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Changing Trends in Substance Use and Sexual Risk Disparities among Sexual Minority Women as a Function of Sexual Identity, Behavior, and Attraction: Findings from the National Survey of Family Growth, 2002-2015

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Abstract

Components of sexual minority (SM) status—including lesbian or bisexual identity, having same-sex partners, or same-sex attraction—individually predict substance use and sexual risk behavior disparities among women. Few studies have measured differing associations by sexual orientation components (identity, behavior, and attraction), particularly over time. Data were drawn from the 2002-2015 National Survey of Family Growth female sample ($n = 31,222$). Multivariable logistic regression (adjusted for age, race/ethnicity, education, marital/cohabitation status, survey cycle, and population-weighted) compared past-year sexual risk behavior, binge drinking, drug use, and

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sexually transmitted infection treatment among sexual minority women (SMW) versus sexual majority women (SMJW) by each sexual orientation component separately and by all components combined, and tested for effect modification by survey cycle. In multivariable models, SM identity, behavior, and attraction individually predicted significantly greater odds of risk behaviors. SM identity became non-significant in final adjusted models with all three orientation components; non-monosexual attraction and behavior continued to predict significantly elevated odds of risk behaviors, remaining associated with sexual risk behavior and drug use over time (attenuated in some cases). Trends in disparities over time between SMW vs. SMJW varied by sexual orientation indicator. In a shifting political and social context, research should include multidimensional sexual orientation constructs to accurately identify all SMW—especially those reporting non-monosexual behavior or attraction—and prioritize their health needs.

Keywords

sexual minority women; sexual orientation; bisexuality; non-monosexual; substance use; sexual risk behavior

INTRODUCTION

Sexual orientation is a multidimensional construct often comprised of sexual identity, sexual behavior, and sexual attraction (Badgett, 2009; Institute of Medicine, 2011). When compared to sexual majority women, sexual minority women—those who self-identify as lesbian, gay, or bisexual (LGB), or who report attraction to or sex with women—have indicated greater levels of substance use and abuse (Hughes, 2011; Lehavot & Simoni, 2011; Parsons, Kelly, & Wells, 2006) and sexual behavior associated with risk for sexually transmitted infections (STIs) and HIV (Goodenow, Szalacha, Robin, & Westheimer, 2008; Herrick, Matthews, & Garofalo, 2010; Lindley, Walsemann, & Carter, 2013).

Research regarding substance use and sexual risk among sexual minority women has varied in its operationalization of sexual orientation, from sexual identity (Hughes, Szalacha, & McNair, 2010; Parsons et al., 2006), to sexual behavior (Bolton & Sareen, 2011; Corliss, Grella, Mays, & Cochran, 2006; Eisenberg, 2001; Kerr, Ding, Burke, & Ott-Walter, 2015; Muzny, Sunesara, Martin, & Mena, 2011), to a combination of identity and behavior (Bauer, Jairam, & Baidooobonso, 2010; Goodenow et al., 2008; Kann, 2011), of identity and attraction (Corliss, Austin, Roberts, & Molnar, 2009), or of identity, behavior, and attraction (Herrick et al., 2010; McCabe, Hughes, Bostwick, West, & Boyd, 2009). Such variation is potentially problematic given that sexual identity, behavior, and attraction are often related but also likely distinct aspects of broader sexual orientation. For example, in the 2011-2013 cycle of the National Survey of Family Growth (NSFG), nearly 13% of females who identified as heterosexual had had same-sex partners and over 25% expressed attraction to women or uncertainty regarding their sexual attractions (Copen, Chandra, & Febo-Vazquez, 2016).

Observed differences in health outcomes among sexual minority vs. sexual majority populations have varied depending on how sexual orientation is measured (Wolff, Wells, Ventura-DiPersia, Renson, & Grov, 2017). Variable measurement of sexual orientation that

does not capture the complexities of sexuality has obscured a full understanding of disparities in sexual risk and substance use among sexual minority women (Lindley et al., 2013; Wolff et al., 2017).

Sexual Minority Women and Sexual Behavior Related to STIs and HIV

Minimal research has examined STI/HIV-related sexual behavior among sexual minority women using multidimensional measures of sexual orientation, but studies that have done so have found variable health outcomes by different sexual orientation components. For example, one study looked at adolescent women's engagement in HIV-related risk behaviors in terms of sexual identity and the sex of sex partners. Lesbian and bisexual identity, as well as a history of female sex partners, both independently predicted increased odds of having numerous sex partners. However, when sexual identity and the sex of sex partners were considered simultaneously, partner sex was a more salient indicator of having numerous partners, outweighing sexual identity (Goodenow et al., 2008). In a study that drew from Youth Risk Behavior Survey data, students who identified as gay or lesbian reported greater rates of previous sexual intercourse in conjunction with substance use compared to bisexually identified students in one survey site. However, when sex under the influence was measured in terms of sex of sex partners, findings were reversed: students with exclusively same-sex partners indicated lower levels of concurrent substance use and sexual intercourse compared to students who had had both male and female sex partners (Kann, 2011). Despite these variations in sexual risk behavior by sexual orientation component, some research has demonstrated that non-monosexual women—that is, women who identify as bisexual or have sex with or express attraction to both men and women—consistently report the highest rates of sexual risk compared to all other women (Everett, 2013; Muzny et al., 2011; Ripley, 2012).

Sexual Minority Women and Substance Use

Substance use outcomes among sexual minority women have also varied by sexual orientation component (Brewster & Tillman, 2012; Matthews, Blosnich, Farmer, & Adams, 2014; McCabe et al., 2009). For example, one study compared substance use and dependence among sexual minority vs. sexual majority adults in the U.S. using indicators of sexual identity, behavior, and attraction. When substance use outcomes were examined in terms of sexual identity, substance use and dependence were elevated for both lesbian and bisexually identified compared to heterosexually identified women. By contrast, when outcomes were examined in terms of sexual behavior, women who had had both male and female sex partners had significant disparities in substance use and dependence, but women who had only had female sex partners were no different from those with only male partners (McCabe et al., 2009). In a study of substance use among youth, sexual minority identity was significantly associated with substance use disparities when measured separately from attraction and behavior, but similar to the aforementioned study of HIV-related risk behaviors, identity was no longer significant when regression models also adjusted for sexual attraction and behavior (Brewster & Tillman, 2012). Despite variations by sexual orientation component, non-mono sexual women have also emerged with the greatest substance use disparities compared to other women (Przedworski, McAlpine, Karaca-Mandic, & VanKim, 2014).

Mechanisms of Risk among Sexual Minority Women in the Context of Policy Changes

Minority stress theory suggests that sexual minority individuals experience unique stressors associated with having a sexual minority status (Meyer, 2003). Research has documented a link between experiences of minority stress (e.g., stigma, discrimination, and internalized homophobia) and adverse health outcomes for sexual minority individuals, with stress spurring negative mental health processes (Hatzenbuehler, 2009; Meyer, 2003), substance use (Lehavot & Simoni, 2011), and sexual risk behavior (Goodenow et al., 2008) as potential resultant coping responses.

Some research suggests that sexual identity is a key predictor of health risk behaviors given that openly identifying as a sexual minority exposes individuals to greater likelihood of discrimination, stigma, and violence (McCabe et al., 2009). However, additional research purports that disclosing one's sexual identity may be protective against health risk behaviors given that disclosure allows for greater access to social support (Juster, Smith, Ouellet, Sindi, & Lupien, 2013). Although some research has shown how different components of sexual orientation differentially predict health disparities for sexual minorities, research remains less conclusive on which sexual orientation components are the most relevant for understanding health disparities among sexual minority women.

Further confounding an understanding of the relationship between various sexual orientation components and health outcomes is how a rapidly evolving political and social climate in the U.S. may impact sexual minority health disparities. Research suggests that a policy environment more favorable to sexual minorities can mitigate minority stress (Hatzenbuehler, McLaughlin, Keyes, & Hasin, 2010; Pachankis et al., 2017). When discrimination and stigma have dissipated and legal protections against discrimination have created a sense of security for sexual minorities, risk behaviors that once functioned as stress coping mechanisms could have also declined (Hatzenbuehler et al., 2010). Between 2000 and 2009, policy changes reflected such growing support of sexual minorities (Movement Advancement Project, 2010). For example, support for permitting openly gay individuals to serve in the military and for gay and lesbian people to adopt children both increased by 21%. The number of states prohibiting sexual orientation-related discrimination increased from 12 to 22, the percent of Fortune 500 companies prohibiting job-based sexual orientation-related discrimination increased from 0.6% to 35%, and the passage of the 2009 Matthew Shepard and James Byrd, Jr. Hate Crimes Prevention Act marked the first U.S. federal law to increase punishment of hate crimes against sexual minorities (Movement Advancement Project, 2010). In 2015, the U.S. Supreme Court pronounced same-sex marriage legal at the federal level (Chappell, 2015).

Much of the existing literature examining the political influence on the health of sexual minorities has treated sexual minority individuals as a composite group without exploring differential effects for various sexual minority and gender subgroups. Most of these studies have measured sexual minority status in terms of sexual identity alone (Hatzenbuehler, 2009, 2011; Hatzenbuehler et al., 2010; Hatzenbuehler, Wieringa, & Keyes, 2011), despite sexual orientation being a multifaceted construct (Laumann, Gagnon, Michael, & Michaels, 1994) with only moderate correlations between sexual identity, behavior, and attraction (Brewster & Tillman, 2012). To our knowledge, only one study examining the impact of structural

stigma on sexual minority health has also included sexual attraction and behavior as elements of sexual orientation (Pachankis et al., 2017). Furthermore, although recent research has examined changing trends in health disparities between sexual minorities and sexual majority individuals, these studies have focused on youth and have employed singular measures of sexual orientation (Fish, Watson, Porta, Russell, & Saewyc, 2017; Watson, Goodenow, Porta, Adjei, & Saewyc, 2017).

In addition to policy advances, the new millennium also ushered in increasing social acceptance of sexual minorities (Movement Advancement Project, 2010; Twenge, Sherman, & Wells, 2016). Between 2000 and 2009, the proportion of Americans viewing same-sex relationships as morally acceptable increased by 23% (Movement Advancement Project, 2010). According to the General Social Survey (GSS), the proportion of U.S. adults who perceived same-sex sexual behavior as “not wrong at all” increased from 11% in 1973 to 49% in 2014 (Twenge et al., 2016).

