Women Who Know: The Relationship between Risk and HIV Testing

Paper for Poster Presentation at:

Population Association of America

2010 Annual Meeting

March 1, 2010

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Abstract

This paper uses data from the 2002 National Survey of Family Growth to evaluate the relationship between risk factors for HIV and being tested for the disease. In particular, I am interested in this relationship in women, since prevalence of HIV in women in the United States has been growing. Utilizing a logistic regression analysis, I examine the relationship between 12 risk factors, including both drug use and sexual risk factors, and whether or not a woman has been tested for HIV. The results of this analysis found that drug use significantly predicted a woman's HIV testing status, however only 4 of the relevant sexual risk factors remained significant in the final model. In the absence of significant error, the results presented in this analysis indicate that women with many of these HIV-related risk factors are no more likely to be tested than are women without the high risk factors.

Introduction

In January of 2003, a major public health and media campaign, *KNOW HIV/AIDS*, was launched as a joint effort between the Kaiser Family Foundation and Viacom. Over the past 5 years, this initiative has sponsored numerous television public service announcements as well as radio and print ads featuring slogans such as "Spread the Know," and "The Know is Spreading." This campaign, aimed at "normalizing [HIV] testing as a part of routine health care," represents a calculated effort to increase awareness and encourage HIV testing to a broader population than had been previously targeted (Kaiser Foundation, 2005). These ad campaigns feature a young and diverse population, targeting both homosexual and heterosexual populations of both genders and a variety of ethnicities. The focus of the *KNOW HIV/AIDS* campaign mirrors several important trends that have been taking place in the incidence and prevalence of HIV/AIDS cases in the United States.

Recent surveillance of the HIV/AIDS epidemic in the United States indicates that the prevalence is growing. In 2007, an estimated 1.2 million individuals were infected with HIV, with women comprising approximately 230,000 of those infected (UNAIDS, 2008). Although the public perception of HIV in the United States continues to focus on homosexual males, the prevalence of HIV among women is growing at a faster rate than that among males (CDC, 1995). Mortality related to HIV is also important, with an estimated 22,000 deaths expected due to HIV/AIDS in the United States (UNAIDS, 2005). In 2005, the Center for Disease Control reported that AIDS was the 5th leading cause of death for women aged 25-44, and the 3rd leading cause of death among Black women ages 25-44 (CDC, 2008). In addition to death related to AIDS, HIV infection is also a concern because of its high rates of co-morbidity with numerous

other diseases (CDC, 1992). The CDC has also reported that the proportion of all AIDS cases that are women has increased to 25.8 percent in 2006 (CDC, 2008).

Over the past 20 years, the growing concern over the HIV/AIDS epidemic has spawned a voluminous amount of related literature. Despite the prolific nature related to this topic, there are still vast areas in need of further treatment, due to the rapidly changing nature of the disease. The increasing prevalence of HIV/AIDS among women suggests that research related to this population is also increasing in importance. In addition to the prevalence information reported above, the Center for Disease Control also reports that an estimated 25 percent of HIV infected individuals are unaware of their infection (CDC, 2003). Awareness of HIV status is important for two reasons. First HIV positive individuals who begin treatment of their infection early experience a more favorable prognosis and reduction in mortality compared to those whose treatment is delayed (CDC, 2003). Additionally, awareness of HIV status is important because it enables individuals to take precautions to reduce the rate of transmission to others.

Also of importance is the differential distribution of HIV infection across racial groups. Research has found that minority populations, specifically African Americans, are overrepresented among those with an HIV diagnosis, and that reductions in mortality related to HIV infection have occurred more rapidly in Whites than in minority populations (CDC, 2003; CDC, 2004; Karon, et al, 2001). Prevalence of HIV by race also differs by type of transmission such that Blacks comprise 65 percent of diagnoses relating to IV-drug use, but 74 percent of diagnoses related to heterosexual contact (CDC, 2003; CDC, 2004). All of these factors speak to the need for further research regarding the prevalence of HIV testing for women in general and minority women specifically. In this paper, I aim to evaluate the status of HIV testing in women by examining the relationship between known risk factors for HIV and testing behavior.

Research in this area has the potential to influence public health initiatives, such as the recent initiatives by the *Know HIV/AIDS* campaign, and make these education and outreach programs more effective in reaching their target audience and encouraging HIV testing among previously neglected populations, such as women.

Theoretical Background and Research Hypotheses

It has been well established that certain populations have an increased risk for contracting HIV. Most frequently, the group identified as having a high risk for HIV in the United States is males who engage in male-to-male sexual contact (CDC, 2004). This is reflected in HIV prevalence trends that continue to report the highest rates of HIV infection among this population and that homosexual men comprise the majority of persons infected with HIV (CDC, 2004). Over time, however, female risk for HIV has steadily increased. At the beginning of the HIV/AIDS epidemic, infection in women was rare and often overlooked due to the focus on homosexual men (Corea, 1992). These early cases in women were almost universally attributed to the use of illegal intravenous drugs (Corea, 1992). Because of this association, prevention strategies targeting women in the United States often focus on the use of IV drugs. During the 1990's, however, risk for women began undergoing significant changes.

