | 30.9 | 1.44 (0.85-2.46) | 2.58 (1.39-4.81) | 33.0 | 1.62 (0.95-2.76) | 2.99 (1.55-5.76) |
| 25-29 | 29.5 | 1.72 (0.94-3.15) | 2.35 (1.22-4.53) | 32.1 | 2.01 (1.15-3.50) | 2.93 (1.63-5.40) |
| 30-34 | 16.7 | 1.34 (0.65-2.76) | 1.51 (0.72-3.18) | 9.4 | 0.79 (0.46-1.33) | 0.97 (0.55-1.70) |
| 35-39 | 10.6 | 0.81 (0.43-1.53) | 0.73 (0.39-1.49) | 13.6 | 1.09 (0.53-2.20) | 1.15 (0.54-2.43) |
| 40-44 years | 12.4 | 1.00 | 1.00 | 11.9 | 1.00 | 1.00 |
| *Race/Ethnicity* | | | | | | |
| African-American, non-Hispanic | 29.2 | 1.03 (0.76-1.39) | 1.37 (0.95-1.97) | 24.5 | 0.86 (0.57-1.30) | 1.25 (0.79-1.98) |
| Hispanic | 8.5 | 0.41 (0.24-0.68) | 0.84 (0.46-1.52) | 12.9 | 0.63 (0.40-1.01) | 1.13 (0.67-1.90) |
| Other ethnicity, non-Hispanic | 2.1 | 0.24 (0.12-0.47) | 0.31 (0.15-0.64) | 4.2 | 0.50 (0.24-1.05) | 0.63 (0.32-1.27) |
| White, non-Hispanic | 60.2 | 1.00 | 1.00 | 58.4 | 1.00 | 1.00 |
| *Marital Status* | | | | | | |
| Never Married | 66.5 | 1.00 | 1.00 | 67.4 | 1.00 | 1.00 |
| Formerly Married | 33.5 | 1.05 (0.79-1.41) | 1.59 (1.08-2.35) | 32.6 | 1.00 (0.67-1.50) | 1.80 (1.17-2.76) |
| *R's education* | | | | | | |
| Less than High School | 15.1 | 0.91 (0.63-1.31) | | 12.0 | 0.64 (0.40-1.01) | |
| High School Graduate | 27.9 | 1.20 (0.87-1.65) | | 23.9 | 0.88 (0.63-1.24) | |
| Some College or more | 57.0 | 1.00 | | 64.2 | 1.00 | |
| *Household Income* | | | | | | |
| <100% FPL | 29.0 | 0.83 (0.58-1.17) | 0.85 (0.57-1.26) | 28.5 | 0.76 (0.50-1.18) | 0.84 (0.55-1.30) |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 100-200% FPL | 24.3 | 0.79 (0.56-1.12) | 0.9 (0.56-1.47) | 22.4 | 0.68 (0.47-0.99) | 0.78 (0.52-1.18) |
| >200% FPL | 46.7 | 1.00 | 1.00 | 49.1 | 1.00 | 1.00 |
| **Childhood Variables** | | | | | | |
| *Mother's Highest Education* | | | | | | |
| No mother figure | 0.3 | 0.39 (0.06-2.38) | | 0.7 | 0.98 (0.23-4.11) | |
| Less than High School | 18.2 | 0.68 (0.44-1.04) | | 14.4 | 0.46 (0.27-0.77) | |
| High School Graduate | 34.3 | 1.04 (0.76-1.41) | | 29.4 | 0.76 (0.52-1.13) | |
| Some College or more | 47.2 | 1.00 | | 55.5 | 1.00 | |
| *Father's Highest Education* | | | | | | |
| No father figure | 10.0 | 1.27 (0.72-2.24) | | 12.7 | 1.24 (0.71-2.15) | |
| Less than High School | 19.4 | 0.97 (0.64-1.48) | | 12.5 | 0.48 (0.31-0.75) | |
| High School Graduate | 32.6 | 1.09 (0.70-1.69) | | 25.4 | 0.66 (0.44-0.97) | |
| Some College or more | 38.1 | 1.00 | | 49.4 | 1.00 | |
| *Did not live with both biological parents at age 14* | 38.8 | 1.56 (1.13-2.17) | | 31.7 | 1.15 (0.76-1.74) | |
| *Presence of biological father* | | | | | | |
| Raised by non-biological male figure | 31.2 | 1.83 (1.31-2.55) | | 12.8 | 0.59 (0.40-0.86) | |
| Raised without father figure | 10.0 | 1.48 (0.88-2.48) | | 12.7 | 1.47 (0.88-2.43) | |
| Raised by biological father | 58.8 | 1.00 | | 74.4 | 1.00 | |
| **Sexual History Factors** | | | | | | |
| *Age of sexual debut* | | | | | | |
| < 15 years | 25.7 | 3.01 (1.98-4.57) | 1.52 (0.98-2.36) | 17.9 | 1.23 (0.79-1.93) | 0.71 (0.44-1.15) |
| 15-17 years | 52.5 | 1.89 (1.32-2.71) | 1.07 (0.71-1.61) | 43.9 | 0.93 (0.64-1.33) | 0.59 (0.40-0.86) |
| 18 or older | 21.9 | 1.00 | 1.00 | 38.2 | 1.00 | 1.00 |
| *Relationship with first partner* | | | | | | |
| Just met/ something else | 10.5 | 1.69 (1.05-2.71) | | 12.9 | 2.01 (1.10-3.70) | |
| Some existing relationship | 89.5 | 1.00 | | 87.1 | 1.00 | |
| *Number of lifetime partners* | | | | | | |
| ≥ 5 lifetime partners | 94.2 | 12.82 (7.13-23.03) | 10.97 (5.97-20.17) | 82.6 | 3.81 (2.50-5.81) | 4.36 (2.87-6.63) |
| 1-4 lifetime partners | 5.8 | 1.00 | 1.00 | 17.4 | 1.00 | 1.00 |
| *Ever had HIV test* | 79.7 | 1.47 (0.94-2.28) | | 76.8 | 1.20 (0.77-1.88) | |
| *STD treatment in past year* | 14.4 | 2.42 (1.45-4.05) | | 6.5 | 0.97 (0.59-1.58) | |
| **Other Risk Factors** | | | | | | |
| *Binge drinking* | | | | | | |
| in past year | 67.8 | 3.93 (2.29-6.76) | 2.63 (1.57-4.40) | 65.1 | 3.85 (2.19-6.79) | 2.7 (1.51-4.84) |