Despite increasingly positive attitudes toward same-sex sexual behavior and burgeoning policy protections for LGB individuals more broadly, research has not found growing positivity toward bisexually identified individuals (Dodge et al., 2016). Perceptions of same-sex relationships do not capture changes in attitudes toward non-monosexual individuals in same- vs. different-sex relationships. Moreover, policies more favorable to sexual minorities may not address the stigma and stereotyping of non-monosexual people that persist among both heterosexual and sexual minority communities (Brewster & Moradi, 2010; Dyar, Feinstein, & London, 2014; Wandrey, Mosack, & Moore, 2015). Because of such ongoing stigma, non-monosexual people may continue to lack community support (Ross et al., 2018) and to face limited social acceptance (Dyar, Feinstein, Schick, & Davila, 2017) regardless of policies that protect against discrimination at an institutional level.

Present Study

In order to understand how each component of sexual orientation contributes to health disparities, both among sexual minority women and compared to sexual majority women, multidimensional measurement of sexual orientation is critical (Wolff et al., 2017). This is especially true in the context of a rapidly shifting political and social environment that can influence the health of sexual minorities overtime (Hatzenbuehler et al., 2010). Specific attention to women who express non-monosexual identity, attraction, and/or sex with more than one sex or gender is also vital given that attitudes toward bisexually identified people have not advanced at the same pace as attitudes toward same-sex relationships more broadly (Dodge et al., 2016).

Using 2002-2015 data from the NSFG, we sought to examine the association of risk behaviors with women’s sexual minority status—with sexual orientation defined in terms of sexual identity, behavior, and attraction—and to explore whether these associations have changed over time as policies implemented during the same period of survey data collection became increasingly supportive of sexual minorities (Movement Advancement Project, 2010).

METHOD

Participants

Data for this study were drawn from the NSFG, a national survey weighted to be representative of the U.S. population age 15 to 44 (Lepkowski et al., 2013). The NSFG began collecting sexual orientation data in its 2002 sample (Groves, Mosher, Lepkowski, & Kirgis, 2009); thus, this study used a combined NSFG dataset from 2002 to 2015 (the most current dataset available at the time of data analysis). The NSFG is unique as one of the few national health surveys to collect data on sexual identity, behavior, and attraction (Wolff et al., 2017).

The NSFG 2002 (Cycle 6) sample included 7,643 female respondents (80% response rate) out of a total sample of 12,571. For the 2006-2010 cycle (continuous interviewing over the cycle), interviews were completed for 48 weeks of each year from June 2006 through June 2010. The sample included 12,279 female respondents (77.7% response rate) out of a total sample of 22,682. The 2011-2015 interviews occurred from September 2011 through September 2015 and included a sample of 11,300 female respondents (response rate 72.3%) out of a total sample of 20,621 (National Center for Health Statistics, 2016a). Despite the change from 12-month to multi-year data interviewing cycles in the NSFG (Groves et al., 2009), the survey items of interest for the present study remained identical.

Measures

Sexual Orientation—The primary independent variables were the three aforementioned sexual orientation components: sexual identity, sexual attraction, and sexual behavior.

Sexual identity was assessed by responses to the question: “Do you think of yourself as: heterosexual or straight; (2) homosexual, gay, or lesbian; (3) bisexual; or (4) something else?” (Reference = heterosexual/straight). Given that “something else” was not available as a response option in the 2011-2015 survey cycle, we excluded those who identified as such from this analysis.

Sexual attraction was assessed by responses to the question: “People are different in their sexual attraction to other people. Which best describes your feelings? (1) only attracted to males; mostly attracted to males; (3) equally attracted to males and females; (4) mostly attracted to females; (5) only attracted to females; or (6) not sure.” We collapsed responses into a four-category variable: (1) only attracted to males; (2) only attracted to females; (3) attracted to both males and females; or (4) not sure (reference = only attracted to males). “Not sure” was retained for this analysis as a separate category within the four-item variable given that we could not ascertain whether these respondents were simply unsure of their sexual attraction, if they misunderstood the other response options, or if they would have indicated exclusive attraction to males, females, or both had they not been given the “not sure” response option.

Sexual behavior in this analysis was limited to measurement of past-year behavior with male and/or female partners (partner gender identity was not assessed) given that women’s sexual behavior may be fluid across the lifespan as their sexual desires and identity evolve

(Diamond, 2003; Meyer & Wilson, 2009). Our sexual behavior variable included four categories: past-year sexual behavior (i.e., oral, vaginal, or anal sex) with (1) only male partners; (2) only female partners; (3) both male and female partners; and (4) no past-year partners (reference = only male partners).

Demographic Characteristics—Demographic characteristics included age in years, race/ethnicity (Hispanic, any race; Black/African-American, non-Hispanic; White, non-Hispanic; and any other race, non-Hispanic), education level (no high school degree to Bachelor's degree or higher), and marital/cohabitation status (married to/living with versus not married to/not living with a partner). Participants were only directly asked about their marital/cohabitation status with an “opposite sex” partner. NSFG recorded voluntary responses about same-sex partnerships as comments but same-sex relationship status was not formally assessed nor was it integrated into the responses to the marital/cohabitation status question.

STI/HIV-Related Sexual Risk Behavior—We measured past-year STI/HIV-related sexual risk behavior as having engaged in any sexual risk behavior with male partners (again, partner gender identity was not assessed) in the past year, defined as any self-reported transactional sex, sex with male partners with high HIV risk (i.e., HIV-positive males, males who used injection drugs, males who had sex with males, or males who had other concurrent partners of any sex), having had five or more male partners in the past year, or any past-year condomless penile-vaginal intercourse with male partners. Given that the NSFG did not assess for it, we were unable to examine HIV and STI-related sexual risk behaviors with female partners. Any past-year condomless sex was assessed by the following question: “Thinking back over the past 12 months, would you say you used a condom with your partner for sexual intercourse [which referred to penile-vaginal intercourse]: (1) every time; (2) most of the time; (3) about half the time; (4) some of the time; (5) none of the time.” We collapsed responses into a dichotomous indicator for any past year condomless sex (responses two through five), which was included within the larger sexual risk behavior variable. Anal sex was not included given that the NSFG only asked about condom use at last, rather than any, occurrence of anal sex within the previous year.

STI Treatment—We defined STI treatment as report of having been treated for gonorrhea, chlamydia, herpes, or syphilis over the past year. This variable was used in place of a variable assessing for STI diagnoses because in the 2002 and 2006-2010 survey cycles, participants were only asked questions about whether they had received an actual STI diagnosis if they first responded “yes” to questions about whether they had been treated for an STI. As such, using the STI treatment variable avoided excluding participants who may have been diagnosed, but who did not receive treatment for STIs.

Recreational Drug Use—The NSFG assessed past-year recreational drug use in four separate questions using the following language: “During the last 12 months, how often have you: [Question 1] smoked marijuana? [Question 2] used cocaine? [Question 3] used crack? [Question 4] used crystal or meth, also known as tina, crack, or ice?” A fifth question asked, “During the last 12 months, how often have you shot up or injected drugs other than those

prescribed to you? “Response options ranged from “never” to “about once a day.” For this study, we measured recreational drug use in the past year as having used any of the aforementioned substances or engaging in non-prescription injection drug use at least once in the past 12 months. Although crystal methamphetamine use was not assessed in the 2002 sample, meth use was included in the drug use indicator given that all but 5 respondents in the 2006-2010 and 2011-2015 samples that had used crystal methamphetamine had also used other drugs.

Binge Drinking—Binge drinking was assessed through the following question: “During the last 12 months, how often did you have 4 or more drinks within a couple of hours? (1) never; (2) once or twice during the year; (3) several times during the year; (4) about once a month; (5) about once a week; (6) about once a day?” For the purposes of this analysis, we used the Substance Abuse and Mental Health Services Administration definition of binge drinking (National Center on Alcohol Use and Alcoholism, n.d.), which is operationalized as (females) having four or more drinks on one occasion at least once a month (responses 4-6).

Data Analyses

Analyses were conducted on the merged 2002, 2006-2010, and 2011-2015 NSFG female datasets, which the NSFG maintains separately from the male datasets. Weights were adjusted to account for the different survey cycles (Centers for Disease Control and Prevention, 2014).

We first describe the sample overall and stratified by each sexual orientation measure and with sexual orientation and health behaviors stratified by survey cycle. The Rao Scott modified chi square test was used to assess the significance of associations between sexual orientation indicators and categorical variables. Next, we examined the proportion of those within each sexual orientation group reporting each health outcome, stratified across survey cycles. Separate crude logistic regression models then explored the association of each of the three indicators of sexual orientation—sexual identity, sexual behavior, and sexual attraction—with each health outcome.

Subsequently, four separate multivariable logistic regression models were run for each health outcome, with each model adjusted for age, race, ethnicity, education level, survey cycle, and marital/cohabitation status. The first set of regression models (Models A1 through A4) included sexual identity as the main predictor for each separate outcome, the second set (Models B1 through B4) included past-year sexual attraction as the main predictor, and the third set (Models C1 through C4) included sexual behavior. Finally, we ran an additional set of models (Models D1 through D4) that included all three measures of sexual orientation to look at their independent associations; a separate model was run for each of the four outcomes.

Chi square tests using Cramer’s V coefficients explored correlations between each indicator of sexual orientation to ensure that the indicators were not highly correlated and could be included in the same regression model. Sexual attraction and sexual identity—as well as identity and sexual behavior—were moderately correlated with Cramer’s V coefficients of

0.59 and 0.53 respectively; sexual behavior and sexual attraction had a low correlation with a Cramer's ν coefficient of 0.37.

We then ran the final adjusted models (Models D1 through D4) including all the aforementioned characteristics but leaving out marital/cohabitation status as a sensitivity analysis to see if the results differed without adjustment for this variable, which excluded marital/cohabitation with same-sex partners. The sensitivity analysis also addressed the fact that the large proportion of women reporting past-year sexual risk behavior was driven by the over 90% of married/cohabiting and about 82% of unmarried/not cohabiting respondents who reported condomless sex within the past year. Given that excluding marital/cohabitation status as a potential covariate had a minimal overall effect on the association between sexual minority status and the primary outcomes, the multivariable results include marital/cohabitation status as a covariate.

For Models D1 through D4 (the models that included all three measures of sexual orientation simultaneously), we then assessed whether the association between sexual minority status and each outcome differed by NSFG survey cycle by adding interaction terms for survey cycle by each of the three measures of sexual orientation, using separate interaction terms for each sexual orientation indicator. We were not able to examine interactions of sexual orientation by individual year of survey interview given that discrete interview years are not publicly available (Centers for Disease Control and Prevention, 2017). If the p -value for any of the interaction terms was significant, final combined models were stratified on survey cycle to examine the direction of the effect modification. We report on trends in health outcomes among sexual minority vs. heterosexual women and women attracted to/who had had sex with only males across survey cycles, focusing on where we observed significant interactions of sexual orientation indicators and survey cycle (Homma, Saewyc, & Zumbo, 2016).