While risk for men has remained somewhat stable, risk factors related to HIV for women have changed dramatically since HIV was first discovered. In 1993, the percentage of women with AIDS who were infected via sexual risk superseded those who were infected via IV drug use (O'Leary and Jemmott, 1995, CDC, 1995). In 1994, the Center for Disease Control classified 66 percent of women with AIDS as having been infected due to heterosexual contact, compared to 27 percent who were infected via IV drug use (CDC, 1995). From 1993 to 2000,

both the proportion of all HIV cases that contracted the disease via IV drug use and the prevalence of HIV among drug users continued to decline. During the same period, however, heterosexual transmission of HIV increased by 9 percent (CDC, 2003).

There are several factors related to sexual behavior that increase the risk of HIV for women. These risk factors are most often related to having a high-risk male sexual partner, such as sex with a bisexual male, a male IV drug user, or a male known to have HIV (CDC, 1995, O'Leary and Jemmott, 1995). Another important factor related to risk of HIV in women is co-infection with other sexually transmitted infections. Co-infection between HIV and other sexually transmitted infections (STIs) occurs due to two reasons. First, both diseases are related to sexual risk behavior, making co-infection more likely. In addition to the relationship with risk behavior, co-infection with other STIs is also related to immune response which makes the body more susceptible to infection with HIV (O'Leary and Jemmott, 1995). Similar research has also reported that rates of HIV are higher for women who are members of a race or ethnic minority and have a low socio-economic status (O'Leary and Jemmott, 1995).

Once at-risk populations have been identified, these populations can then be targeted for HIV prevention and reduction strategies. One important prevention strategy is the encouragement of HIV testing (CDC, 2003). There are several ways that this testing can occur. For example, in 1985 the American Red Cross began routinely testing all donated blood for HIV. This means that all individuals who have donated blood since that time have been tested for HIV, regardless of their risk behavior. In fact, in 1994 the majority of women who reported having had an HIV test give blood donation as the reason for being tested (Turner, 1994). This same source found that 35 percent of all women reported having had an HIV test, with rates higher among women with another STI and unmarried women.

Another HIV testing strategy is to encourage women to be tested for HIV during pregnancy. Significant reductions in transmission of HIV infection from mother to newborn has been linked to prenatal testing and treatment of HIV infection (CDC, 2002). While women are able to refuse HIV testing during prenatal care, testing of pregnant women has become widespread. In 2002, it was estimated that 69 percent of pregnant women received an HIV test at some point during their pregnancy (Anderson, et al. 2005). While testing related to blood donation and pregnancy continues to be of vital importance in the detection of HIV/AIDS, both types of testing are mainly passive in nature and do not represent the relationship between significant risk behavior and receiving an HIV test.

Research related to HIV testing among women with known risk factors is somewhat more difficult to find and mostly descriptive in nature. For example, Anderson, et al. used 2002 NSFG data to report that only 25 percent of women at a high risk for developing HIV have received a test in the previous 12 months. When breaking down by type of HIV risk, Anderson, et al. found that HIV testing was more prevalent among those at risk due to drug use than sexual behavior. This and other research also found that Black and Hispanic women were more likely to have received an HIV test than were White women, corresponding with their higher prevalence of HIV infection (Anderson, et al. 2005; Ebrahim, et al. 2004; Remez, 2002). Other research in this area has found that, while Blacks and Hispanics have a higher prevalence of HIV testing, their knowledge of treatment for the disease is lower than Whites (Ebrahim, et al. 2004). Several studies do report, however, that individuals at a high risk for developing HIV have a higher percentage of HIV tests at least once in their lifetime than those with a low risk of infection (Anderson, et al. 2005, CDC, 2004, Remez, 2002).

An important focus of research related to HIV prevalence and testing rates is to inform and encourage the development of prevention and education strategies. Since the epidemiology of both HIV risk and HIV infection has been found to differ based on both gender and ethnicity, many argue that prevention and education strategies should be developed that individually target these populations. For example, several studies have found that strategies that specifically target the needs and characteristics of populations such as women in general (Miller, et.al. 2000; Mize, et.al., 2002) and Black women specifically (Gentry, et.al, 2005; Kalichman, et.al, 1993), are more likely to be successful than strategies that are more broad in nature. In order to assist in planning and developing these targeted strategies, it is necessary to continue to develop in-depth information and research related specifically to these populations.

Although previous research conducted using NSFG data has examined testing behavior using descriptive methods, there remains a need to evaluate this topic more extensively. Previous research has also indicated the importance of women as a study population, due to recent increases in the prevalence of HIV/AIDS among women. The main focus of the research in this paper, therefore, is to evaluate the state of HIV testing among women. HIV testing is especially important for women who have a known risk factor for acquiring the disease. The knowledge of whether or not women who are at a high risk for contracting HIV are being tested has the potential for significant public health implications.

In this paper, I will determine the relationship between specific, individual and known risk factors for HIV and women's testing behavior. Each individual risk factor will be evaluated separately to determine their ability to predict HIV testing behavior in women. This paper will be guided by two main hypotheses:

H.1: Women who are at an increased risk of becoming infected with HIV due to having a known risk factor for the disease are hypothesized to also be more likely to actively seek to be tested for HIV.

H.2: Women who are at risk of developing HIV due to drug use are hypothesized to have a higher odds of receiving an HIV test than are women who are at risk due to sexual behavior.

This second hypothesis is motivated by the previous research that found that the HIV epidemic in women began in relation to IV drug use on the part of women themselves. Because of this relationship between drug use and risk in women, early education and prevention efforts for women have specifically targeted this population. In the past decade, however, there has been a significant increase in women who have become infected with HIV due to sexual risk behaviors. Because of this more recent shift in HIV risk in women, it is expected that public perception of the need for women to be tested due to sexual behavior has experienced a "lag" behind perception of the risk due to IV drug use.