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| | | | | | |
|---|---|---|---|---|---|
| not in past year | 26.6 | 2.26 (1.34-3.81) | 1.93 (1.19-3.13) | 29.5 | 2.57 (1.35-4.90) | 2.25 (1.19-4.23) |
| non drinker | 5.5 | 1.00 | 1.00 | 5.4 | 1.00 | 1.00 |
| *Used any drugs in past year* | 40.7 | 2.82 (1.94-4.11) | 1.71 (1.12-2.60) | 36.3 | 2.35 (1.72-3.22) | 1.66 (1.17-2.38) |

\* adjusted for age at interview , age of sexual debut, race, marital status [of unmarrieds], no. of lifetime partners, alcohol use, drug use and income.

† CI: Confidence Interval

# Chapter 4:  Sexual discordance and sexual partnering among heterosexual women

**Abstract**

**Purpose:** This study examined the characteristics of self-identified heterosexual women who were concordant or discordant in their sexual behavior and the association of discordance and subsequent sexual partnering among American women aged 15-44 years from the 2006-2010 National Survey of Family Growth (NSFG).

**Methods:** Sexual concordance was defined as reporting a heterosexual identity and no female partners in the past year; discordance was defined as reporting a heterosexual identity and having at least one female partner in the past year. Sexual partnering was defined as being concurrent, serially monogamous or monogamous in the previous year. Descriptive statistics were obtained. Polytomous logistic regression models were used to evaluate the association between sexual discordance and sexual partnering.

**Results:** Among self-identified heterosexual and sexually active American women, 11.2% reported ever having had a same sex partner. Discordance was uncommon (1.8%). Heterosexually discordant women who had both male and female partners in the previous year were 5.5 as likely to report having a concurrent relationship (95% CI: 2.77-11.09) and 2.43 times as likely to report engaging in serially monogamous relationships (95% CI: 1.19-4.97) with their male partners than concordant women.

**Discussion:** Discord between heterosexual identity and same sex behavior is a risk factor for risky behaviors, including concurrent sexual partnering with multiple male partners. Sexual health guidelines for women need to be cognizant that women who have sex with women are still at risk for STDs, particularly for women with non-monogamous sexual partners. Women who have sex with women and also men, may act as bridges for the transmission of STDs,

particularly to their monogamous female partners.  Sexual education programming needs to include information inclusive of non-heteronormative behaviors and identities in order to provide sexual minorities with the tools and information they need to stay healthy. Clinical guidelines should also be revised to ensure that all women are offered counseling and screening for reproductive and sexual health.

## Introduction

Discordant sexual identity and behavior occurs when a person reports one sexual identity (e.g. heterosexual) but different sexual behaviors (e.g. same sex or bisexual behaviors). People may report discordant identity and behavior for many reasons, including internalized heterosexism,[47] homophobia,[46] or simply not perceiving themselves as a sexual minority. Societal pressures such as heteronormativity may increase discordant sexual identity and behavior. Heteronormativity is a construct that endorses heterosexual partnering as the norm for society.[163,164] This sanctioning of opposite sex partnering as "natural" casts other sexual partnering types as "unnatural" or even deviant.[165] Because of this cultural bias, sexual minorities may feel discrimination, stigmatization and intense pressure to present an outwardly heterosexual orientation,[109,166] while still engaging with same sex partners. Among men who have sex with men, engaging in the insertive role with male sexual partners has been correlated with self-report of heterosexual identity.[49,50,167] Among women, little research has been done to describe the phenomenon of heterosexual orientation and behavior discord, although some qualitative studies have examined concepts like "heteroflexibility,"[52] and the theoretical exploration of a supposed "plasticity" of female sexual attraction and behavior.[53,80]

More men than women self-identify as homosexual or bisexual, yet more women report same sex activity. Previous studies in the U.S. estimate that 2-4% of males and 1-2% of females self-identify as homosexual.[168-170] Estimates of lifetime same-sex behavior among women range from 8-20% in the United States.[44,45,169] In the most recent round of the U.S. National Survey of Family Growth (NSFG 2006-2010), some form of same-sex sexual behavior was reported by 12% of women aged 25–44 over their lifetime, twice the proportion reported among men in this

age group.[45]  The trend existed among younger women too, with nearly 2% of boys and 10% of girls aged 15–17 reporting any lifetime same-sex sexual behavior.[45]

