



# Disparities in smoking during pregnancy by sexual orientation and race-ethnicity

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## ABSTRACT

The intersection between sexual orientation and race-ethnicity is emerging as an important dynamic for health. Prior research indicates that sexual orientation can have very different health implications for White, Black, and Latina individuals and that these patterns are unpredictable. Here we use U.S. data from the National Survey of Family Growth (2006–2019,  $n = 15,163$  pregnancies) to examine how an important health indicator – smoking during pregnancy – is shaped jointly by sexual orientation and race-ethnicity. Smoking during pregnancy was more common among sexual minority women (both bisexual-identified and heterosexual-identified who expressed same-gender attraction/behavior), compared to heterosexual women. Second, the association between sexual orientation and smoking during pregnancy differed by race-ethnicity: sexual minority status was more strongly associated with smoking among Latina women, compared to White women. Finally, the subgroup with the highest rates of smoking during pregnancy was bisexual White women. These findings indicate that smoking rates among pregnant sexual minority women warrant attention (regardless of race-ethnicity), particularly as births within this group are rising. It is important to address structural factors that may create more stress for sexual minority women, since smoking is often a response to stress. These findings also highlight the role of heterogeneity: low smoking rates among pregnant Latina women mask within-group disparities.

## 1. Introduction

Smoking during pregnancy is an area of concern within public health because it increases the risk of preterm birth, low birth weight, various birth defects, and sudden infant death syndrome (Center for Disease Control, 2019). Understanding which women are at elevated risk of smoking and why can inform policies to alleviate the structural factors contributing to smoking and help providers offer better care to patients. A substantial body of research has demonstrated that smoking behavior is shaped by sexual orientation (Corliss et al., 2014; Fallin et al., 2015; Marshal et al., 2009), and a parallel body of research has shown smoking behavior is structured by race-ethnicity (American Lung Association, 2020; Drake et al., 2018; Unger et al., 2001). However, status characteristics often interact to impact health, rather than simply being additive (Hsieh & Ruther, 2016). The concept of intersectionality argues that different power structures combine to create health patterns (Crenshaw, 1989; Bauer, 2014). While quantitative survey research is limited in its ability to fully illuminate these dynamics, it can identify how health indicators differ depending on various combinations of social identities

(Agenor, 2020). In this paper, we examine how sexual minority status and race shape smoking behavior, focusing on the critical period during pregnancy.

### 1.1. Sexual orientation and smoking

Prior research indicates that smoking behaviors differ by sexual orientation. Specifically, sexual minority individuals smoke at higher rates than their heterosexual counterparts, although their reported desire to quit is similar (Fallin et al., 2015). This disparity begins early, and behaviors continue to diverge: sexual minority adolescents and young adults are more likely than their heterosexual peers to smoke cigarettes and their use increases more rapidly over time compared to heterosexual youth (Marshal et al., 2009; Corliss et al., 2014; Corliss et al., 2013; Fish et al., 2019).

According to the stress process framework, people experience stress not only because of acute events but also due to everyday social conditions, and both can contribute to poor health (Mirowsky & Ross, 2003; Pearlin et al., 1999). Building on this idea, the minority stress

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framework argues that having an identity that is stigmatized – including being a sexual minority – can be a cause of such stress (Meyer, 2003). In turn, stress can negatively impact health both directly (through physiological effects of stress on the body) and indirectly (by creating a need for coping strategies that can be harmful to health, such as smoking) (Hatzenbuehler et al., 2010). Prior research has identified specific types of stressors that may lead to smoking among sexual minority women. These include internalized homophobia and negative reactions to disclosure of sexuality, such as family rejection and victimization (Blosnich et al., 2013; Gamarel et al., 2020; Bontempo & D'Augelli, 2002; Blosnich & Horn, 2011).

Smoking behavior may vary not only between heterosexual and sexual minority women, however, but also across sexual minority women, depending on their individual characteristics. In particular, sexual orientation is a multi-dimensional construct – consisting of sexual attraction, behavior, and identity – and these dimensions can combine in different ways, with different implications for stress and support. Women who identify as bisexual may experience stress stemming from biphobia and may lack community-based support, since bisexual women often report feel excluded from both lesbian and heterosexual communities (Roberts et al., 2015). In contrast, women who have same-gender attraction or behaviors but identify as heterosexual may experience stress from different sources (for example, stress related to concealing their sexual attractions or behaviors from others) (Meyer, 2003). Differences in the type and severity of stressors experienced may contribute to differences in smoking behavior across sexual minority subgroups.

Sexual orientation-based patterns in smoking during pregnancy, specifically, are not well established, however. A prior study finds that bisexual and lesbian women (grouped together) are more likely to smoke during pregnancy than heterosexual women, but the authors did not examine the role of other dimensions of sexual orientation (attraction and behavior) (Gonzales et al., 2019). In another recent study, bivariate descriptives indicated that women who have sex with women (WSW) but identify as heterosexual smoke at elevated rates during pregnancy, but it is unknown whether disparities hold when controlling for sociodemographic and pregnancy characteristics (Everett et al., 2019).