Data and Methods

Data used in this paper were collected from the 2002 wave of the National Survey of Family Growth. This survey has been conducted periodically by the National Center for Health Statistics. Topics included in this survey include a wide range of questions concerning sexual and reproductive behavior and health. In 2002, this nationally representative survey included both male and female respondents between the ages of 15 and 44, with an over-sample of teenagers, Blacks and Hispanics. The 2002 version of this survey was the first one to include males; however a slightly different version of the survey was used for male respondents,

resulting in two separate datasets for male versus female respondents. In this paper, only the female dataset will be utilized. The female sample of respondents included 7,643 women.

The National Survey of Family Growth utilized female face-to-face interviewer to administer in-depth questionnaires. Sensitive questions, including questions related to the HIV risk factors of interest in the present and subsequent chapters, were entered directly into the computer by the respondent to enhance the reliability and confidentiality of answers. While respondents are asked about a variety of sexual behaviors and sexually transmitted diseases, they are not asked whether or not they are presently HIV positive or the results of any tests that they have received. Questions related to HIV testing, however, are asked, allowing for an analysis of HIV risk factors and their relationship to HIV testing.

Following a descriptive analysis of the variables included in this paper, I used logistic regression modeling to measure the relationship between risk factors and HIV testing. I estimated 2 separate models for each of three dependent variables for a total of 6 separate logistic regression models. These three dependent variables represent three HIV testing outcomes:

1. Whether the respondent has had ANY HIV test
2. Whether the respondent has had an HIV test unrelated to blood donation
3. Whether the respondent has had an HIV test that is unrelated to blood donation, pregnancy, or other routine testing.

The first model for each dependent variable will measure only the relevant risk factors and their relationship to HIV testing, while the second model will include several control variables.

Prior to estimating the logistic regression models, I ruled out the possibility of multicolinearity between my independent variables by examining the tolerances for each variable. The tolerance for each independent variable was over 0.35 for all variables, indicating

that it is appropriate to include all variables together in the same model. The NSFG data also include sample weights to take into account over-samples in the data. Sample weights were included in my analysis according to instructions included in the NSFG technical documentation. To aid in interpretation, I report the antilog of the logit coefficients, or odds ratios, for each of my independent variables. Within dependent variables, I am able to compare across models to determine if risk factors that significantly predict HIV testing behavior remain significant in the full model. Across dependent variables, I am able to determine if significant risk factors vary when the outcome includes or excludes testing that is passive in nature.

Relevant Variables

There are numerous variables that are relevant for this paper. The two primary categories of variables are related to HIV testing behavior and known risk factors. These variables were derived from a series of questions asked of respondents related to their sexual and drug use behaviors, questions related to their HIV testing behavior, and several follow up questions regarding any HIV test they might have received.

Dependent Variables

The main dependent variable of interest in this paper is whether or not a respondent has received an HIV test. Questions included in the 2002 NSFG related to testing behavior include whether or not the respondent has received an HIV test, blood donation, reasons why the respondent was tested for HIV, and where the HIV test was obtained. In 1985, the American Red Cross began routinely testing all donated blood for HIV antibodies. This means that all individuals who have donated blood in the United States since 1985 have received an HIV blood test. While the testing of these individuals probably does test individuals who would not

otherwise be tested, it represents testing that is "passive," rather than individuals who are actively seeking to be tested due to their known risk status. Additionally, respondents are asked if they have ever received an HIV test apart from one they received while donating blood.

For women, the presence of routine HIV testing during prenatal care has also led to the "passive" testing of many more women. While prenatal HIV testing is not universal, due to lack of prenatal care or individual refusal, it has become highly prevalent. As a follow up question to asking whether or not the survey participant has received an HIV test, the NSFG data asks the respondent for the reason why an HIV test was obtained. These possible reasons for testing include:

- Hospitalization or surgical procedure
- To apply for health or life insurance
- Just to find out if infected
- Because of referral by a doctor
- To apply for a marriage license
- Because of pregnancy or as a part of prenatal care
- Some other reason

The inclusion of this question enables me to differentiate those who have "actively" sought to be tested for HIV from those who were tested for other reasons. Using these multiple sources for HIV testing information found in the data, I can classify all respondents into 4 testing categories:

- No HIV test
- HIV test related to blood donation only
- Pregnancy or other routine HIV test
- HIV test unrelated to blood donation or pregnancy

In this paper, I will estimate separate models with different dependent variables that I have created from these classifications:

Any HIV Test – This dependent variable is a dummy variable coded "0" if the respondent does not report any HIV test. This variable is coded "1" if the respondent has had any HIV test, regardless of the reason given. Additionally, this variable is coded "1" if they have donated blood since 1985.

HIV Test, excluding blood donation – This dependent variable is a dummy variable coded "0" if the respondent does not report any HIV test or if the respondent's only HIV test was due to blood donation. This variable is coded "1" if the respondent reports an HIV test unrelated to blood donation, regardless of the reason given for the test.

HIV Test, excluding blood donation and routine or pregnancy related testing –This variable is a dummy variable coded "0" if the respondent does not report any HIV test or if the respondent's only reported HIV test was due to blood donation. The variable is also coded "0" if the respondent reports that the main reason for their HIV test was because they were pregnant, because of hospitalization or other surgical procedure, to apply for health or life insurance, or to apply for a marriage license. This variable is coded "1" if the respondent lists the reason for their HIV test was given as just to find out if infected, referral by a doctor, or some other reason.