Women who had not had sex with a male partner within the past year were excluded from models examining STI/HIV-related sexual risk behavior (Models A1 through D1). For the models exploring past-year STI treatment, given that only 21 lesbian identified women, 17 women exclusively attracted to females, and five who had sex only with women in the past year reported any past-year STI treatment, these groups were excluded from the adjusted models.

All analyses accounted for the complex sampling method and were weighted to the population. Analyses were performed in SAS 9.3 (SAS Institute, Cary NC) using the proc survey functions. Statistical significance was set at an alpha of .05 for regression models and an alpha of .10 for interaction terms, given that power decreases when examining effect modification (Marshall, 2007).

RESULTS

Table 1 displays demographic characteristics of the female U.S. population drawn from NSFG data, 2002 to 2015. The mean age was 29.68 years ($SE = 0.09$). About 41% of the sample was legally married to or living with an opposite-sex partner (40.93%) and the

majority identified as non-Hispanic white (60.81%). Roughly a quarter of women fell within each category of education level. Most women reported a heterosexual identity (93.68%), being exclusively attracted to males (85.52%), and having had only male partners during the previous year (90.46%).

Table 2 shows the overall proportion within sexual orientation category and engaging in past-year risk behaviors, as well as stratified by NSFG survey cycle. Overall, 87.50% of women who had sex with a male partner in the past year reported any STI/HIV-related sexual risk behavior during that time, but as noted, this was driven by the over 90% of married/cohabiting women who reported any past-year condomless sex with a male partner. Nearly 4% of women reported having received STI treatment within the previous year. Close to 15% of women reported binge drinking once a month or more within the past year; 16.37% indicated any past-year recreational drug use (including marijuana). From 2002 to 2011-2015, women were significantly less likely to report sexual risk behavior (89.43% in 2002 vs. 87.22% in 2011-2015, $p = .001$) and binge drinking (16.87% in 2002 vs. 12.44% in 2011-2015, $p < .001$) (Table 2). Despite these declines, health disparities largely persisted between sexual minority and sexual majority women regardless of how sexual orientation was measured (see Table 3). We further describe specific trends below in the context of effect modification.

Logistic Regressions, Interactions, and Stratified Models

Table 4 shows results of unadjusted (crude) logistic regression models and results of the combined adjusted Models D1-D4. Table 5 shows interactions between each sexual orientation component and each NSFG survey cycle. Table 6 shows final adjusted models stratified by survey cycle.

Past-Year Sexual Behavior Related to STI/HIV Risk—This set of results describes findings from logistic regression models with past-year STI/HIV sexual risk behaviors as the main outcome. We first examined sexual risk behaviors by sexual orientation indicators in unadjusted models, and subsequently in three separate models (adjusted for age, race/ethnicity, education level, survey cycle, and marital/cohabitation status) by sexual identity (Model A1), attraction (Model B1), and behavior (Model C1). In Model D1, we then adjusted for all three sexual orientation indicators simultaneously. Below, we report on unadjusted models and the combined Model D1; see Supplemental tables for Models A1-C1.

In unadjusted logistic regression models (Table 4), women reporting women attracted to males and females (OR: 1.19, $p = .030$), as well as both male and female partners within the past year (OR: 1.37, $p = .024$) had significantly greater odds of past-year sexual risk behavior compared to women who only had male partners, while women reporting attraction only to females had 62% decreased odds of sexual risk behavior (OR: 0.38, $p = .033$). Sexual minority identity was not a significant predictor of elevated sexual risk behavior in unadjusted models (Table 4).

In Model D1, which included all three indicators of sexual orientation simultaneously, sexual identity remained non-significant, and attraction to both males and females (AOR:

1.26, $p = .016$) as well as having had partners of both sexes in the past year (AOR: 1.75, $p = < .001$) remained significantly associated with greater odds of sexual risk behavior (Table 4).

Next, we added interaction terms between each sexual orientation measure and survey cycle to Model D1. There was significant interaction between bisexual identity and survey cycle 2006-2010 ($p = .074$) and between attraction to both males and females and cycle 2006-2010 ($p = .002$) (Table 5). Because we found significant interactions, we stratified Model D1 by survey cycle to examine effect modification (Table 6).

In stratified models (see Table 6), bisexual compared to heterosexual identity was associated with 1.69 times the odds of sexual risk behavior ($p = .244$) in 2002 but a 30% decreased odds in 2006-2010 ($p = .192$). An odds ratio less than 1 for the interaction of bisexual identity and survey cycle 2006-2010 (AOR: 0.40; see Table 5) indicates that the disparity in sexual risk behavior between women who identified as bisexual and heterosexual narrowed from the 2002 to the 2006-2010 survey cycles (Homma et al., 2016). Reporting attraction to both males and females was associated with a non-significant decreased odds of sexual risk behavior in 2002 (AOR: 0.90, $p = .531$) but a significantly increased odds of risk behavior in the 2006-2010 cycle (AOR: 1.92, $p < .001$). An odds ratio greater than 1 for the interaction of attraction to both males and females and survey cycle 2006-2010 (AOR: 2.02; see Table 5) indicates that the disparity in sexual risk behavior between women attracted to both males and females compared to those exclusively attracted to males widened from 2002 to 2006-2010 (Homma et al., 2016). Figures 1 and 2 visually depict changes in the proportion of these groups that engaged in sexual risk behaviors, without adjustment for age, race/ethnicity, education level, or marital status.

Past-Year STI Treatment—Here, we report on findings from logistic regression models with past-year STI treatment as the main outcome. We first examined STI treatment by sexual orientation indicators in unadjusted models, and subsequently in three separate models for each sexual orientation indicator (Model A2: by sexual identity; Model B2: by sexual attraction; Model C2: by sexual behavior), adjusted for age, race/ethnicity, education level, survey cycle, and marital/cohabitation status. In Model D2, we then adjusted for all three sexual orientation indicators simultaneously. Below, we report on unadjusted models and the combined Model D2; see Supplemental tables for Models A2-C2.

In unadjusted models (see Table 4), non-monosexuality in terms of identity, behavior, and attraction were each associated with greater odds of STI treatment as compared to exclusive heterosexuality (bisexual identity OR: 1.91, $p < .001$; attraction to both males and females OR: 1.92, $p < .001$; sex with both male and female partners in the past year OR: 3.06, $p < .001$) (Table 4). In the model that combined all three indicators of sexual orientation (Model D2, Table 4), bisexual identity was no longer significantly associated with STI treatment in the past year, but being attracted to and having both male and female partners remained significant (AOR: 1.58, $p < .001$; 1.77, $p = .002$ respectively) (Table 4).

Next, we added interaction terms between each sexual orientation measure and survey cycle to Model D2. Since none of the interactions were significant, we did not stratify Model D2 by survey cycle.

Past-Year Drug Use—Next, we report on findings from logistic regressions with past-year drug use as the main outcome. We first examined drug use by sexual orientation indicators in unadjusted models, and subsequently in three separate models for each sexual orientation component (Model A3: by sexual identity; Model B3: by sexual attraction; Model C3: by sexual behavior) adjusted for age, race/ethnicity, education level, survey cycle, and marital/cohabitation status. In Model D3, we then adjusted for all three sexual orientation indicators simultaneously. Below, we report on unadjusted models and the combined Model D3; see Supplemental tables for Models A3-C3.

In unadjusted logistic regression models (see Table 4), sexual minority identity (lesbian OR: 2.75, $p < .001$; bisexual OR: 4.22, $p < .001$), attraction (only attracted to females OR: 3.64, $p < .001$; attracted to both males and females OR: 3.97, $p < .001$), and behavior (exclusively female past-year partners OR: 1.77, $p = .001$, both male and female past-year partners OR: 6.58, $p < .001$) were all significantly associated with increased odds of self-reported past-year drug use compared to sexual majority women. For each measure of sexual orientation, women with self-reported non-monosexual identity, attraction, and behavior had the greatest odds of past-year drug use compared to other groups.

In Model D3, which adjusted for all three measures of sexual orientation, sexual minority identity was no longer a significant predictor of drug use, while attraction exclusively to females (AOR: 3.11, $p < .001$) and attraction to both males and females (AOR: 2.91, $p < .001$), as well as having both male and female past-year sex partners (AOR: 2.21, $p < .001$) remained significantly associated with higher odds of drug use. Having exclusively female past-year sex partners, however, was associated with lower odds of drug use in this adjusted model, predicting a 48% decreased odds of past-year use compared to those with exclusively male past-year partners ($p = .004$) (Table 4).

Next, we added interaction terms between each sexual orientation measure and survey cycle to Model D3 (see Table 5). Because we found significant interaction between lesbian identity and survey cycle 2006-2010 ($p = .028$); bisexual identity and 2011-2015 ($p = .005$); having exclusively female past-year partners and cycle 2011-2015 ($p = .042$); having both male and female past-year partners in cycles 2010-2006 ($p = .052$) and 2011-2015 ($p = .015$) (Table 5), we then stratified Model D3 by survey cycle.

Lesbian identity predicted non-significant decreased odds of drug use in 2002 (AOR: 0.38, $p = .126$) but increased odds in 2006-2010 (AOR: 1.45, $p = .375$). A similar pattern was observed for bisexually identified women: Bisexual identity was associated with significantly decreased odds of drug use in 2002 (AOR: 0.62, $p = .041$) but increased odds in 2011-2015 (AOR: 1.52, $p = .017$). An odds ratio greater than 1 for interactions between lesbian identity and survey cycle 2006-2010 (AOR: 3.60) and for the interaction of bisexual identity and survey cycle 2011-2015 (AOR: 2.22, see Table 5 for interactions) demonstrates that the disparities in drug use among lesbian vs. heterosexual women widened from 2002 to 2006-2010, and among bisexual vs. heterosexual women from 2002 to 2011-2015 (Homma et al., 2016).

Having both male and female past-year sex partners was associated with significantly higher odds of past-year drug use relative to women with exclusively male past-year partners in all three survey cycles, but with the strength of the association decreasing over time (2002 AOR: 3.91, $p < .001$; 2006-2010 AOR: 2.15, $p < .001$; 2011-2015 AOR: 1.81, $p = .003$) (Table 6). Having exclusively female partners was associated with decreasing odds of drug use compared to women with exclusively male partners in each survey cycle, but the association was only significant in the 2011-2015 cycle (2002 AOR: 0.93, $p = .885$; 2006-2010 AOR: 0.69, $p = .275$; 2011-2015 AOR: 0.33, $p = .001$) (Table 6). Odds ratios less than 1 for the interactions between sex with male and female partners and survey cycles 2006-2010 (AOR: 0.53) and 2011-2015 (AOR: 0.46), and between exclusively female sex partners and 2011-2015 (AOR: 0.31; see Table 5 for interactions) indicate narrowing disparities in drug use among sexual minority women compared to women with exclusively male partners (Homma et al., 2016). See Figs. 3 and 4 for visual representations of these changing trends without adjustment for age, race/ethnicity, education level, or marital status.