We expect that sexual minority women smoke at higher rates than heterosexual women during pregnancy for several reasons. First, extant research suggests that sexual minority women smoke at higher rates both in general and during in the preconception period (preconception smoking is a significant predictor of smoking during pregnancy) (Fallin et al., 2015; Corliss et al., 2013; Limburg et al., 2020). Third, research shows that pregnancy can create additional stressors for sexual minority women. Sexual minority women have to reconcile their own sexuality with an assumption (made in healthcare settings and the larger world) that they are heterosexual and that their pregnancy exists within a relationship with a male partner. This can cause some sexual minority women to feel invisible or like their identity has been erased (Ross et al., 2012). It may be that the presence of this pregnancy-specific set of stressors makes it more difficult for sexual minority women to quit or avoid smoking during pregnancy compared to heterosexual women.

### 1.2. Race-ethnicity and smoking

A separate body of research has examined racial-ethnic differences in smoking rates both in and out of pregnancy. Non-Latina White women have the highest rates of smoking during pregnancy (10.5%), followed by non-Latina black women (6%) and Latina women (1.8%) (Drake et al., 2018; Martin et al., 2019). We see the same racial-ethnic pattern in the broader (non-pregnant) population, but with much higher levels (16%, 13.5%, and 7.1%, respectively) (Unger et al., 2001; American Lung Association, 2020; Perreira & Cortes, 2006). The reasons for these differences are not fully understood, but previous research has identified several contributing factors, including differentials in self-reported stress and differences in the effect of peer smoking on own smoking

(Unger et al., 2001; Perreira & Cortes, 2006).

### 1.3. Sexual orientation and race-ethnicity

Based on prior research, we anticipate that the association between sexual minority status and smoking may differ depending on race-ethnicity. Some research finds sexual minority status to be associated with positive outcomes for non-White individuals in a way that it is not for Whites. For example, among heterosexual women, Black and Latina women are more likely to have unintended pregnancies than their White counterparts, but that relationship is reversed among sexual minority women (i.e., White sexual minority women are more likely to have unintended pregnancies than Black and Latina sexual minority women) (Everett, Mollborn, Jenkins, Limburg, & Diamond, 2020). However, for other outcomes, sexual minority status is associated with more positive outcomes for White women than for Black and Latina women: among heterosexual women, White women experience better birth outcomes (i.e., lower preterm birth and higher birth weight), and among sexual minority women, the health advantage of White women is even larger. (Everett et al., ) One of the few studies that examined the joint effects of race-ethnicity and sexual minority status on smoking found little evidence of meaningful interactions in the Youth Risk Behavior Survey data (Hsieh & Ruther, 2016). In sum, we expect that there may be moderating effects of race-ethnicity on the association between sexual minority status and smoking, but based on prior literature, it is difficult to anticipate the direction of the interaction a priori.

## 2. Materials and methods

Data come from the National Survey of Family Growth (NSFG), a nationally representative sample of the civilian, noninstitutionalized population ages 15–44. A variety of information is collected on the woman's prior pregnancies and births, sexual orientation and relationships, and sociodemographic factors. Data have been collected continuously since 2006, and available data from 2006 to 2019 are pooled to maximize sample size. Response rates varied from 65% in 2017–19 to 78% during the 2006–2010 period (National Center for Health Statistics, 2019). We use pregnancy histories from the “female” dataset, which is restricted to cisgender women (therefore, pregnancies to those who do not identify as women were not included in the study). We start with the full group of pregnancies that ended in live birth, miscarriage, or stillbirth and were eligible to be assessed on smoking (i.e., only pregnancies in the previous five years include smoking information). We then limit the sample to women who identify as White, Black, or Hispanic/Latina (since the “other” race-ethnicity category is small and also challenging to interpret due to its diversity) and limit it to women in one of our four sexual orientation categories. These limitations yield a starting sample of 15,423 pregnancies. From this group, we exclude 62 pregnancies to adolescents under 15 (0.4%), eleven pregnancies to women who did not answer questions on smoking (0.07%), and 187 pregnancies that were missing data on intention status (1%). The final analytic sample consists of 15,163 pregnancies.

### 2.1. Measures

**Smoking.** Women were asked whether they smoked during each pregnancy (1 = yes, 0 = no). Women who reported smoking during the pregnancy were also asked how much they smoked (1 = about one cigarette a day or less; 2 = just a few cigarettes a day (2–4 cigarettes), 3 = about half a pack a day (5–14 cigarettes), 4 = about a pack a day (15–24 cigarettes), 5 = about 1 1/2 packs a day (25–34 cigarettes), 6 = about 2 packs a day (35–44 cigarettes), 7 = more than 2 packs a day (45 or more cigarettes)).