Independent Variables – HIV Risk Factors

The main independent variables of interest are related to behaviors that increase an individual's risk of contracting HIV. Several of these risk factors were discussed previously in the literature review, and all factors have been established in previous research to be relevant. The NSFG data allow for the measurement of numerous individual risk factors for HIV. In this paper, I include each factor in the analysis individually. For sexual risk factors, questions were

not asked of individuals who reported never having a sexual partner. These individuals will be recoded to indicate that they do not have any of the sexual risk factors. In addition, sexual risk variables for women take into account sexual activity with male sexual partners. Since previous literature has established that risk of HIV transmission is relatively low through same sex behaviors among females, only heterosexual behavior is considered in the present analysis. The majority of these risk factor variables are dummy variables that are coded "1" if the respondent reports the presence of the risk factor and "0" if they do not. The relevant categories of risk included in the dataset are:

Involuntary Intercourse – The dataset includes several questions on involuntary intercourse including whether or not their first sexual experience was voluntary as well as whether or not they had ever been raped. Respondents are considered to have this risk factor if they indicate that they have been subjected to involuntary intercourse at any time during their lifetime. The questionnaire asks about the "wantedness" of sexual intercourse, and as such can encompass both violent rape by a stranger, as well as intercourse that the respondent didn't actually *want* to engage in but ultimately agreed to.

Drug Use – There are several relevant questions related to drug use included in the NSFG dataset. These questions include whether or not the respondent has used IV drugs, crack, or cocaine in the previous 12 months. While IV drug use specifically is a significant factor for HIV, the extremely low overall prevalence of reports of IV drug use in the sample made this factor difficult to measure alone. Instead, a "drug use" variable was created using data compiled from the drug use questions. Respondents are coded as "1" if they report any of these drug use behaviors.

Bisexual Partner – For women, one important risk factor is whether or not she is engaging in sexual activity with a male who has also engaged in sexual activity with another male. Since this question is asked of women about their male sexual partner, it cannot fully measure this risk since it is limited to sexual activity of a partner that the woman is aware of. This risk factor is included only for women and limits responses to sexual partners in the previous 12 months.

IV Drug Using Partner – This question asks respondents if any of their sexual partners in the previous 12 months have used IV drugs. Again, as in the risk factor related to a bisexual partner, responses are limited to behavior that is known to the respondent and occurred in the last 12 months.

Prostitution – In the female dataset, several questions are asked related to prostitution. Respondents are asked whether or not they have ever received money or drugs in exchange for sexual activity and whether or not they have ever paid money or drugs in exchange for sexual activity. These questions will be utilized to measure HIV risk due to engaging in prostitution by creating two separate variables. The first variable will be coded as "1" if the respondent reports having *received* money or drugs from a male in exchange for sexual activity, while the second variable will be coded "1" if the respondent reports having *paid* money or drugs to a male in exchanged for sexual activity.

Sex with an HIV+ Partner – Respondents are asked whether they have knowingly engaged in sexual activity with a partner that they knew to be HIV positive in the previous 12 months. As in previous risk factors, this is limited to instances where a partner's HIV status is known to the respondent and to activity that occurred in the last 12 months.

Has other STI – This variable is created out of a series of questions that ask if the respondent has been treated for one of a series of sexually transmitted infections (STIs) in the previous 12 months. STIs included in the questionnaire are gonorrhea, Chlamydia, herpes, syphilis, or genital warts. This variable does not include treatment received for HIV infection. Respondents are coded as "1" on this variable if they report any one or more of these STIs.

Unprotected Sex – This variable measures a respondent's risk due to engaging in unprotected sex. It is created by combining the responses from two different questions. Answers to the question related to frequency of condom use in the previous 12 months were combined with the number of sexual partners in the same period. Respondents were categorized as "0," for low risk, if they reported zero or one sexual partner in the previous 12 months, or if they reported that they used a condom "every time" or "most of the time" they engaged in sexual intercourse in the previous 12 months. Respondents were categorized as "1," representing risk, if they reported 2 or more sexual partners in the previous 12 months along with moderate or infrequent condom use.

Non-Monogamous Partner - This question asks the respondent if in the previous 12 months they have engaged in sexual activity with a partner that they knew to also be engaging in sexual activity with another partner.

Number of Sexual Partners – Measurement of the number of sexual partners is included as a risk factor since risk for HIV increases as the total number of a person's sexual partners also increases. For women, the dataset includes the total lifetime number of male sexual partners as well as the number of male sexual partners in the previous 12 months.

Independent Variables - Other

In addition to factors known to be associated with HIV infection, there are other variables that should be included in the analysis. These variables have also been established to be related to prevalence of HIV infection, and several are related to HIV risk behavior as well. These additional variables are:

Race/ethnicity – The NSFG allow for the measurement of 3 racial categories (White, Black, and Other), with one category for ethnicity, Hispanic. I have categorized these into 4 groups: non-Hispanic White, non-Hispanic Black, non-Hispanic Other, and Hispanic. In this paper, these are measured as a series of dummy variables coded "1" if the respondent is of the specified group and "0" for all other respondents.

Marital Status – The NSFG data allows for 6 distinct marital status categories. These categories encompass both legal and non-legal statuses. These categories are: married, unmarried-cohabiting, divorced, married-separated, widowed and single. For this variable, respondents in the divorced, separated, and widowed categories are combined into one "previously married" category. As with race, marital status is measured with a series of dummy variables coded "1" if the respondent is of the specified marital status and "0" for all other respondents.