Past-Year Binge Drinking Once a Month or More—Finally, we report on findings from logistic regression models with past-year binge drinking once a month or more as the main outcome. We first examined binge drinking by sexual orientation indicators in unadjusted models, and subsequently in three models adjusted for age, race/ethnicity, education level, survey cycle, and marital/cohabitation status: Model A4 examined past-year binge drinking by sexual identity, Model B4 by sexual attraction, and Model C4 by sexual behavior. In Model D4, we then adjusted for all three sexual orientation indicators simultaneously. Below, we report on unadjusted models and the combined Model D4; see Supplemental tables for Models A4-C4.

In the unadjusted logistic regression models (see Table 4) examining self-reported past-year binge drinking at least once a month, women reporting exclusive attraction to females had the greatest odds of past-year binge drinking when compared to women who reported exclusive attraction to males (OR: 2.41, $p < .001$; attraction to both OR: 1.93, $p < .001$); however, women with a bisexual identity (OR: 2.17, $p < .001$; lesbian identity OR: 2.12, $p < .001$) and with both male and female past-year partners (OR: 3.60, $p < .001$; exclusively female partners OR: 1.79, $p = .020$) had the highest odds of past-year binge drinking compared to heterosexually identified women and women who only had sex with male partners in the past year.

In Model D4 that included all three measures of sexual orientation, sexual minority identity was no longer significantly associated with self-reported binge drinking in the past year. Attraction to both males and females (AOR: 1.44, $p < .001$) and having had both male and female past-year partners (AOR: 2.03, $p < .001$) remained significant predictors of binge drinking compared to those with exclusively male past-year male partners.

When we added interaction terms between each sexual orientation measure and survey cycle to Model D4, we found significant interaction between having exclusively female past-year partners and survey cycle 2011-2015 ($p = .024$, see Table 5). Having only female partners (versus only male partners) predicted decreased odds of drinking in 2002 (AOR: 0.29, $p = .002$) and 2006-2010 (AOR: 0.49, $p = .179$) but was associated with (non-significant) greater

odds of binge drinking in 2011-2015 (AOR: 1.99, $p = .315$). An odds ratio greater than 1 (AOR: 6.40) for the interaction of exclusively female partners and survey cycle 2011-2015 (see Table 5) shows that the disparity in binge drinking compared to those with exclusively male partners widened from 2002 to 2011-2015 (Homma et al., 2016) (see Fig. 5).

Results with Non-Monosexual Women as the Reference Group

Given that non-monosexual women generally presented with the highest levels of risk behavior, we re-ran the final models (D1-D4) with bisexual identity, attracted to both males and females, and past-year sex with both males and females as reference groups to assess if differences between non-monosexual and monosexual women were significant. In most cases, we found that non-monosexual women, regardless of how sexual orientation was measured, had significantly higher odds of risk behavior compared to both monosexual sexual minority (e.g., lesbian identified or exclusively female partners) and sexual majority women (e.g., heterosexual identified or exclusively male partners). See Supplemental Table 5 for full details.

DISCUSSION

We examined three dimensions of sexual orientation—sexual identity, behavior, and attraction—across three survey cycles of the NSFG. Concurrently accounting for sexual identity behavior, and attraction allowed for exploration of which sexual orientation components are independently associated with each health behavior relative to sexual majority women. The results of this study echo previous research showing that sexual minority orientation is associated with elevated odds of risky health behaviors among women, and that sexual attraction and behavior emerged as stronger predictors of health disparities between sexual minority and sexual majority women than sexual identity (Brewster & Tillman, 2012; Goodenow et al., 2008).

Similar to existing literature, non-monosexual women generally had the greatest disparities relative to other groups. Health disparities for women identifying as bisexual seemed to be explained by attraction to and sex with both males and females, rather than having a bisexual identity in and of itself. We suggest three hypotheses for this finding. First, women who identify as bisexual may have greater access to supportive communities as bisexual identity becomes increasingly common in the U.S. (England, Mishel, & Caudillo, 2016). Social support may protect against the deleterious effects of minority stress (Hatzenbuehler, 2009) among bisexual women (MacKay, Robinson, Pinder, & Ross, 2017). For women who express attraction to or have sex with both men and women without assuming a bisexual or other non-monosexual (e.g., queer; pansexual) identity, however, community connection may not be as readily available. Second, the association between both-sex attractions, as well as both-sex sexual partners and health risk behaviors may also be a result of concealment of a bisexual or other non-monosexual identity in anticipation of rejection and/or discrimination (Paul, Smith, Mohr, & Ross, 2014), which has been linked to decreased social support (Pachankis, 2007). Coming out as bisexual can decrease internalized bisexual stigma (Paul et al., 2014), but women who express bisexual attractions and behaviors without assuming a bisexual or other non-monosexual identity may not

experience the health benefits of coming out. Finally, “internalized monosexism” (e.g., internalizing stereotypes that non-monosexuality is a temporary identity or indicative of promiscuity) (Dyar et al., 2017) may also contribute to greater health disparities among women expressing non-monosexual attraction and behavior (Goodenow et al., 2008). For non-monosexual people who do not divulge a bisexual identity, internalized monosexism appears to be particularly heightened (Dyar et al., 2017).

Changing Health Disparity Trends Across NSFG Survey Cycles

In models stratified by NSFG survey cycle, we found variable trends in health disparities depending on how sexual orientation was measured. For example, disparities in sexual risk behavior between bisexually and heterosexually identified women narrowed from the 2002 to the 2006-2010 survey cycles, but disparities between women attracted to males and females and those attracted exclusively to males widened from 2002 to 2006-2010. In models with drug use as the outcome, disparities widened between bisexually and heterosexually identified women, but narrowed between women with both male and female partners and those with only male partners from 2006-2010 to 2011-2015. Thus, the measure of sexual orientation used to assess trends across survey cycles impacts depiction of health disparities between sexual minority and sexual majority women.

Although researchers may determine at the data analysis phase that not all indicators of sexual orientation are relevant to the research questions at hand, we recommend that each component be made available within national health surveys to allow for more robust analyses of sexual orientation data and to provide health researchers with more options to explore which elements of sexual orientation are associated with health disparities among sexual minorities (Wolff et al., 2017), particularly women expressing non-monosexuality. We also suggest that sexual minority health disparity studies explore correlations between each component of sexual orientation to determine whether different indicators of orientation are measuring different constructs and thus should be examined separately (Wolff et al., 2017).

Although disparities dissipated for some groups over time, non-monosexuality generally remained associated with increased odds of health risks across survey cycles. Specifically, non-monosexual attraction remained associated with elevated odds of STI/HIV-related sexual risk and non-monosexual behavior with drug use across survey cycles. The potential for lack of community support, identity concealment, and internalized monosexism may be responsible for these enduring health risks. As recently reviewed by Ross et al. (2018), bisexual individuals continue to report a dearth of community support. As mentioned above, attitudes toward bisexuality have not improved over time as they have toward lesbian and gay identity (Dodge et al., 2016) and persistent monosexism appears to uphold a negative social climate for non- monosexual individuals (Dyar et al., 2017).

Limitations

Our findings should be understood in light of their limitations. First, we were limited to defining our variables in terms of the survey items at hand. Sexual attraction and behavior questions asked about attraction to and sex with “males” and “females” without considering

individuals who may not identify as male or female or how respondents might express attraction in terms of partner gender identity rather than sex. Drug use measures did not assess for opioid (prescription or heroin) use, despite a growing epidemic in the United States during the administration of the NSFG survey cycles (Califf, Woodcock, & Ostroff, 2016). Survey questions also did not assess for substance use disorders. Although research has demonstrated that sex between female partners may facilitate STI transmission (Marrazzo & Gorgos, 2012; Ripley, 2012), the NSFG did not include items assessing for these behaviors. Our analyses were thus limited to examining women's HIV/STI-related sexual risk with male partners. Additionally, the NSFG question on marital/cohabitation status does not formally assess same-sex partnerships. Since marriage has been shown to be protective against health risks such as substance use (Urquia, O'Campo, & Ray, 2013), future research might explore differences in health outcomes for married vs. unmarried sexual minority individuals.

Data were self-reported and thus subject to social desirability bias, particularly questions regarding potentially stigmatizing behavior like same-sex sexual behavior and substance use (Bauer et al., 2010). Despite a total sample of over 30,000 women, samples remained small for sexual minority women. This prevented a more in-depth analysis of risk behaviors by sexual minority status, and the inability to detect significant associations due to low statistical power (Type 2 error).

The results from this study should be applicable to the U.S. population given that the NSFG is a nationally representative sample; however, they are unlikely to apply to other populations that have different levels of acceptance or stigma associated with sexual minority status. NSFG data are not weighted on sexual orientation since there are no existing population-level data on this variable. Finally, we were unable to examine interactions of sexual orientation by NSFG interview year given that the NSFG does not have sufficient sample sizes to make valid statistical inferences for any 12-month period. Furthermore, the NSFG was not designed to be nationally representative for calendar years because of its continuous design (National Center for Health Statistics, 2016b). We were thus limited to more crude analyses involving interactions of sexual orientation components and NSFG survey cycles.

Despite these limitations, this study compared sexual minority and sexual majority women over time using measurement methods that include all three components of sexual orientation, which we feel is an improvement on previous methods that used only one definition of sexual minority status.

Conclusions

This investigation documented several important findings related to sexual minority women's health outcomes and how those outcomes may vary over time. Our findings indicate that measurement methods matter when assessing associations between sexual orientation and health risk behaviors and future research should account for components of sexual behavior and attraction in addition to sexual identity in study design and instrumentation. Further, including all three constructs of sexual orientation in regression models exploring health risks among sexual minority women is needed to identify which

groups have the greatest health disparities. To identify the specific mechanisms that contribute to elevated risks for non-monosexual women observed in multiple survey cycles, future research should investigate health outcomes separately among women who express non-monosexuality in terms of identity, behavior, and/or attraction rather than considering all sexual minority women as a composite group.