The number of women reporting either sexual minority identities or discordant sex behavior has been increasing.  In the 2002 NSFG, more than 4% of American women 15-44 years of age reported having a female sex partner in the previous 12 months;[171] by the current round, 12% of female respondents 15-44 years of age reported having had a female sexual partner in the past year.[45]

Compared to women who have sex with men only (WSMO), WSW (either WSW or WSWM) are unduly affected by a variety of psychosocial and physical health issues.[54,55]  WSW are disproportionately affected by mood disorders and increased psychological distress.[57-60]  Compared to WSMO, WSW are more likely to abuse alcohol and illicit substances [63,65,66] and have higher rates of tobacco use and longer histories as smokers.[65,67,69]   Contrary to traditionally held beliefs, WSW are also at  risk of contracting STDs, particularly herpes simplex virus type 1 and 2 (HSV-1 and HSV-2),[83] human papillomavirus (HPV),[72,84] chlamydia and gonorrhea,[73,74] trichomoniasis,[88] syphilis,[89] hepatitis A,[94]  and bacterial vaginosis.[90,91]  Up to 44% of WSW have a lifetime history of one or more STDs.[70-73]   While women who self-report as bisexual or WSMW are at the highest risk for acquiring these STDs, even more so than WSMO (women who have sex with men only), women who have sex with women are less likely to be counseled to have Papanicolaou tests  or other clinical screening for STDs, including  HIV.[84,90,93,94]

Despite growing evidence of increasing numbers of American women reporting that they engage in both opposite sex and same sex behavior, existing studies have inconsistently used varying parameters for definitions of sexuality asking about lifetime experience but current

orientation identity or attraction.[172,173]   Others have focused only on specific sub-populations of Americans,[173,174] or have had relatively small sample sizes.[173]   There is a small body of literature that has documented that women who self-identify as "lesbian" and who are also sexually active with men have riskier sexual behaviors.  However, there is scant information on associations between a discordant sexual orientation identity and same sex behavior among adult women who self-identify as heterosexual.

Using a nationally-representative sample, we examined the association between discordant heterosexual sexual orientation identity and same-sex sexual behavior and prevalence of risky behaviors among women, including sexual partnering behaviors with men.  We hypothesized that discord between heterosexual orientation identity and actual sexual behaviors would result in elevated risk behaviors, including risky sexual partnering with men, as compared to sexually concordant women.

**Methods**

This study was exempt for review by the Virginia Commonwealth University Institutional Review Board because the public use data file did not contain personal identifiers.

*Procedure*

The study used data from the continuous 2006-2010 cycle of the National Survey of Family Growth (NSFG).  The NSFG collects data on reproductive health among men and women 15 to 44 years of age who live in civilian households in the United States.  The NSFG sampling framework has been described in before.[99]  Trained female interviewers conducted interviews in participants' homes using Computer Assisted Personal Interview (CAPI) technology and Audio Computer Assisted Self-Interviewing (ACASI) .

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*Sample and Eligibility*

By June 2010, over 22,600 interviews had been completed in 110 Primary Sampling Units (PSUs). The public use data files released in January 2012 included more than 12,000 interviews of women. The sample included women, ages 15-44 years, who self-identified as heterosexual or straight and reported being sexually active in the previous twelve months. Bisexual and homosexual women who reported sexual behaviors concordant with those identities and homosexual women who reported opposite behaviors were excluded. Women who did not report a sexual orientation identity were also excluded. There were 1,004 women ineligible due to non-heterosexual identity, 2,404 ineligible because they did not report a sexual partner in the previous year and 29 because they had missing values for discordant or concordant behavior in the prior 12 months. An additional 1,489 participants were excluded due to missing data on key variables; the largest single contributor to this group were missing values related to consistent condom use (n=582). The remaining 7,353 women were eligible.

*Measures*

Sexuality. Sexuality was assessed by using two different measures: self-identified sexual orientation and sexual behavior in the past 12 months. Sexual orientation identity was assessed by asking participants how they would describe themselves, specifically: "Do you think of yourself as heterosexual or straight; homosexual, gay, or lesbian; bisexual; or something else?" Sexual behavior was assessed by asking participants: a) whether they had had any sexual experience with a female partner in their lifetime, b) the number of female partners over their lifetime, c) whether they had had "any sexual experience" with a female partner in the past 12 months and d) the number of female partners over the past 12 months.

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Based on these responses, women were categorized as: 1) self-reported heterosexual identity with concordant sexual behavior (concordant); and 2) self-reported heterosexual orientation with discordant sexual behavior (discordant). To be consistent with the measure of sexual identity at the time of interview, only sexual activity reported in the 12 months prior to interview was considered in in the definition of current discord/ concordance.

Sexual Behaviors. Age at sexual debut was measured by three categories- less than 15 years of age, 15-17 years of age and 18 years or older. Number of sex partners in the past 12 months (categorized as 1 partner, 2 partners or 3 or more partners) and lifetime number of sexual partners (categorized as ≤5 and ≥6) was also assessed. Other sexual behaviors included consistent condom use with male partner(s) (defined always, inconsistent use (i.e. sometimes or most of the time), or never used a condom), reporting exchanging sex for money, drugs or shelter in the past year (dichotomous ever/ never) and having sex with a high-risk male (i.e. non-monogamous male partner, MSM, Injecting Drug User or known HIV positive). HIV testing history and treatment for STDs in the past 12 months were examined as proxy indicators for high risk sexual behavior.