Education - There are several possible ways that the NSFG would allow one to operationalize education. For this paper, I have chosen to measure educational attainment in 3 categories, less than a high school degree or equivalent, high school graduate or equivalent without any college, and high school graduate with at least some college or higher. These are measured as 3 dummy variables coded "1" if the respondent has the specified level of educational attainment and "0" for all other respondents.

Income – As with education, there were numerous variable in the dataset related to a respondent's level of income. For this paper, I have utilized the question that asked for the respondent's pre-tax family income for the previous year. Respondents were given 14 categories of income, and could give their responses in weekly, monthly or yearly amounts. These categories ranged from a low of $5,000 or less per year to a high of $75,000 or more. For this paper, I have left the original income categories intact and have included income as a continuous variable, ranging from 1-14 depending on reported category.

Health Insurance – This variable measures whether the respondent had been covered by any health insurance program for all of the previous 12 months. This includes any type of coverage such as private insurance, employer-sponsored health insurance, and government-sponsored programs (Medicaid, Medicare, etc). Respondents were coded "1" if they reported being covered for all of the previous 12 months and "0" if they had no health insurance or experienced a lapse or loss of coverage.

Place of Residence – This variable categorizes respondent's place of residence as urban, suburban, or rural. Respondents are classified as urban if they live in a census designated metropolitan statistical area, in a central city according to classifications from the 2000 census. Suburban respondents live in a census designated metropolitan statistical area that is not the central city. Respondents are designated as rural if they do not live in a census designated metropolitan statistical area. As before, this is measured using a series of dummy variables.

Age – Respondent's age at the time of the survey is measured in continuous years of age.

Ever been pregnant – For female respondents, this variable is a dummy variable that is coded "1" if the respondent reports having ever been pregnant, regardless of the outcome of the pregnancy. It is coded "0" if the respondent has never been pregnant.

Results

Descriptive Results

Before reporting results from the logistic regression analyses, I first report descriptive statistics for the variables in my analyses. The initial, univariate descriptive results are presented in Tables 1 and 2. All results reported are weighted to take the NSFG sample design into account. For the dependent variable, HIV testing, 68.33% of the sample reported having had an HIV test, with 28.28% reporting tests unrelated to blood donation, pregnancy or other routine testing. Women who had only had an HIV test due to blood donation comprised 13.37% of the sample, while the remaining 26.68% consisted of women whose sole HIV test was due to pregnancy or other routine testing.

Also reported in Table 1 are the distributions of the risk factors associated with HIV infection. Percentages reported in this table refer to percent of the total sample reporting the risk behavior. The most prevalent of all risk factors is sex with a non-monogamous partner (9.37%) closely followed by unprotected sex (9.14%). The third most prevalent risk factor was involuntary intercourse, although this was almost half of the prevalence of the first two at 4.68%. The least prevalent factors were sex with a male known to be infected with HIV (0.58%) and women who have paid money or drugs to a male in exchange for sex (0.95%).

Table 1 also reports the mean values for the 4 continuous variables used in the present chapter. The mean age of respondents was 29.97 years of age. The mean income reported was 9.34, which corresponds to the $30,000 - $34,999 per year range. The mean number of sexual partners reported for the respondent's lifetime prior to the survey was 5.6. Included in this mean

are women who reported no or one male sexual partner in their lifetime, which comprise 10% and 21% of the sample, respectively (not shown).

In Table 2, I present the univariate descriptive results for the additional independent variables included in the full models. This includes marital status, race/ethnicity, education, place of residence, health insurance status, and whether or not the respondent has ever been pregnant. The majority of the sample reports being either married (45.97%) or single (35.06%). Non-Hispanic White respondents comprise 65.76% of the sample, followed by Hispanic respondents (14.82%), and Non-Hispanic Black respondents (13.89%). For education, most respondents had some college (50.80%), high school graduates was the next most common (27.97%), followed by no high school diploma (20.92%). The majority of respondents were urban residents (49.00%), followed by suburban residents (33.31%) and rural residents (17.68%). A total of 77.04% had health insurance and 65.69% has ever been pregnant.

Table 1. Descriptive Results, HIV Testing Categories and Risk Factors

	Percent	Mean	Standard Deviation
HIV Testing:			
No HIV Test	31.68	---------	---------
Blood Donation	13.37	---------	---------
Pregnancy Related or Routine Test	26.68	---------	---------
Other HIV Test	28.28	---------	---------
Risk Factors:			
Involuntary Intercourse	4.68	---------	---------
Drug User	3.20	---------	---------
Bisexual Part.	2.51	---------	---------
IV Drug-Using Part.	3.19	---------	---------
Prostitute	2.06	---------	---------
Sex with Prostitute	0.95	---------	---------
Sex with HIV+ Male	0.58	---------	---------
Has Other STI	3.40	---------	---------
Non-Monogamous Part.	9.37	---------	
Unprotected Sex	9.14	---------	
Age	---------	29.97	0.17
Number of Sex Part.	---------	5.63	0.13
Income	---------	9.34	0.08

Note: Since these results are weighted to take into account the NSFG sample design, these are linearized standard errors, rather than standard deviations. The actual standard deviations for unweighted versions of these variables are substantially higher.