Multilevel interventions could be implemented to achieve health equity for all sexual minority women. For example, at the individual level, substance use disorder treatment programs for sexual minority women could address women's experiences with stigma and discrimination and work with women to develop healthy coping mechanisms (Meyer, 2003). At a community level, tailored prevention strategies (e.g., social marketing campaigns) could address both the association between substance use and sexual risk behavior among sexual minority women, as well as the variations in sexual risk behavior by partner gender or sex and sexual identity. Finally, at the institutional and policy levels, the findings from this study suggest that policies and laws supporting sexual minorities should continue to be developed and monitored. Although some policies have resulted in improving acceptance of sexual minorities, the impact of a long history of homophobia, bigotry, and violence against sexual minorities may continue to contribute to ongoing adverse health outcomes among sexual minority women. Emerging research also suggests that the 2016 presidential election has again contributed to a hostile, discriminatory environment for sexual minorities (Veldhuis, Drabble, Riggle, Wootton, & Hughes, 2018). Policies and programs that support resiliency for all sexual minorities—especially non-monosexual women—are critical to ensure optimal health outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
STI/HIV-Related Sexual Risk Behavior by Sexual Identity, National Survey of Family Growth, 2002-2015, Females Aged 15-44

Figure 2.
STI/HIV-Related Sexual Risk Behavior by Sexual Attraction, National Survey of Family Growth, 2002-2015, Females Aged 15-44

Figure 3.
Recreational Drug Use by Sexual Identity, National Survey of Family Growth, 2002-2015,
Females Aged 15-44

Figure 4.
Drug Use by Sexual Behavior, National Survey of Family Growth, 2002-2015, Females
Aged 15-44

Figure 5.
Binge Drinking by Sexual Behavior, National Survey of Family Growth, 2002-2015,
Females Aged 15-44

Table 1.

Demographic Characteristics, National Survey of Family Growth. 2002-2015. Females Aged 15-44 (N=31,222)^a

	Unweighted n (weighted %)/M age (SE)
Sexual Identity	
Heterosexual	38,217 (93.68)
Gay/lesbian	508 (1.47)
Bisexual	1,648 (4.99)
Sexual Attraction	
Only to Males	25,286 (85.52)
Only to Females	315 (0.88)
To Both	5,068 (15.62)
Not sure	337 (0.99)
Sexual Behavior, Past Year	
Only Males	23,417 (90.46)
Only Females	365 (1.26)
Both	1,087 (3.54)
No Sex Partners	1,495 (4.74)
Race & Ethnicity	
Hispanic (any race)	7,164 (17.96)
Black, Non-Hispanic	6,485 (14.46)
Other Race, Non-Hispanic	1,848 (6.78)
White, Non-Hispanic	15,725 (60.81)
Education Level	
No High School	7,657 (20.64)
High School/GED	8,069 (25.05)
Some College/Associate's	8,864 (29.14)
Bachelor's or Higher	6,631 (25.18)
Married/living with partner	10,461 (40.93)
Age (continuous)	29.68 (0.09)

^aTotal n may not add up to 100% due to missing responses.

Table 2.

Sexual Orientation & Past-Year Health Behaviors Stratified by National Survey of Family Growth Survey Cycles, 2002-2015, Females Aged 15-44 ($N = 31,222$)^a

	2002 (<i>n</i> = 7,643)		2006-2010 (<i>n</i> = 12,279)		2011-2015 (<i>n</i> = 11,300)		χ^2	<i>b</i> _{<i>p</i>}
	Unweighted <i>N</i> (weighted %)/M age (SD)	Unweighted <i>n</i> (weighted %)	Unweighted <i>n</i> (weighted %)	Unweighted <i>n</i> (weighted %)	Unweighted <i>n</i> (weighted %)	Unweighted <i>n</i> (weighted %)		
<i>Sexual Orientation</i>								
Sexual Identity								
Heterosexual	38,217 (93.68)	6,780 (95.35)	11,275 (94.54)	10,162 (92.27)	43.87	< .001		
Gay/lesbian	508 (1.47)	100 (1.34)	197 (1.23)	211 (1.64)	4.20	.123		
Bisexual	1,648 (4.99)	258 (3.29)	591 (4.24)	799 (6.18)	54.21	< .001		
Sexual Attraction								
Only to Males	25,286 (85.52)	6,483 (85.78)	9,960 (82.92)	8,843 (80.41)	42.52	< .001		
Only to Females	315 (0.88)	56 (0.67)	124 (0.77)	135 (1.07)	6.00	.050		
To Both	5,068 (15.62)	987 (12.75)	1,985 (15.55)	2,096 (17.30)	34.65	< .001		
Not sure	337 (0.99)	70 (0.80)	117 (0.76)	150 (1.22)	7.49	.023		
Sexual Behavior, Past Year								
Only Males	23,417 (90.46)	5,925 (90.06)	9,208 (89.87)	8,284 (91.05)	3.43	.179		
Only Females	365 (1.26)	92 (1.33)	160 (1.11)	113 (1.31)	.88	.645		
Both	1,087 (3.54)	222 (3.37)	439 (3.48)	426 (3.68)	.67	.717		
No Sex Partners	1,495 (4.74)	410 (5.25)	733 (5.53)	352 (3.96)	13.41	.001		
<i>Health Behaviors, Past Year</i>								
Sexual risk behavior ^c	19,628 (87.50)	4,918 (89.43)	7,576 (86.09)	7,134 (87.22)	14.37	.001		
Received medication for STIs	1,504 (3.93)	310 (3.38)	591 (4.00)	603 (4.21)	5.89	.052		
Binge drinking once a month	3,590 (14.81)	951 (16.87)	1,542 (16.95)	1,097 (12.44)	34.20	< .001		
Any recreational drug use	5,571 (16.37)	1,308 (16.39)	2,220 (16.63)	2,043 (16.20)	.24	.885		

^aTotal n may not add up to 100% due to missing responses.

^bResults based on Rao-Scott modified chi square tests.

^cSexual risk behavior defined as: any self-reported past-year transactional sex with male partners, any sex with male partners with high HIV risk (i.e., HIV-positive males, males who use injection drugs, males who had sex with males, or males who had other concurrent partners of any sex), any sex with five or more male partners, or any condomless penile-vaginal intercourse with male partners.

Table 3.

Past-Year Health Behaviors by Sexual Orientation and National Survey of Family Growth Survey Cycles, 2002-2015, Females Aged 15-44 ($N = 31,222$)^a

Sexual Orientation	Unweighted N	Health Behavior Unweighted n (weighted %)	2002 Unweighted n (weighted %)	2006-2010 Unweighted n (weighted %)	2011-2015 Unweighted n (weighted %)	χ^2	b p
STI/HIV-Related Sexual Risk Behavior ^c							
Sexual Identity							
Heterosexual	38,217	18,103 (87.37)	4,462 (89.14)	7,082 (86.06)	6,559 (87.14)	11.40	.003
Gay/lesbian	508	82 (78.32)	31 (89.14)	27 (80.53)	24 (62.98)	28.32	< .001
Bisexual	1,648	1,093 (89.81)	172 (94.17)	401 (87.57)	520 (89.53)	4.90	.087
Sexual Attraction							
Only to Males	25,286	15,905 (87.23)	4,181 (89.48)	6,111 (85.35)	5,613 (86.96)	18.53	< .001
Only to Females	315	47 (72.29)	14 (83.51)	17 (80.78)	16 (59.38)	292.96	< .001
To Both	5,068	3,519 (89.07)	690 (89.19)	1,400 (90.04)	1,429 (88.50)	0.97	.615
Not sure	337	141 (89.68)	28 (93.22)	47 (79.93)	66 (92.44)	11.21	.004
Sexual Behavior, Past Year							
Only Males	23,417	18,608 (87.39)	4,697 (89.22)	7,184 (86.00)	6,727 (87.17)	12.75	.002
Only Females	365	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	--	--
Both	1,087	943 (90.46)	192 (93.44)	379 (88.25)	372 (90.13)	3.00	.223
No Sex Partners	1,495	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	--	--
Received Medication for STIs							
Sexual Identity							
Heterosexual	38,217	1,295 (3.73)	264 (3.20)	508 (3.75)	523 (4.02)	4.92	.086
Gay/lesbian	508	21 (2.74)	2 (2.52)	11 (3.73)	8 (2.41)	1.15	.564
Bisexual	1,648	144 (6.88)	15 (5.54)	63 (9.17)	66 (6.36)	3.04	.221
Sexual Attraction							
Only to Males	25,286	1,063 (3.44)	241 (3.10)	408 (3.31)	414 (3.73)	3.22	.200
Only to Females	315	17 (4.12)	3 (4.54)	5 (4.00)	9 (4.02)	0.06	.968
To Both	5,068	394 (6.38)	59 (5.16)	171 (7.81)	164 (6.16)	4.19	.123
Not sure	337	27 (5.93)	6 (4.73)	7 (2.55)	14 (5.60)	5.12	.080
Sexual Behavior							

Sexual Orientation	Unweighted N	Health Behavior Unweighted n (weighted %)	2002 Unweighted n (weighted %)	2006-2010 Unweighted n (weighted %)	2011-2015 Unweighted n (weighted %)	χ^2	p
Only Males	23,417	1,236 (4.28)	260 (3.70)	490 (4.41)	486 (4.55)	4.48	.106
Only Females	365	5 (1.50)	1 (1.69)	2 (0.81)	2 (1.74)	0.53	.767
Both	1,087	158 (12.05)	20 (8.70)	73 (12.89)	65 (13.41)	2.19	.334
No Sex Partners	1,495	37 (2.32)	15 (2.56)	13 (1.77)	9 (2.58)	0.42	.811
Any Recreational Drug Use							
Sexual Identity							
Heterosexual	38,217	4,576 (14.83)	1,099 (15.46)	1,851 (15.11)	1,626 (14.32)	1.93	.380
Gay/lesbian	508	171 (32.40)	21 (20.55)	75 (41.02)	75 (34.13)	12.22	.002
Bisexual	1,648	723 (42.34)	116 (42.63)	270 (44.75)	337 (41.31)	0.82	.665
Sexual Attraction							
Only to Males	25,286	3,434 (12.46)	883 (13.37)	1,384 (12.38)	1,167 (11.94)	3.20	.203
Only to Females	315	109 (34.12)	15 (21.97)	45 (38.91)	49 (36.50)	8.62	.013
To Both	5,068	1,963 (36.11)	395 (36.66)	772 (38.68)	796 (34.55)	3.48	.176
Not Sure	337	57 (18.90)	12 (19.32)	18 (12.54)	27 (21.03)	1.60	.448
Sexual Behavior							
Only Males	23,417	4,125 (15.89)	988 (15.72)	1,662 (16.54)	1,475 (15.61)	1.05	.591
Only Females	365	113 (25.08)	23 (23.36)	58 (36.61)	32 (20.32)	6.22	.044
Both	1,087	621 (55.42)	137 (61.45)	256 (56.83)	228 (51.36)	3.04	.218
No Sex Partners	1,495	148 (9.64)	38 (9.17)	71 (8.52)	39 (10.95)	1.02	.600
Binge Drinking at Least Once a Month							
Sexual Identity							
Heterosexual	38,217	3,075 (13.83)	797 (15.71)	1,369 (16.01)	909 (11.53)	30.92	< .001
Gay/lesbian	508	102 (25.41)	21 (27.89)	39 (25.79)	42 (19.58)	10.10	.006
Bisexual	1,648	323 (25.83)	62 (30.45)	121 (28.92)	140 (23.25)	4.33	.115
Sexual Attraction							
Only to Males	25,286	2,487 (12.92)	701 (15.10)	1,080 (14.74)	706 (10.57)	30.45	< .001
Only to Females	315	71 (26.33)	15 (29.46)	28 (41.19)	28 (19.18)	14.05	.001
To Both	5,068	984 (22.30)	218 (25.34)	420 (25.47)	346 (19.37)	10.33	.006
Not Sure	337	43 (27.05)	15 (49.03)	13 (29.98)	15 (17.26)	33.90	< .001