Opposite Sex Sexual Partnerships. Each respondent was asked the number of opposite sex partners they had had vaginal sex with in the previous 12 months. For up to three discrete opposite sex partners reported, the date in months and year of first and last sexual intercourse were asked, and except for any partners identified as currently married to or cohabitating with the respondent, whether or not the partner was "current." The ACASI part of the interview also asked respondents how many male and female partners they had (over lifetime and in the prior 12 months) as well as types of sexual activity engaged in (oral, vaginal or anal).

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Sexual partnerships were conceptualized in three distinct categories: monogamy, serial monogamy; and concurrency. Monogamy was defined as reporting one opposite sex partner over the course of the previous 12 months. Serial monogamy was defined as more than one opposite sex partner over the past 12 months but with no overlap of first/ last sex dates of any other partners. Concurrency was defined as more than one opposite sex partner in the past 12 months with an overlap of current partner first sex date and previous partner[s] last sex date. Only respondents reporting at least one male sex partner in the previous year were analyzed for sexual partnership type since partnering dates were only recorded for opposite sex partners. We calculated the gaps for serial monogamists as number of months between first sexual intercourse with most recent partner and last sex with previous partner and first sex with second to last partner and last sex with third to last partner where applicable.

Risky Behaviors. Binge drinking in the past 12 months was classified as reporting having had five or more drinks within a couple of hours during the last 12 months. Illicit drug use was analyzed as a dichotomous variable with any use—either injecting or non-injecting- reported in the past year versus no use.

Demographic Characteristics. Demographic variables of interest included: age in years at the time of interview (categorized as 15-20, 21-24, 25-30, 31-34, and 35-44); race/ethnicity (defined as White, non-Hispanic, African-American, non-Hispanic, Hispanic and Other ethnicity); relationship status (defined as "never married, formerly married, widowed, or separated" and "currently married/cohabitating"); educational attainment (categorized as "less than high school education not currently enrolled", "less than high school education but still enrolled", "high school graduate or GED holder", and "at least some college of more"); income level, measured as percent of federal poverty level (FPL) was categorized as "below 100% FPL",

"100-199% FPL" and "greater than or equal to 200% FPL" ), U.S. nativity of respondent (defined as yes or no), and urbanicity (conceptualized as living in center city of a metropolitan area (MSA), living outside a city but within an MSA or outside an MSA).

Analytic Approach

All analyses accounted for the complex sampling design and weighting of the NSFG[99] using SUDAAN version 11. We first estimated the prevalence of discordant sexuality among heterosexual women. Weighted percentages were reported. Then we compared sociodemographics, sexual behaviors and norms, and risky behaviors for discordant and concordant sexuality among all women using chi-square tests with an α of 0.05. We then conducted polytomous logistic regression to account for the three level sexual concurrency outcome variable. Multivariable analyses were used to assess the association between sexual discordance and sexual partnering behaviors and poor health behaviors adjusting for potential confounders. Crude and adjusted Odds Ratios and 95% confidence intervals are reported here.

**Results**

Among all heterosexual women, 11.2% reported ever having had a same sex partner. Table 4.1 shows the characteristics of the sample stratified by concordant or discordant sexual identity and partnering in the previous 12 months. The majority of self-identified heterosexual women (98.2%) did not report same sex behavior in the previous year. The majority of women in the discordant group reported having one female sex partner in the past 12 months (51.7%), 39.0% reported having two female sex partners, and 9.3% reported having three or more. The distribution of number of sex partners in the past year who were men also differed by discordant

group with women reporting sexual discordance reporting more sex partners who were men in the past year (p<0.0001).

The discordant group tended to be younger (p<0.0001) relative to the concordant group. Sexually concordant women were more likely than the discordant group to be currently married or cohabitating with a male. There were no differences in the trend across racial or ethnic groups, income, or urbanicity. There was a trend for those with higher education reporting more discordant behavior (p=0.0044). A higher proportion of sexually discordant women reported being US born than those who were concordant (95.0% versus 84.9%).

*Risky Behaviors*

There was a disproportionate distribution of other risk behaviors among discordant versus concordant women. Among concordant women, the majority reported having ever had an HIV test (66.9%), close to half reported binge drinking of alcohol in the past year (41.8%) and almost two out of ten reported any illicit drug use in the past year (15.8%). Among discordant women, the proportions reporting these behavior were uniformly higher: almost nine out of ten reported ever having had an HIV test (82.1%), eight in ten reported binge drinking of alcohol in the past year (80.0%) and more than half reported any illicit drug use in the past year (52.9%).

*Sexual Behavior*

Median age of sexual debut was younger for those reporting discordance (15.1 years (IQR:14.1-16.0) versus 16.2 years (IQR:14.8-18.0)). The trend among sexually discordant women was for a younger age of sexual debut as compared to the trend for concordant women: 26.2% of discordant women had a debut under the age of 15 whereas 14.1% of concordant women did; 64.4% of discordant women had an average debut as compared to 47.2% of

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concordant women; and 9.4% of discordant women had a debut at 18 or older whereas 38.7% of concordant women did.