Table 2. Descriptive Results, Additional Independent Variables

	Percent
Marital Status:	
Married	45.97
Cohabiting	9.08
Previously Married	9.89
Single	35.06
Education:	
< High School	20.92
High School Grad.	27.97
> High School Grad.	50.80
Place of Residence:	
Urban	49.00
Suburban	33.31
Rural	17.68
Race/Ethnicity:	
Non- Hispanic White	65.76
Non-Hispanic Black	13.89
Hispanic	14.82
Non-Hispanic Other	5.53
Health Insurance	77.04
Ever Been Pregnant	65.69

In Table 3 I report the distribution across categories of HIV testing for subgroups of respondents. In this table, percentages total across the rows. For example, of those women who reported involuntary intercourse, 23.23% reported that they had never had an HIV test, 10.59% report having only had an HIV test due to blood donation, 34.59% report a pregnancy related or other routine test, and the final 31.59% report having had a test unrelated to blood donation or routine testing. For all risk factors, the majority of respondents reported having had an HIV test of some type. The highest percentages of "other" HIV tests were for respondents who reported drug use (50.1%) or having another STI (49.2%). Even in these categories, however, 21.9% and 19.3% respectively reported never having been tested for HIV. With the exception of the distribution for the variable "sex with HIV+ male," all other bivariate distributions had a χ^2 statistic that was significant at the $p < 0.10$ level (involuntary intercourse), or the $p < 0.05$ level (all other risk factors).

Table 3. Descriptive Results, Percent Distribution of Each Testing Category for Categorical Independent Variables

	No HIV Test	Blood Donation	Pregnancy Related or Routine Test	Other HIV Test	Total
Risk Factors:					
Involuntary Intercourse**	23.23	10.59	34.59	31.59	100
Drug User*	21.93	10.28	17.68	50.11	100
Bisexual Part.*	22.78	5.63	26.15	45.43	100
IV Drug-Using Part.*	27.01	6.60	28.78	37.61	100
Prostitute*	22.54	3.58	28.05	45.83	100
Sex with Prostitute*	12.32	7.27	46.62	33.79	100
Sex with HIV+ Male	16.49	10.20	39.56	33.76	100
Has Other STI*	19.30	8.06	23.48	49.17	100
Non-Monogamous Part.*	22.23	12.49	22.76	42.53	100
Unprotected Sex*	21.70	10.46	23.02	44.82	100
Race/Ethnicity:					
Non-Hispanic White*	30.21	16.95	26.87	25.97	100
Non-Hispanic Black*	28.73	5.60	24.63	41.04	100
Hispanic*	36.94	6.63	27.95	28.48	100
Non-Hispanic Other*	42.47	8.23	26.14	23.17	100
Marital Status:					
Married*	22.61	14.82	39.95	22.62	100
Cohabiting*	24.45	9.37	30.03	36.15	100
Previously Married*	22.07	7.33	24.20	46.41	100
Single*	48.15	14.20	9.10	28.55	100
Education:					
< High School*	53.51	5.08	18.19	23.21	100
High School Grad.**	29.46	12.02	29.61	28.91	100
> High School Grad.*	23.92	17.56	28.53	30.00	100
Place of Residence:					
Urban*	30.87	12.78	29.90	26.45	100
Suburban*	30.14	12.65	24.08	33.13	100
Rural*	36.82	16.34	22.63	24.21	100
Has Health Insurance*	32.56	14.57	26.91	25.96	100
Ever Been Pregnant *	20.53	11.00	38.56	29.91	100

* χ^2 $p < 0.05$ ** χ^2 $p < 0.10$

The second half of Table 3 reports results of a cross tabulation of the other categorical independent variables with the three HIV testing categories. For race/ethnicity, I found that a higher percentage of Non-Hispanic Black respondents are found to have been tested apart from blood donation or pregnancy/routine testing (41.04%) than were other races. Hispanic respondents were more likely than other groups to have received only a pregnancy related or routine test (27.95%), and Non-Hispanic White respondents were more likely than other groups to have only had a test due to blood donation (16.95%). Those in the Non-Hispanic Other category had the highest percentage of never having been tested (42.47%). For marital status, the highest percentage of never having an HIV test was found for single women (48.17%). Previously married women had the highest percentage of having been tested apart from blood donation or pregnancy/routine testing, 46.41%. In the education categories, those with less than high school had the highest percentage of not having ever been tested (53.51%), with the highest rate of testing unrelated to blood donation or pregnancy/routine testing found in those with more than high school education (30.00%). Part of the relationship for education is likely due to the age of the sample, since the majority of women in the "less than high school" category are women who have not yet completed high school (that is, they are less than 18 years of age), rather than being "high school dropouts." Finally, women who have been pregnant at least once in their lifetime have a low prevalence of never being tested (20.53%) or blood donation (11.00%), and a relatively higher prevalence of testing related to pregnancy (38.56%). All bivariate distributions for the independent, "control" variables were significant at either the $p < 0.10$ level (high school graduate) or the $p < 0.05$ level (all other variables).