Sexual Orientation	Unweighted <i>N</i>	Health Behavior <i>n</i> (weighted %)	2002 Unweighted <i>n</i> (weighted %)	2006-2010 Unweighted <i>n</i> (weighted %)	2011-2015 Unweighted <i>n</i> (weighted %)	χ^2	<i>p</i>
Sexual Behavior							
Only Males	23,417	2,840 (14.40)	764 (16.45)	1,238 (16.75)	838 (11.90)	30.73	< .001
Only Females	365	67 (23.17)	14 (13.93)	31 (25.16)	22 (27.50)	3.75	.153
Both	1,087	335 (37.70)	74 (42.68)	148 (44.00)	113 (32.45)	6.63	.036
No Sex Partners	1,495	89 (9.27)	24 (12.54)	49 (10.87)	16 (5.64)	4.87	.088

^aTotal *N* may not add up to 100% due to missing responses.

^bResults based on Rao-Scott modified chi square tests.

^cSexual risk behavior defined as: any self-reported past-year transactional sex with male partners, any sex with male partners with high HIV risk (i.e., HIV-positive males, males who use injection drugs, males who had sex with males, or males who had other concurrent partners of any sex), any sex with five or more male partners, or any condomless penile-vaginal intercourse with male partners.

Table 4.
Logistic Regression Models, National Survey of Family Growth, 2002-2015, Females Aged 15-44

	Crude Associations		Final Multivariable Models ^a	
	OR (95% CI)	<i>p</i>	AOR (95% CI)	<i>p</i>
Past Year STI/HIV-Related Sexual Risk Behaviors ^b (Final Multivariable Model D1, <i>n</i> = 22,140)				
Sexual Identity	<i>n</i> = 22,230			
Heterosexual ^c	1.00		1.00	
Gay/Lesbian	0.52 (0.26, 1.07)	.076	0.57 (0.28, 1.17)	.123
Bisexual	1.28 (0.98, 1.67)	.075	1.10 (0.80, 1.51)	.548
Sexual Attraction	<i>n</i> = 22,600			
Only to Males ^c	1.00		1.00	
Only to Females	0.38 (0.16, 0.92)	.033	0.40 (0.14, 1.16)	.093
To Both	1.19 (1.02, 1.40)	.030	1.26 (1.04, 1.53)	.016
Not Sure	1.27 (0.60, 2.71)	.527	1.29 (0.54, 3.22)	.588
Sexual Behavior, Past Year	<i>n</i> = 22,531			
Only Males ^c	1.00		1.00	
Only Females	<i>d</i>	--	<i>d</i>	
Both	1.37 (1.04, 1.79)	.024	1.75 (1.29, 2.37)	< .001
No Sex Partners	<i>d</i>	--	<i>d</i>	
Survey Cycle	<i>n</i> = 22,621			
2002 ^c	1.00		1.00	
2006-2010	0.73 (0.63, 0.85)	< .001	0.76 (0.66, 0.89)	.001
2011-2015	0.81 (0.69, 0.94)	.007	0.84 (0.73, 0.98)	.030
Age (continuous)	<i>n</i> = 22,621			
	1.05 (1.04, 1.05)	< .001	1.04 (1.03, 1.04)	< .001
Race & Ethnicity	<i>n</i> = 22,621			
Hispanic, Any Race	0.82 (0.71, 0.94)	.006	0.83 (0.71, 0.97)	.018
Black, Non-Hispanic	0.78 (0.68, 0.89)	< .001	0.94 (0.81, 1.09)	.423

	Crude Associations		Final Multivariable Models ^a	
	OR (95% CI)	p	AOR (95% CI)	p
Other Race, Non-Hispanic	0.66 (0.53, 0.81)	< .001	0.70 (0.56, 0.87)	.001
White, Non-Hispanic ^c	1.00		1.00	
Education Level	n = 22,621			
No High School	0.92 (0.78, 1.06)	.231	1.47 (1.24, 1.73)	< .001
High School/GED	1.32 (1.11, 1.57)	.002	1.70 (1.43, 2.01)	< .001
Some College/Associate's	1.07 (0.94, 1.23)	.314	1.39 (1.21, 1.59)	.018
Bachelor's or Higher ^c	1.00		1.00	
Married/Living with Partner	n = 22,621			
Yes	2.05 (1.83, 2.30)	< .001	2.24 (1.99, 2.53)	< .001
No ^c	1.00		1.00	
Received Medication for STIs in the Past Year (Final Multivariable Model D2, n = 25,289)				
Sexual Identity	n = 30,339			
Heterosexual ^c	1.00		1.00	
Gay/Lesbian	0.73 (0.41, 1.28)	.268	d	
Bisexual	1.91 (1.43, 2.53)	< .001	0.78 (0.54, 1.15)	.213
Sexual Attraction	n = 30,971			
Only to Males ^c	1.00		1.00	
Only to Females	1.21 (0.67, 2.19)	.535	d	
To Both	1.92 (1.58, 2.32)	< .001	1.58 (1.24, 2.02)	< .001
Not Sure	1.77 (1.01, 3.10)	.047	0.95 (0.47, 1.93)	.888
Sexual Behavior, Past Year	n = 26,342			
Only Males ^c	1.00		1.00	
Only Females	0.34 (0.11, 1.05)	.060	d	
Both	3.06 (2.29, 4.10)	< .001	1.77 (1.24, 2.52)	.002
No Sex Partners	0.53 (0.30, 0.93)	.027	0.42 (0.23, 0.76)	.004
Survey Cycle	n = 31,040			

	Crude Associations		Final Multivariable Models ^a	
	OR (95% CI)	p	AOR (95% CI)	p
2002 ^c	1.00		1.00	
2006-2010	1.91 (1.00, 1.43)	.057	1.18 (0.97, 1.43)	.100
2011-2015	1.26 (1.04, 1.51)	.018	1.25 (1.01, 1.54)	.042
	n = 31,040			
Age (continuous)	0.97 (0.96, 0.98)	< .001	0.97 (0.96, 0.98)	< .001
Race & Ethnicity	n = 31,040			
Hispanic, Any Race	1.28 (1.02, 1.59)	.031	1.15 (0.87, 1.49)	.297
Black, Non-Hispanic	2.21 (1.85, 2.65)	< .001	1.72 (1.40, 2.10)	< .001
Other Race, Non-Hispanic	1.22 (0.81, 1.84)	.349	1.26 (0.76, 2.11)	.372
White, Non-Hispanic ^c	1.00		1.00	
Education Level	n = 31,040			
No High School	1.95 (1.49, 2.56)	< .001	1.75 (1.30, 2.37)	< .001
High School/GED	1.84 (1.41, 2.40)	< .001	1.35 (1.03, 1.78)	.029
Some College/Associate's	1.70 (1.27, 2.27)	< .001	1.31 (0.98, 1.75)	.065
Bachelor's or Higher ^c	1.00		1.00	
Married/Living with Partner	n = 31,040			
Yes	0.55 (0.46, 0.65)	< .001	0.54 (0.45, 0.64)	< .001
No ^c	1.00		1.00	
Any Past-Year Recreational Drug Use (Final Multivariable Model D3, n = 25,792)				
Sexual Identity	n = 30,323			
Heterosexual ^c	1.00		1.00	
Gay/Lesbian	2.75 (2.13, 3.54)	< .001	0.81 (0.50, 1.31)	.381
Bisexual	4.22 (3.59, 4.95)	< .001	1.14 (0.90, 1.43)	.272
Sexual Attraction	n = 30,956			
Only to Males ^c	1.00		1.00	
Only to Females	3.64 (2.62, 5.06)	< .001	3.11 (1.84, 5.26)	< .001
To Both	3.97 (3.61, 4.38)	< .001	2.91 (2.54, 3.34)	< .001

	Crude Associations		Final Multivariable Models ^a	
	OR (95% CI)	p	AOR (95% CI)	p
Not Sure	1.64 (1.01, 2.67)	.048	2.03 (1.23, 3.34)	.006
Sexual Behavior, Past Year	n = 26,372			
Only Males ^c	1.00		1.00	
Only Females	1.77 (1.27, 2.47)	.001	0.52 (0.34, 0.91)	.004
Both	6.58 (5.27, 8.21)	< .001	2.21 (1.70, 2.88)	< .001
No Sex Partners	0.57 (0.34, 0.74)	< .001	0.42 (0.31, 0.56)	< .001
Survey Cycle	n = 31,057			
2002 ^c	1.00		1.00	
2006-2010	1.02 (0.98, 1.16)	.795	0.99 (0.86, 1.14)	.903
2011-2015	0.99 (0.87, 1.12)	.834	0.91 (0.79, 1.05)	.206
	n = 31,057			
Age (continuous)	0.94 (0.94, 0.95)	< .001	0.94 (0.94, 0.95)	< .001
Race & Ethnicity	n = 31,057			
Hispanic, Any Race	0.67 (0.60, 0.76)	< .001	0.57 (0.49, 0.66)	< .001
Black, Non-Hispanic	1.04 (0.94, 1.16)	.445	0.78 (0.69, 0.88)	< .001
Other Race, Non-Hispanic	0.68 (0.54, 0.86)	.001	0.76 (0.57, 1.01)	.058
White, Non-Hispanic ^c	1.00		1.00	
Education Level	n = 31,057			
No High School	2.00 (1.74, 2.29)	< .001	1.44 (1.21, 1.71)	< .001
High School/GED	1.89 (1.67, 2.16)	< .001	1.47 (1.26, 1.71)	< .001
Some College/Associate's	2.00 (1.75, 2.28)	< .001	1.52 (1.33, 1.74)	< .001
Bachelor's or Higher ^c	1.00		1.00	
Married/Living with Partner	n = 31,057			
Yes	0.42 (0.38, 0.46)	< .001	0.46 (0.41, 0.52)	< .001
No ^c	1.00		1.00	
Any Past-Year Binge Drinking at Least Once a Month (Final Multivariable Model D4, n = 20,252)				
Sexual Identity	n = 22,663			