The total number of lifetime opposite sex partners was greater among those reporting discordance (Median: 8.4 (IQR:4.1-14.8)) than those reporting concordance (Median: 3.8 (IQR: 1.5-7.0)). About one out of seven of sexually discordant women (69.5%) reported five or more lifetime male partners as opposed to a little under half (44.4%) of the concordant women.

Of heterosexual women reporting ever having a female partner (n=744), most reported only one partner with slightly higher proportions of concordant (67.1%) than discordant women (49.5%). There was a greater percentage of discordant women reporting 2-4 lifetime partners versus those currently concordant (39.4% versus 30.0%). Nearly one out of ten discordant women reported five or more ever female partners as compared to less than 1% (0.3%) of concordant women. The majority of discordant women (51.7%) reported only one female partner in the previous year; about 10% reported either just two partners and the final 10% reported three or more female partners in the past year.

*Sexual identity discord and adult sexual partnering relationships*

Table 4.2 shows the association between sexual identity discord and adult sexual partnering patterns. A crude analysis revealed that discordant identity and behavior was associated with both concurrency (crude Odds Ratio (cOR): 8.7; 95% Confidence Interval (CI): 4.9-15.5) and serial monogamy (cOR: 3.7; 95% CI: 2.0-6.8) with male partners in the previous year. After adjusting for age, ethnicity, marital status, income, education, living in a metropolitan area, U.S. nativity, age at sexual debut and number of lifetime partners, the association was still very strong. Heterosexually discordant women were 7.9 as likely to report

having concurrent relationship with their male partners in the previous year (95% CI: 4.1-15.2) than concordant women. They were also 3.4 times as likely to report engaging in serially monogamous relationships with men over the previous year (95% CI: 1.7-6.8) than their concordant peers. The mean gap length for women reporting serial monogamy with male partners was 3.5 months between partners (SD=2.4). The gap was not significantly different for discordant women in comparison to concordant women.

Table 4.3 illustrates the greater prevalence of risk behaviors among those who are discordant versus their concordant peers. Women reporting a discordant identity and partnering behavior were more likely than their concordant peers to engage in some more risky sexual practices with men. Discordant women were more likely to report ever engaging in anal sex with a man ($x^2_{1df}$=27.3,p <0.0001), ever having had an HIV test ($x^2_{1df}$=23.3, p =0.0001), and having had a high risk male partner in the previous year ($x^2_{1df}$=14.6, p =<0.0001). Rates for having been treated for an STD in the previous year were different between sexually concordant and discordant women, but not significant ($x^2_{1df}$=3.6,p=0.0597). Engaging in sex for drugs or money in the past 12 months and not using a condom at last vaginal intercourse were not statistically significant ($x^2_{1df}$=1.8 ,p = 0.1241 and , $x^2_{1df}$=0.5 ,p =0.6960, respectively).

**Discussion**

Female sexuality, in particular sexual attraction and behaviors, may vary over a woman's lifetime. Among self-identified heterosexual and sexually active American women, more than one in ten (11.2%) reported ever having had a same sex partner. While the majority of self-identified heterosexual women did not report same sex behavior in the previous year, 1.8% reported both a heterosexual orientation identity and recent same sex behavior. The estimates of

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prevalence of both discordant sexual identity and behavior among American women are in line with previous studies.[44,45,79,172]

Our findings are consistent with the notion that while some women may exclusively self-report a heterosexual identity, it is possible for them to have non-concordant partners at the same time, as well as to move from sexual orientation identity categories over time.[53,80,173,175,176] Relative to heterosexual women who reported only male partners in the past year, heterosexually discordant women who had both male and female partners in the previous year had an increased odds of concurrent relationships with their male partners and had increased odds of engaging in serially monogamous relationships with men over the previous year.

Our results support our hypothesis that women who self-identify as heterosexual but who have recent sexual activity with other women would have increased sexual partnering risks, especially with their male partners. The literature has generally assumed that WSW are at a low risk of STDs, including HIV. While substantial research has been done to examine HIV risk factors among gay, bisexual and other men who have sex with men (MSM) both in the United States and abroad, and several studies have been undertaken to understand risk factors and correlates of HIV among transgender people, research is lacking among sexually discordant women. Indeed, our findings give rise to concern about other potential risk factors like injecting drug use, unprotected heterosexual sex, with either MSW or MSM or male injecting drug users, or exchanging sex for drugs or money,[44,74] among women who self-identify as heterosexual but report recent sexual partnerships with women.

Our study documents the growing number of women who report same sex activity in the United States. Between 1.4 and 4.3% of all American women, may be classified as women who

have sex with women (WSW) based on either same sex behavior or self-reported orientation identity.[44]   In the NSFG, nearly three times as many women as men (12% vs. 4.3%) reported any same-sex partners in the previous year.[45]   This increase may be due to changing societal norms, accepting greater permissiveness of female same sex behavior or diminishing stigma of female same sex or bisexuality prompting more people already engaging in these behaviors to report them.  However, given that men and women were not asked all of the same questions related to same sexual activities, this gender gap might be artificially wide.  In the 2006-2010 NSFG, men who answered ''no'' to specific same-sex behavioral questions (i.e. reporting any oral or anal sex with a male partner) were not asked, as were women, the additional general question about "any sexual experience with a (same sex) partner.''