Logistic Regression Results

Following the descriptive analysis, I estimated 2 logistic regression models for each of 3 dependent variables. Table 4 reports the estimated effects in terms of odds ratio multipliers. The first set of 2 models uses any HIV test as the dependent variable. The first model uses only the risk factors as independent variables. In this model, sex with a prostitute, having a bisexual partner, and total number of sexual partners all significantly increased the odds of having an HIV test. When the additional independent variables are added to the model, having a non-monogamous partner and being a prostitute both become significant as well, although engaging in prostitution has a significantly negative effect. Both sex with a prostitute and total number of sexual partners retain significance in the presence of controls. Also significant in the full model was the Non-Hispanic other race variable, the previously married and single marital statuses, both education categories, rural residence, age and the "ever been pregnant" variable. For education, women with either less than high school or high school only were significantly less likely to have had any HIV test than were women with at least some college. Finally, women who had ever been pregnant were about 3 times as likely to have had any HIV test as were women who had never been pregnant. This relationship is as expected since this dependent variable includes women whose HIV test was due to pregnancy.

Table 4. Logistic Regression Results (ORs) for Three HIV Testing Outcomes

	Any HIV Test		HIV Test (excluding blood donation)		HIV Test (excluding blood donation and pregnancy/ routine)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Risk Factors:						
Involuntary Intercourse	1.16	1.02	1.43	1.21	1.03	1.05
Drug User	1.22	1.64	1.20	1.76*	1.80*	1.95*
Bisexual Part.	1.65**	1.75**	2.11*	2.09*	1.86*	1.75*
IV Drug-Using Part.	0.62	0.69	1.26	0.87	0.95	1.03
Prostitute	0.80	0.41*	1.26	0.67	1.58	1.18
Sex with Male Prostitute	7.38*	22.30*	3.68*	5.92*	0.77	0.84
Sex with HIV+ Male	0.60	0.49	0.54	0.66	0.78	0.76
Has Other STI	1.38	1.35	1.46**	1.42	1.58*	1.53*
Non-Monogamous Part.	1.16	1.53*	1.03	1.24	1.30*	1.06
Unprotected Sex	0.92	0.97	1.12	1.09	1.56*	1.26**
Total # of Sex Partners	1.13*	1.09*	1.08*	1.06*	1.04*	1.03*
Race/Ethnicity:						
Non-Hispanic White		ref.		ref.		ref.
Non-Hispanic Black		1.14		1.81*		1.75*
Hispanic		0.91		1.21**		1.27*
Non-Hispanic Other		0.55*		0.94		0.97
Marital Status:						
Married		ref.		ref.		ref.
Cohabiting		0.92		1.02		1.55*
Previously Married		0.65*		0.84		1.72*
Single		0.61*		0.54*		1.47*
Education:						
< High School		0.37*		0.59*		0.65*
High School Grad.		0.54*		0.73*		0.81**
> High School Grad.		ref.		ref.		ref.
Place of Residence:						
Urban		ref.		ref.		ref.
Suburban		0.92		0.90		1.11
Rural		0.69*		0.60*		0.80**
Income		0.99		0.99		0.96*
Health Insurance		0.89		0.77*		0.75*
Age		0.97*		0.97*		1.02*
Ever Been Pregnant		3.52*		4.48*		0.90
Model Fit Statistics:[1]						
Unweighted Pseudo R^2	0.07	0.14	0.05	0.14	0.04	0.07
F-adjusted test statistic	61.80	2.33	86.50	2.55	21.12	2.46
p-value	$2.50\ e^{-31}$	0.02	$3.00\ e^{-36}$	0.01	$2.38\ e^{-17}$	0.02
N	6487	6033	6487	6033	6487	6033

* p <.05 **p<.10

[1] Strictly speaking, a Pseudo R^2 statistic cannot be computed in a logistic regression model that takes into account the sample weights. These pseudo R^2 statistics are taken from an unweighted model for reference. A better measure of model fit that does take into account sample weights is the F-adjusted test statistic. For a complete discussion of model fit using sample weights, see Archer and Lemeshow, 2006.

In the second set of 2 models, the dependent variable was HIV testing, excluding respondents whose sole HIV test was from donating blood. In this model, having a bisexual partner, sex with a prostitute, having another STI, and total number of sexual partners all significantly increased the likelihood of being tested for HIV, with all but having another STI retaining their significance in the presence of controls. In addition, the drug use variable becomes significant in the full model. Both the bisexual partner variable and the total number of sexual partners variable are of a similar magnitude in both models. For example, the results indicate that for each additional sexual partner a woman has in her lifetime she is 6% more likely to have been tested for HIV. Several of the additional independent variables are also significant in this model, including Non-Hispanic Black race, health insurance status, high school graduates, rural residence, age, and previous pregnancy. This model indicates that Non-Hispanic Black women are 81% more likely than Non-Hispanic White women to have been tested, and that women with health insurance are 23% less likely to have been tested than women who were not fully covered in the previous 12 months.

The final set of logistic regression results reported in Table 4 are the results when the dependent variable of HIV testing excludes tests related to blood donation, pregnancy, or other routine testing. This outcome seeks to represent the women who are actively seeking to be tested for HIV. In the initial model, risk factors that were found to significantly increase the odds of being tested were drug use, having a bisexual partner, having another STI, having a non-monogamous sexual partner, unprotected sex, and total number of sexual partners. In the presence of controls, the non-monogamous partner variable loses its significance, while the effects for the variables bisexual partner, unprotected sex, has other STI, and total number of sexual partners retain significance but experience a slight reduction in magnitude. Women who

were drug users were found to be 95% more likely to have been tested than non-drug users. Also significant, but of lower magnitude, was the bisexual partner variable which indicated that women with a bisexual partner were 75% more likely to have been tested. This bisexual partner variable, along with the total number of sexual partners variable, was able to maintain significance across all three models.