	Crude Associations		Final Multivariable Models ^a	
	OR (95% CI)	p	AOR (95% CI)	p
Heterosexual ^c	1.00		1.00	
Gay/Lesbian	2.12 (1.50, 3.00)	< .001	1.06 (0.51, 2.19)	.881
Bisexual	2.17 (1.77, 2.65)	< .001	1.09 (0.83, 1.42)	.546
Sexual Attraction	n = 23,012			
Only to Males ^c	1.00		1.00	
Only to Females	2.41 (1.58, 3.67)	< .001	1.92 (0.90, 4.11)	.093
To Both	1.93 (1.70, 2.20)	< .001	1.44 (1.20, 1.71)	< .001
Not Sure	2.50 (1.51, 4.13)	< .001	1.71 (0.73, 4.00)	.214
Sexual Behavior, Past Year	n = 20,569			
Only Males ^c	1.00		1.00	
Only Females	1.79 (1.10, 2.93)	.020	0.82 (0.34, 1.95)	.649
Both	3.60 (2.87, 4.52)	< .001	2.03 (1.54, 2.66)	< .001
No Sex Partners	0.61 (0.42, 0.88)	.008	0.44 (0.30, 0.66)	< .001
Survey Cycle	n = 23,061			
2002 ^c	1.00		1.00	
2006-2010	1.01 (0.86, 1.17)	0.94	1.04 (0.89, 1.21)	.622
2011-2015	0.70 (0.60, 0.82)	< .001	0.69 (0.59, 0.80)	< .001
	0.70 (0.60, 0.82)			
	n = 23,061			
Age (continuous)	0.96 (0.95, 0.96)	< .001	0.97 (0.96, 0.97)	< .001
Race & Ethnicity	n = 23,061			
Hispanic, Any Race	0.88 (0.76, 1.03)	.108	0.87 (0.74, 1.03)	.103
Black, Non-Hispanic	0.03 (0.72, 0.96)	.013	0.64 (0.54, 0.76)	< .001
Other Race, Non-Hispanic	0.8 (0.54, 0.87)	.002	0.70 (0.53, 0.92)	.010
White, Non-Hispanic ^c	1.00		1.00	
Education Level	n = 23,061			
No High School	1.71 (1.42, 2.05)	< .001	1.10 (0.88, 1.38)	.387
High School/GED	1.93 (1.62, 2.30)	< .001	1.51 (1.25, 1.83)	< .001
Some College/Associate's	1.82 (1.54, 2.14)	< .001	1.42 (1.20, 1.67)	< .001

Crude Associations		Final Multivariable Models ^a	
OR (95% CI)	p	AOR (95% CI)	p
1.00		1.00	
Bachelor's or Higher ^c			
Married/Living with Partner	n = 23,061		
Yes	0.49 (0.43, 0.54)	0.49 (0.42, 0.56)	< .001
No ^c	1.00	1.00	

^a All final multivariable models adjusted for age, race/ethnicity, education level, marital/cohabitation status, and survey cycle.

^b Sexual risk behavior defined as: any self-reported past-year transactional sex with male partners, any sex with male partners with high HIV risk (i.e., HIV-positive males, males who use injection drugs, males who had sex with males, or males who had other concurrent partners of any sex), any sex with five or more male partners, or any condomless penile-vaginal intercourse with male partners.

^c Reference category

^d Excluded due to inapplicability or small sample size.

Table 5.

Trends in Health Disparities among Sexual Minority Women in the National Survey of Family Growth, 2002-2015, Females Aged 15-44; Interactions between Sexual Orientation Components and Survey Cycles in Logistic Regression Models D1-D4

Interactions	AOR (95% CI)	p
Model D1 - Past-Year STI/HIV-Related Sexual Risk Behaviors ^a		
Sexual Identity by Survey Cycle		
Heterosexual by 2002 ^b	1.00	
Lesbian by 2006-2010	0.56 (0.07, 4.39)	.581
Bisexual by 2006-2010	0.40 (0.14, 1.09)	.074
Lesbian by 2011-2015	0.25 (0.04, 1.61)	.145
Bisexual by 2011-2015	0.63 (0.24, 1.64)	.340
Sexual Attraction by Survey Cycle		
Only to Males by 2002 ^b	1.00	
Only to Females by 2006-2010	2.65 (0.19, 37.39)	.472
To Both by 2006-2010	2.02 (1.31, 3.12)	.002
Not Sure by 2006-2010	0.49 (0.07, 3.56)	.478
Only to Females by 2011-2015	1.80 (0.16, 20.62)	.638
To Both by 2011-2015	1.27 (0.82, 1.97)	.295
Not Sure by 2011-2015	1.80 (0.28, 11.68)	.537
Past-Year Sexual Behavior by Survey Cycle		
Only Males by 2002 ^b	1.00	
Both by 2006-2010	0.53 (0.21, 1.34)	.180
Both by 2011-2015	0.76 (0.32, 1.79)	.527
Model D2 - Received Medication for STIs in the Past Year		
Sexual Identity by Survey Cycle		
Heterosexual by 2002 ^b	1.00	
Bisexual by 2006-2010	1.33 (0.41, 4.31)	.638
Bisexual by 2011-2015	0.97 (0.31, 3.05)	.954

Interactions	AOR (95% CI)	p
Sexual Attraction by Survey Cycle		
Only to Males by 2002 ^b	1.00	
To Both by 2006-2010	1.44 (0.77, 2.70)	.257
Not Sure by 2006-2010	0.30 (0.06, 1.43)	.133
To Both by 2011-2015	1.01 (0.53, 1.93)	.966
Not Sure by 2011-2015	0.46 (0.11, 1.98)	.297
Past-Year Sexual Behavior by Survey Cycle		
Only Males by 2002 ^b	1.00	
Both by 2006-2010	0.79 (0.26, 2.42)	.687
No Sex Partners by 2006-2010	0.60 (0.20, 1.74)	.346
Both by 2011-2015	1.22 (0.44, 3.39)	.700
No Sex Partners by 2011-2015	0.84 (0.23, 3.10)	.798
Model D3 - Any Past-Year Recreational Drug Use		
Sexual Identity by Survey Cycle		
Heterosexual by 2002 ^b	1.00	
Lesbian by 2006-2010	3.60 (1.16, 11.17)	.028
Bisexual by 2006-2010	1.40 (0.81, 2.45)	.232
Lesbian by 2011-2015	1.89 (0.61, 5.87)	.269
Bisexual by 2011-2015	2.22 (1.27, 3.87)	.005
Sexual Attraction by Survey Cycle		
Only to Males by 2002 ^b	1.00	
Only to Females by 2006-2010	0.67 (0.18, 2.48)	.554
To Both by 2006-2010	1.17 (0.83, 1.65)	.372
Not Sure by 2006-2010	0.29 (0.06, 1.44)	.133
Only to Females by 2011-2015	1.76 (0.48, 6.40)	.393
To Both by 2011-2015	1.05 (0.75, 1.46)	.788
Not Sure by 2011-2015	0.47 (0.12, 1.88)	.288
Past-Year Sexual Behavior by Survey Cycle		
Only Males by 2002 ^b	1.00	

Interactions	AOR (95% CI)	p
Only Females by 2006-2010	0.73 (0.24, 2.26)	.592
Both by 2006-2010	0.53 (0.28, 1.00)	.052
No Sex Partners by 2006-2010	0.80 (0.46, 1.39)	.420
Only Females by 2011-2015	0.31 (0.10, 0.95)	.042
Both by 2011-2015	0.46 (0.25, 0.85)	.015
No Sex Partners by 2011-2015	1.19 (0.62, 2.27)	.604
Model D4 - Any Past-Year Binge Drinking at Least Once a Month		
Sexual Identity by Survey Cycle		
Heterosexual by 2002 ^b	1.00	
Lesbian by 2006-2010	1.25 (0.30, 5.25)	.761
Bisexual by 2006-2010	0.83 (0.46, 1.51)	.546
Lesbian by 2011-2015	0.30 (0.06, 1.61)	.160
Bisexual by 2011-2015	1.15 (0.61, 2.15)	.670
Sexual Attraction by Survey Cycle		
Only to Males by 2002 ^b	1.00	
Only to Females by 2006-2010	0.59 (0.11, 3.13)	.532
To Both by 2006-2010	1.12 (0.76, 1.63)	.568
Not Sure by 2006-2010	0.32 (0.04, 2.57)	.287
Only to Females by 2011-2015	0.66 (0.11, 4.02)	.649
To Both by 2011-2015	1.08 (0.70, 1.66)	.741
Not Sure by 2011-2015	0.37 (0.06, 2.43)	.300
Past-Year Sexual Behavior by Survey Cycle		
Only Males by 2002 ^b	1.00	
Only Females by 2006-2010	1.67 (0.46, 5.99)	.435
Both by 2006-2010	1.04 (0.53, 2.05)	.908
No Sex Partners by 2006-2010	0.80 (0.35, 1.84)	.600
Only Females by 2011-2015	6.40 (1.29, 31.83)	.024
Both by 2011-2015	0.84 (0.43, 1.62)	.598
No Sex Partners by 2011-2015	0.58 (0.21, 1.57)	.287

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Sexual risk behavior defined as: any self-reported past-year transactional sex with male partners, any sex with male partners with high HIV risk (i.e., HIV-positive males, males who use injection drugs, males who had sex with males, or males who had other concurrent partners of any sex), any sex with five or more male partners, or any condomless penile-vaginal intercourse with male partners.

Reference category
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Table 6.