There is a growing acceptance of female same-sex sexuality, couched in the theory that female sexuality is malleable.[53,80]  This fluidity may have implications for women's sexual health.  Previous literature has suggested "when sexual norms are in a state of flux…women may receive conflicting messages about appropriate sexual behavior."[81]  This may create confusion and embarrassment leading to inconsistency in good sexual health practices such as birth control, gynecological health care, and prevention, testing, and treatment of sexually transmitted infections.[81]

The sexual minority stress model[56] posits that there are external and internal conditions that produce increased stress among sexual minorities.  Within this framework, stigma, prejudice, and discrimination create a "hostile and stressful social environment" that serves as an incubator for numerous poor health outcomes.  This environment produces conditions that force sexual minority women to look for coping mechanisms.  Such coping mechanisms may be stressed to depletion and lead to unhealthy or self-destructive measures such as binge drinking,

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illicit drug use and risky sexual partnering behavior. Our data were consistent with this conceptual model. Heterosexual women who reported same sex partners in the past year were more likely to binge drink, report illicit drug use, and to engage in sex with risky male partners (i.e. non-monogamous partners, injecting drug users, known HIV positive men or men who have sex with men).

Our data are also consistent with a small but compelling body of literature that has documented that women who self-identify as "lesbian," but who are also sexually active with men, often demonstrate increased sexual risk-taking behavior.[93] In two previous studies among women attending STD clinics, WSMW had an increase in HIV-related risk behavior, including sex with gay or bisexual men, use of injection drugs and crack cocaine, and exchange of sex for drugs or money.[75,97] The College Alcohol Study, which was comprised of more than 14,000 randomly selected college students in the United States, also demonstrated that WSMW were more likely to report multiple sex partners than women who only had sex with men.[98] Our results confirm that for heterosexually self-identified but same sex active women, prevalence of these risky behaviors is in fact higher than their sexually concordant peers. For sexually discordant women, increased stress because of internalized homophobia, cognitive dissonance or marginalization may put them at even greater risk than sexual minorities who embrace their orientation. Our data did not allow us to evaluate these potential mechanisms.

Concurrency modeling predicts that temporally overlapping sexual partnerships increase the risk of transmission from the person who practices it and raises the risk of acquisition to the partners of that person. The person practicing concurrency has an increased risk simply because of their increased number of sexual partners, not by the temporal overlap.[37] Therefore, the risk of interest is actually that for the partner. In terms of STD transmission, concurrency is critical

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in that it highlights the fact that those characteristically thought of as ''low risk', including those with only one partner and WSW, may actually be at an elevated risk if they are linked to a larger sexual network.[3] Women who have sex with women and also men, may act as bridges for the transmission of STDs. For women who partner with discordant heterosexual women, concurrent sexual partnering with men of that partner may unknowingly place that at higher risk for acquiring STDs. For WSW who maintain a monogamous relationship to a concurrent yet discordant female partner, unawareness of their partners behavior may actually decrease concern for implementing safer sex practices and place them at risk for STD acquisition. Our data do not capture risky sexual behaviors between women beyond numbers of partners; however, our results strongly suggest that women who are discordant have riskier behavior in general as well as more concurrent partnerships with their male partners.

Serial monogamy may also introduce risk given the length of the interval between partnerships: smaller gaps make serial partnering as likely a transmitter of STDs as concurrent ones.[142] The average time gap for serial monogamy in the U.S. is about 60 days.[152] Our study supports this finding with over 88% reporting gaps of six months or less and 61.7% reporting gaps of three months or less; more than one out of five reported a gap of a month or less among serial monogamists. Although discordant women did not have significantly different gaps than concordant women, all of these average gaps would put the serial relationships within the infectious period of chlamydia, gonorrhea, syphilis, HSV, HPV, and HIV infections.[152]

*Considerations and Strengths*

The analyses have some limitations that ought to be considered. All information was self-reported. Since some of the behaviors asked about are stigmatized, there is potential for under-

reporting. However, to limit information bias and under-reporting, both Computer Assisted Personal Interview (CAPI) technology and Audio Computer Assisted Self-Interviewing (ACASI) were employed. The use of computer-assisted methods in order to enhance response rates and accuracy are well supported in the literature.[133,161] The use of ACASI is known to improve reporting when asking especially sensitive questions, much like those asked in this survey.[133] Another possibility for bias due to misclassification or missing data comes from the limited sexual orientation identities presented for participants from which to choose. Previous literature has illustrated that to some people, sexual orientation labels are off-putting or even irrelevant to their sexuality.[177] Only participants who self-identified as "heterosexual or straight" were included in this analysis.

In terms of sexual partnering, the temporal overlap of opposite sex partners is not perfectly measured. Because only month and year were reported, it is possible that actual temporal overlap did not occur, for example, if a relationship stopped in the beginning of the month and a second one only began in the end of the month. If this was the case, more partnerships would be misclassified as "concurrent" than truly were. However, in previous studies comparing the accuracy of using similar date comparison methods of determining concurrency versus a direct question if the respondent had been concurrent, relatively high agreement was found between the two types of measures so this approach is likely to provide a good estimate of the true prevalence of concurrency.[8,28] Nevertheless, the estimates where similar for sexually concurrency and serial monogamy.