Also of note in this final model was the relationship between the additional independent variables and the dependent variable. Women who were Non-Hispanic Black or Hispanic were significantly more likely to have had an HIV test than Non-Hispanic White women. In the area of marital status, all other statuses were found to significantly increase the odds of being tested when compared to married women. Both income and health insurance status were found to be negatively related to the likelihood of being tested for HIV. Finally, the ever been pregnant variable loses significance, and changes in its direction of magnitude. This is to be expected since those women whose only HIV test was related to pregnancy have been excluded.

Discussion and Results of Hypothesis Testing

Overall, a comparison of all of these models indicates the importance of properly classifying the dependent variable. The significance and magnitude of effect for different risk factors changes dramatically depending on how the dependent variable is specified. In order to more closely measure this relationship between risk and actively seeking to be tested, it is imperative that the dependent variable is specified as accurately as possible. It is also important to note that previous research that used the NSFG data to descriptively measure the relationship between risk and HIV testing only excludes testing related to blood donation from their classification of HIV testing, but does not exclude pregnancy or other routine testing. The results in this paper indicate that, since the relationship between risk and HIV testing does differ based on the types of tests included, it is important that the type of testing being measured is clearly specified. In addition to this methodological exercise, this paper was also seeking to test several substantive hypotheses. These hypotheses were:

H.1: Women who are at an increased risk of becoming infected with HIV due to having a known risk factor for the disease are hypothesized to also be more likely to actively seek to be tested for HIV.

H.2: Women who are at risk of developing HIV due to drug use are hypothesized to have a higher odds of receiving an HIV test than are women who are at risk due to sexual behavior.

My initial hypotheses was tentatively supported in my final model, with 5 out of 12 total risk factors maintaining significance in the presence of controls and when "passive" HIV testing has been excluded. It is important to note, however, that factors that represent a relatively

high magnitude of risk, such as engaging in prostitution, having an IV drug-using partner, and especially, having an HIV+ partner, are all non-significant in the final model. The results presented in this analysis, then, seem to indicate that the likelihood of women with risk factors to be tested for HIV differs based on the risk factors she has. While several of these factors were significant in increasing the odds of being tested, for several of these key high risk factors, women who have them are no more likely to be tested than are women without the high risk factors. It is possible that these results are due to the nature of the data, such as the relatively small number of women reporting risk factors or due to possible under-reporting of risk behavior. Although miss-reporting is inevitable, the data collection process included numerous steps to increase the reliability of the data. In the absence of significant error, the results presented in this analysis indicate that the likelihood of women with risk factors to be tested for HIV differs based on the risk factors she has.

My second hypothesis, however, was fully supported in the final model. As expected, drug users were significantly more likely to have been tested for HIV outside of blood donation or pregnancy than were non-drug users, and this variable had the highest odds ratio of all of the risk factors in the final model. The results I found in this chapter does provide some support for the idea that there is a "lag" in public perception of HIV risk due to heterosexual behavior in women.

Implications and Conclusions

The findings reported in this paper have the potential for significant public health implications. As mentioned previously, the number of women with HIV infection is growing rapidly, with the source of infection more likely to be related to sexual behavior than IV drug use. If women at risk due to sexual behavior are not being tested, then the potential morbidity and mortality rates in women could continue to climb. Individuals who are actively seeking an HIV test, as was measured for the 3rd dependent variable (HIV Test excluding blood donation and pregnancy related or routine testing), can be uniquely targeted for prevention measures. Testing can be related to reduction in both morbidity and mortality from HIV/AIDS. First, mortality can be reduced in women who test positive due to early detection and treatment. Second, future morbidity can be reduced through post-test education and counseling. This post-test education can teach prevention strategies to those who test negative, as well as strategies to prevent transmission, including transmission to future offspring, in those who test positive.

These results indicate the need for further policies that target the population identified in this research. Specifically, it is imperative that HIV/AIDS related outreach target women at risk due to sexual behavior. Additionally, since a woman's risk can sometimes be unknown even to her (for example, due to unknown behavior of a male sexual partner), strategies targeting all sexually active women are not unwarranted. The research presented in this paper suggests that strategies encouraging testing of IV drug users, the group that was of the highest risk in the past, have been successful in increasing awareness of the need to be tested for HIV. The present research also suggests that the relationship between risk and testing is not as strong for those at

risk due to sexual behavior, indicating a possible lag time between public perception of HIV/AIDS risk and actual risk.

One limitation of the present research is that it focuses exclusively on data for the United States. It is well known that the HIV/AIDS epidemic is worldwide, with infection rates significantly higher in other countries. The effect of HIV/AIDS on women, one of the main focuses of this paper, is also significantly higher in other countries. For example, a recent report released by the United Nations reports that an estimated 13.5 million women are currently infected with HIV in Sub-Saharan Africa, with a total of 2.4 million AIDS related deaths thus far in 2005 (UNAIDS, 2005). The global importance of HIV testing for women, therefore, is even higher than that of the United States alone.

There are several important directions for this present research to take in the future. The NSFG data has a wealth of information in addition to what was analyzed in the present research. Specifically, data related to post-test education are a logical follow up to the analysis related to HIV testing. The NSFG data includes questions on whether or not respondents who had an HIV test were counseled after they received their results and what topics were covered during the counseling. This data would shed light on the present status of HIV related education and prevention strategies and inform specific areas for improvement. Continued, extensive research related to the HIV/AIDS epidemic overall, and women specifically, will continue to be of vital importance for the foreseeable future.

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