Final Multivariable Models (D1, D3, D4) Stratified by National Survey of Family Growth Survey Cycle, Females Aged 15-44

	2002 (<i>n</i> = 5,126)			2006-2010 (<i>n</i> = 8,776)			2011-2015 (<i>n</i> = 8,143)		
	AOR	(95% CI)	<i>p</i>	AOR	(95% CI)	<i>p</i>	AOR	(95% CI)	<i>p</i>
Past-Year STI/HIV-Related Sexual Risk Behaviors, ^a Stratified Model D1									
Sexual Identity									
Heterosexual ^b	1.00			1.00			1.00		
Gay/Lesbian	1.04 (0.24, 4.54)	.233		0.63 (0.14, 2.75)	.537		0.27 (0.09, 0.84)	.024	
Bisexual	1.69 (0.70, 4.06)	.244		0.70 (0.41, 1.19)	.192		1.17 (0.76, 1.82)	.474	
Sexual Attraction									
Only to Males ^b	1.00			1.00			1.00		
Only to Females	0.29 (0.04, 1.89)	.194		0.78 (0.12, 5.19)	.793		0.52 (0.11, 2.38)	.395	
To Both	0.90 (0.65, 1.25)	.531		1.92 (1.43, 2.57)	<.001		1.18 (0.87, 1.61)	.285	
Not Sure	1.18 (0.30, 4.63)	.817		0.58 (0.13, 2.56)	.470		2.22 (0.59, 8.32)	.238	
Sexual Behavior, Past Year									
Only Males ^b	1.00			1.00			1.00		
Only Females	c	--		c	--		c	--	
Both	2.31 (1.08, 4.95)	.032		1.31 (0.75, 2.27)	.343		1.99 (1.30, 3.07)	.002	
No Sex Partners	c	--		c	--		c	--	
Age (continuous)	1.02 (1.01, 1.04)	.012		1.04 (1.03, 1.05)	<.001		1.04 (1.02, 1.05)	<.001	
Race & Ethnicity									
Hispanic, Any Race	0.92 (0.69, 1.24)	.594		0.93 (0.73, 1.18)	.558		0.77 (0.61, 0.97)	.028	
Black, Non-Hispanic	1.03 (0.75, 1.40)	.866		0.92 (0.71, 1.19)	.528		0.90 (0.73, 1.12)	.355	
Other Race, Non-Hispanic	0.84 (0.57, 1.23)	.366		0.57 (0.38, 0.86)	.007		0.74 (0.52, 1.04)	.085	
White, Non-Hispanic ^b	1.00			1.00			1.00		
Education Level									
No High School	1.39 (0.95, 2.03)	.087		1.84 (1.44, 2.34)	<.001		1.26 (0.98, 1.62)	.067	
High School/GED	2.26 (1.60, 3.21)	<.001		1.62 (1.29, 2.04)	<.001		1.59 (1.20, 2.10)	.001	
Some College/Associate's	1.30 (0.99, 1.72)	.062		1.31 (1.05, 1.63)	.015		1.52 (1.24, 1.89)	<.001	

	2002 (<i>n</i> = 5,126)			2006-2010 (<i>n</i> = 8,776)			2011-2015 (<i>n</i> = 8,143)		
	AOR	(95% CI)	<i>p</i>	AOR	(95% CI)	<i>p</i>	AOR	(95% CI)	<i>p</i>
Bachelor's or Higher ^b	1.00			1.00			1.00		
Married/Living with Partner									
Yes	1.73 (1.34, 2.25)		< .001	2.26 (1.88, 2.72)		< .001	2.51 (2.08, 3.03)		< .001
No ^b	1.00			1.00			1.00		
	2002 (<i>n</i> = 6,374)			2006-2010 (<i>n</i> = 10,408)			2011-2015 (<i>n</i> = 9,110)		
	AOR	(95% CI)	<i>p</i>	AOR	(95% CI)	<i>p</i>	AOR	(95% CI)	<i>p</i>
Sexual Identity									
Heterosexual ^b	1.00			1.00			1.00		
Gay/Lesbian	0.38 (0.18, 0.81)		.126	1.45 (0.64, 1.34)		.375	0.77 (0.34, 1.77)		.537
Bisexual	0.62 (0.39, 0.98)		.041	0.96 (0.69, 1.35)		.807	1.52 (1.08, 2.14)		.017
Sexual Attraction									
Only to Males ^b	1.00			1.00			1.00		
Only to Females	3.00 (1.17, 7.08)		.022	1.88 (0.75, 4.71)		.175	4.71 (1.88, 11.80)		.001
To Both	2.74 (2.09, 3.61)		< .001	3.16 (2.54, 3.93)		< .001	2.78 (2.25, 3.44)		< .001
Not Sure	4.05 (1.09, 15.14)		.037	1.17 (0.45, 3.03)		.744	2.03 (1.06, 3.87)		.033
Sexual Behavior, Past Year									
Only Males ^b	1.00			1.00			1.00		
Only Females	0.93 (0.36, 2.40)		.885	0.69 (0.35, 1.35)		.275	0.33 (0.17, 0.63)		.001
Both	3.91 (2.39, 6.40)		< .001	2.15 (1.44, 3.20)		< .001	1.81 (1.22, 2.69)		.003
No Sex Partners	0.39 (0.26, 0.60)		< .001	0.31 (0.20, 0.47)		< .001	0.54 (0.31, 0.94)		.028
Age (continuous)	0.94 (0.93, 0.96)		< .001	0.96 (0.95, 0.97)		< .001	0.93 (0.92, 0.94)		< .001
Race & Ethnicity									
Hispanic, Any Race	0.47 (0.36, 0.63)		< .001	0.48 (0.38, 0.60)		< .001	0.67 (0.54, 0.83)		< .001
Black, Non-Hispanic	0.62 (0.49, 0.77)		< .001	0.74 (0.59, 0.94)		.013	0.91 (0.76, 1.09)		.316
Other Race, Non-Hispanic	1.01 (0.51, 2.01)		.976	0.85 (0.53, 1.36)		.492	0.60 (0.42, 0.85)		.004
White, Non-Hispanic ^b	1.00			1.00			1.00		
Education Level									
No High School	1.90 (1.33, 2.72)		.001	1.52 (1.16, 2.00)		.003	1.14 (0.86, 1.51)		.363

	2002 (<i>n</i> = 5,126)			2006-2010 (<i>n</i> = 8,776)			2011-2015 (<i>n</i> = 8,143)		
	AOR	(95% CI)	<i>p</i>	AOR	(95% CI)	<i>p</i>	AOR	(95% CI)	<i>p</i>
High School/GED	1.85 (1.39, 2.46)		< .001	1.33 (1.04, 1.70)		.022	1.39 (1.08, 1.79)		.002
Some College/Associate's	1.61 (1.22, 2.12)		.001	1.21 (0.98, 1.50)		.071	1.67 (1.34, 2.07)		< .001
Bachelor's or Higher ^b	1.00			1.00			1.00		
Married/Living with Partner									
Yes	0.40 (0.31, 0.52)		< .001	0.43 (0.36, 0.52)		< .001	0.52 (0.43, 0.63)		< .001
No ^b	1.00			1.00			1.00		
	2002 (<i>n</i> = 4,840)			2006-2010 (<i>n</i> = 8,163)			2011-2015 (<i>n</i> = 7,249)		
	AOR	(95% CI)	<i>p</i>	AOR	(95% CI)	<i>p</i>	AOR	(95% CI)	<i>p</i>
Sexual Identity									
Heterosexual ^b	1.00			1.00			1.00		
Gay/Lesbian	1.59 (0.76, 3.34)		.217	1.85 (0.51, 6.69)		.350	0.44 (0.10, 1.93)		.278
Bisexual	1.01 (0.64, 1.58)		.983	0.88 (0.59, 1.29)		.503	1.23 (0.81, 1.85)		.336
Sexual Attraction									
Only to Males ^b	1.00			1.00			1.00		
Only to Females	2.82 (0.80, 9.97)		.108	1.88 (0.53, 6.68)		.329	2.14 (0.54, 8.42)		.278
To Both	1.26 (0.92, 1.71)		.153	1.43 (1.13, 1.81)		.003	1.48 (1.08, 2.02)		.014
Not Sure	3.09 (0.81, 11.82)		.099	1.34 (0.27, 6.62)		.720	1.50 (0.48, 4.67)		.481
Sexual Behavior, Past Year									
Only Males ^b	1.00			1.00			1.00		
Only Females	0.29 (0.13, 0.64)		.002	0.49 (0.17, 1.39)		.179	1.99 (0.52, 7.68)		.315
Both	2.02 (1.21, 3.37)		.007	2.32 (1.48, 3.64)		< .001	1.92 (1.25, 2.97)		.003
No Sex Partners	0.53 (0.28, 1.00)		.048	0.45 (0.25, 0.79)		.006	0.34 (0.15, 0.75)		.008
Age (continuous)	0.96 (0.95, 0.98)		< .001	0.96 (0.94, 0.97)		< .001	0.98 (0.96, 0.99)		.003
Race & Ethnicity									
Hispanic, Any Race	0.75 (0.55, 1.01)		.057	0.69 (0.51, 0.93)		.013	1.07 (0.83, 1.39)		.593
Black, Non-Hispanic	0.52 (0.40, 0.69)		< .001	0.52 (0.39, 0.68)		< .001	0.83 (0.62, 1.10)		.197
Other Race, Non-Hispanic	0.81 (0.49, 1.35)		.422	0.47 (0.30, 0.73)		.001	0.83 (0.56, 1.23)		.352
White, Non-Hispanic ^b	1.00			1.00			1.00		

	2002 (<i>n</i> = 5,126)		2006-2010 (<i>n</i> = 8,776)		2011-2015 (<i>n</i> = 8,143)	
	AOR (95% CI)	<i>p</i>	AOR (95% CI)	<i>p</i>	AOR (95% CI)	<i>p</i>
Education Level						
No High School	1.35 (0.91, 2.00)	.140	0.95 (0.70, 1.27)	.714	1.04 (0.67, 1.62)	.851
High School/GED	1.61 (1.12, 2.33)	.011	1.32 (1.01, 1.72)	.043	1.63 (1.18, 2.26)	.004
Some College/Associate's	1.54 (1.14, 2.08)	.005	1.26 (1.01, 1.58)	.039	1.46 (1.09, 1.96)	.012
Bachelor's or Higher ^b	1.00		1.00		1.00	
Married/Living with Partner						
Yes	0.32 (0.25, 0.41)	< .001	0.47 (0.38, 0.59)	< .001	0.56 (0.44, 0.72)	< .001
No ^b	1.00		1.00		1.00	

^aSexual risk behavior defined as: any self-reported past-year transactional sex with male partners, any sex with male partners with high HIV risk (i.e., HIV-positive males, males who use injection drugs, males who had sex with males, or males who had other concurrent partners of any sex), any sex with five or more male partners, or any condomless penile-vaginal intercourse with male partners.

^bReference category

^cExcluded from analyses due to inapplicability or small sample size.