Finally, the sequence of questions related to sexual activity, age of sexual debut and the dates of partnership to determine sexual partnering only capture opposite sex partnerships. By defining "sex" as penile-vaginal intercourse only, women who engaged in other types of same or opposite

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sexual practices would be excluded.  Age of sexual debut was only captured as age at which the respondent had first intercourse with a male partner.  This definition would exclude any other types of earlier sexual experience including oral or anal sex with an opposite or same sex partner. This could potentially misclassify some earlier debuting women as later initiators of sexual activity.  The questions capturing dates of partnership only asked about opposite sex partners so we are unable to quantify potential overlap of female partners, or more risky, overlap of male and female partners over the past year.

This study also has a number of important strengths. It was a large, nationally representative population-based study.  Oversampling of minority groups provides confidence that sufficient numbers of minorities were included in the analyses.  The use of sampling weights helps to account for non-response bias and other issues in sampling which improves the extent to which results can be generalized to the general US population.  In addition, the response rate for the 2006-2010 NSFG was excellent at 77% which permits generalizability of the results to the household civilian population of women in the United States.  Further, while previous studies used lifetime ever same sex behavior but current sexual identity and attraction (which disjoints the temporality of a true discordant identity),[172] our analysis of sexual behavior ever as well as in the previous year adds to the literature.

Previous studies have had a limited look at opposite sex partner risks.  We have extended the literature by including risky sexual partnering practices with male partners, including ever having anal sex with a man, adding two condom use measures, determining if the participants had high risk male partner(s), measuring if there was an exchange of sex for money or drugs with a man in the past year and examining the relationship with first male sexual partner.  This is also

the first study that examines the prevalence of sexual partnering behaviors of heterosexually identified but behaviorally bisexual or lesbian women with their male partners.

**Conclusions**

This study has several important public health implications. In terms of clinical practice, health care providers and counselors should not assume that if their patients are married, living with or reporting a current relationship with a man that they are only engaged in heterosexual activity.  For women who do report female partners, clinicians should be aware that there are still potential risks for acquiring or transmitting STDs and that these women should be availed necessary screening and treatment.  Women who partner with women need to be made aware of the potential for increased risk of STDs including HIV, especially if their female partner also has male partner(s).

From a policy perspective, these results suggest that sex education must not assume an "either/ or" heteronormative model to presenting youth with information on reproductive and sexual health.  Youth must be counseled on the wide expression of sexualities and the potential risks of engaging in behaviors perhaps not traditionally considered as dangerous (i.e. WSW partnering).  Effective education must not only include information on safer sex or limiting partners but also needs to address the concomitant issues of drug and alcohol use, stigma against sexual minorities and changing societal norms vis à vis sexual identities or what "sex" is.

Recent research shows that heteronormative attitudes about what ''counts'' as sex (typically limited to penile penetration of the anus or vagina) are actually increasing among younger generations.[178,179]  These attitudes in turn have made other intimate activities, like oral sex, to be considered non-risky and even casual.  This disconnect may be due to the focus on

sexual education programs in school on abstinence from penile-vaginal sex and pregnancy prevention and the near absence of information and risks associated with other behaviors.  This traditional approach also devalues non-heteronormative behaviors and orientation identities, leaving sexual minorities with little information or skills to navigate their own sexual maturation. These considerations need to be accounted for in designing sexual and reproductive health guidelines for women in general and sexual education programming for youth.

**Table 4.1. Characteristics of women by sexual identity and behavior concordance/discordance in the past 12 months**

| | Sexually discordant heterosexual | Sexually concordant heterosexual | |
|---|---|---|---|
| | (n=190) (1.8%) | (n=8,590) (98.2%) | P-Value |
| **Sociodemographic Variables** | Weighted percentage[*] | | |
| *Age at time of interview* | | | <0.0001 |
| 15- 20 years of age | 29.2 | 10.5 | |
| 21-24 years of age | 28.2 | 13.2 | |
| 25-29 years of age | 8.4 | 19.5 | |
| 30-34 years of age | 16.5 | 17.3 | |
| 35-39 years of age | 11.9 | 20.0 | |
| 40-44 years of age | 5.2 | 19.4 | |
| *Race/ethnicity* | | | 0.2960 |
| White, non-Hispanic | 66.6 | 62.6 | |
| African-American, non-Hispanic | 17.2 | 14.1 | |
| Hispanic | 11.9 | 17.0 | |
| Other ethnicity, non-Hispanic | 4.3 | 6.3 | |
| *Marital status* | | | 0.0002 |
| Currently married or cohabitating | 44.0 | 66.2 | |
| Formerly married | 5.4 | 8.5 | |
| Never married | 50.6 | 25.3 | |
| *Highest level of education* | | | 0.0044 |
| Less than high school but currently in school | 9.6 | 3.5 | |
| Less than high school NOT currently in school | 18.9 | 15.0 | |
| High school graduate | 31.3 | 24.5 | |
| At least some college | 40.2 | 57.0 | |
| *Income level* | | | 0.0590 |
| <100% Federal Poverty Level | 25.0 | 20.3 | |
| 100-199% Federal Poverty Level | 33.5 | 22.8 | |
| ≥200% Federal Poverty Level | 41.6 | 56.9 | |
| *US born* | 95.0 | 84.9 | <0.0001 |
| *Urbanicity* | | | 0.4914 |
| MSA, center city | 35.5 | 31.5 | |
| MSA, outside center city | 41.1 | 47.7 | |
| non-MSA | 23.1 | 20.8 | |

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| Sexual History Variables | | | |
|---|---|---|---|
| *Age at sexual debut* | | | <0.0001 |
| <15 years | 26.2 | 14.1 | |
| 15-17 years | 64.4 | 47.2 | |
| 18+ years | 9.4 | 38.7 | |
| *5 or more lifetime male partners* | 69.5 | 44.4 | <0.0001 |
| *3 or more male partners in previous 12 months* | 25.1 | 4.0 | <0.0001 |
| *Ever had a female partner over lifetime* | 100.0 | 8.9 | NA |
| *Total # of lifetime female partners* | | | NA |
| None | 0 | 91.1 | |
| 1 | 51.7 | 6.0 | |
| 2 to 4 | 39.0 | 2.7 | |
| 5 or more | 9.3 | 0.3 | |

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| | | | |
|---|---|---|---|
| **Income level** | | | **0.0590** |
| <100% Federal Poverty Level | 25.0 | 20.3 | |
| 100-199% Federal Poverty Level | 33.5 | 22.8 | |
| ≥200% Federal Poverty Level | 41.6 | 56.9 | |
| **US born** | 95.0 | 84.9 | <0.0001 |
| **Urbanicity** | | | 0.4914 |
| MSA, center city | 35.5 | 31.5 | |
| MSA, outside center city | 41.1 | 47.7 | |
| non-MSA | 23.1 | 20.8 | |
| **Sexual History Variables** | | | |
| Age at sexual debut | | | <0.0001 |
| <15 years | 26.2 | 14.1 | |
| 15-17 years | 64.4 | 47.2 | |
| 18+ years | 9.4 | 38.7 | |
| **5 or more lifetime male partners** | 69.5 | 44.4 | <0.0001 |
| **3 or more male partners in previous 12 months** | 25.1 | 4.0 | <0.0001 |
| **Ever had a female partner over lifetime** | 100.0 | 8.9 | NA |
| **Total # of lifetime female partners** | | | NA |
| None | 0 | 91.1 | |
| 1 | 51.7 | 6.0 | |
| 2 to 4 | 39.0 | 2.7 | |
| 5 or more | 9.3 | 0.3 | |

[*] Percentages may not total to 100% owing to rounding.

**Table 4.2. Association between Sexual Discordance and Sexual Partnering in the Past 12 months among Heterosexual Women**

| Sexuality | Sexual Partnering | Weighted percentage with outcome | Crude Odds Ratio (95% Confidence Interval) | Sociodemographic Adjusted* Odds Ratio (95% CI) | Fully Adjusted** Odds Ratio (95% CI) |
|---|---|---|---|---|---|
| Discordant Sexuality | Concurrency | 31.3 | 8.7 (4.9-15.5) | 7.12 (3.48-14.56) | 5.54 (2.77-11.09) |
| Concordant Sexuality | Concurrency | 5.8 | 1.00 | 1.00 | 1.00 |
| Discordant Sexuality | Serial Monogamy | 13.6 | 3.7 (2.0-6.8) | 2.85 (1.30-6.21) | 2.43 (1.19-4.97) |
| Concordant Sexuality | Serial Monogamy | 5.9 | 1.00 | 1.00 | 1.00 |

* Adjusted for age, ethnicity, marital status, income, education, living in metropolitan area, and US born.

** Adjusted for age, ethnicity, marital status, income, education, living in metropolitan area, US born, age at first sexual intercourse, and number of lifetime male partners.

**Table 4.3.   Other Risky Behaviors Among Heterosexual Women with Concordant or Discordant Sexual Partnering Behavior**

| | Sexually discordant heterosexual (n=190) | Sexually concordant heterosexual (n=8,590) | P-value |
|---|---|---|---|
| | *Weighted Percentages* | | |
| Anal Sex | 66.3 | 35.2 | <0.0001 |
| High Risk Male Partner | 39.5 | 10.6 | <0.0001 |
| Exchange sex for drugs or money | 3.3 | 0.5 | 0.1241 |
| No condom at last sex | 35.6 | 25.6 | 0.6960 |
| Inconsistent condom use past year | 74.6 | 61.9 | 0.237 |
| Ever had an HIV test | 82.1 | 66.9 | 0.0001 |
| Binge Drinking† | 80.0 | 41.8 | 0.0001 |
| Any illicit drug use over the past 12 months ‡ | 52.9 | 15.8 | <0.0001 |

† "Binge drinking" was defined as having 5 or more alcoholic drinks over the course of a few hours
‡ Illicit drug use was defined as any consumption of marijuana, cocaine, crack, or heroin, by any route.

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**Vita**

Jennifer Ann Nield was born May 19, 1972 in New York, NY.  She is a United States citizen. She received her Bachelors of Science in Foreign Service in International Affairs from the Walsh School of Foreign Service at Georgetown University in Washington, DC in 1994.  She earned her Maters of Public Health from the School of Public Health and Tropical Medicine at Tulane University in New Orleans, LA in 1998. She has over 12 years of experience in international public health, especially in the areas of HIV/AIDS and reproductive health.  Prior to undertaking doctoral studies in Epidemiology at VCU in 2010, she served for close to four years as the PEPFAR Planning, Monitoring and Reporting advisor at USAID/Zambia.  She has also served in various program management capacities at Family Health International's Institute for HIV/AIDS, the Association of Public Health Laboratories and Family Planning International Assistance (formerly the International arm of Planned Parenthood of America).  Her international work experience has allowed her to work in nineteen countries, spanning Africa, Latin America and the Caribbean. Upon completion of this degree, she hopes to return "home" to Africa.