**Sexual Orientation.** Respondents were asked about their sexual identity (i.e., whether “you think of yourself” as “heterosexual or straight” “homosexual, gay, or lesbian,” or “bisexual”), who they are

attracted to (“only attracted to males,” “mostly attracted to males,” “equally attracted to males and females,” “mostly attracted to females” or “only attracted to females”) and their past sexual experiences with male and female partners. We create four mutually-exclusive categories: (1) those who identify as “homosexual, gay, or lesbian” (hereafter “lesbian”), (2) those who identify as bisexual, (3) those who identify as heterosexual but have had sex with women or report some same-gender attraction (hereafter “heterosexual-WSW/SGA”), and (4) those who identify as heterosexual and do not report prior sex with women or same-gender attraction (hereafter “heterosexual”).

**Race-ethnicity.** We compare three groups: non-Latina White women (hereafter “White” or “NL White”), non-Latina Black women (hereafter “Black” or “NL Black”), and Hispanic/Latina women (hereafter “Latina”).

**Control variables.** Several control variables are included in the analysis because previous research indicates they are correlated with sexual orientation and/or race-ethnicity and may shape smoking behavior (Drake et al., 2018; Monte & Ellis, 2014; Mathews & Hamilton, 2016). Age at conception is treated as a continuous variable. Four categories are used for pregnancy order: first pregnancy (reference category), second pregnancy, third pregnancy, and fourth or higher-order pregnancy. Intention status of the pregnancy is categorized as: intended (coming at the “right time” or later than the woman wanted it; reference category), mistimed (coming earlier than the woman wanted it), or unwanted (coming when the woman wanted no future birth). Educational categories are: less than high school, high school or GED (reference category), some college, or a bachelor’s degree or above.

2.2. Analytic approach

To test whether there are differences in smoking during pregnancy by sexual orientation, we estimate logistic regression models in which the dependent variable is whether the woman reported smoking during the pregnancy. The key independent variable is sexual orientation, and models control for age at conception, pregnancy order, pregnancy intention status, and education. Models are estimated using the full group of pregnancies and then stratified by race-ethnicity. To identify possible moderation, we perform a statistical test to determine whether the coefficients differ across models<sup>1</sup> (specifically, whether the sexual orientation gap in smoking changes across race-ethnicity-stratified models) (Mize et al., 2019). This approach combines the covariance matrices of the models being compared and the results of the test are comparable to those from interaction terms within a single model (Mize et al., 2019). To facilitate interpretation further, we present predicted probabilities of smoking for the twelve possible combinations of race-ethnicity and sexual orientation.

Next, we examine the level of smoking (among those who reported any smoking) during the pregnancy. We estimate OLS regression models in which the dependent variable is the level of smoking (1–7 scale). These models follow the same format as the previous models (i.e. the key independent variable is sexual orientation, models are stratified by race-ethnicity, and sociodemographic factors are included as control variables).

3. Results

Descriptive statistics are presented in Table 1 and indicate some key differences by race-ethnicity and some notable similarities. Latina women had the lowest prevalence of smoking during pregnancy (4%), followed by Black women (9%), and then White women (16%). Among those who smoked, the amount of smoking was similar across racial-ethnic groups. White, Black, and Latina women differ in their distribution across sexual orientation categories, though the differences are not

**Table 1**  
Descriptive statistics, NSFG 2006–2019 (pregnancies; weighted).

|   | All    | Stratified by Mother’s Race-Ethnicity |          |        | Tests for difference across race-ethnicity <i>t</i> -test or chi-square) |
|---|--------|---------------------------------------|----------|--------|--|
|   |        | NL White                              | NL Black | Latina |  |
| Smoked during the pregnancy (%)                                   | 11.9   | 15.7                                  | 8.7      | 4.0    | a, b, c  |
| Amount smoked during pregnancy, among smokers <sup>1</sup> (mean) | 2.6    | 2.7                                   | 2.5      | 2.8    |  |
| Sexual Orientation  |        |                                       |          |        | d  |
| Heterosexual <sup>2</sup> (Ref)                                   | 76.4   | 74.5                                  | 74.6     | 83.0   |  |
| Heterosexual-WSW/SGA <sup>3</sup>                                 | 16.9   | 18.5                                  | 17.0     | 12.4   |  |
| Bisexual  | 6.2    | 6.4                                   | 7.7      | 4.5    |  |
| Lesbian   | 0.5    | 0.6                                   | 0.7      | 0.1    |  |
| Age at conception   | 27.1   | 27.7                                  | 25.7     | 26.5   | a, b, c  |
| Pregnancy order   |        |                                       |          |        | d  |
| 1st pregnancy (Ref)   | 29.3   | 30.2                                  | 28.2     | 27.6   |  |
| 2nd pregnancy   | 27.7   | 28.8                                  | 26.1     | 25.7   |  |
| 3rd pregnancy   | 19.7   | 19.6                                  | 18.9     | 20.5   |  |
| 4th or higher pregnancy   | 23.4   | 21.4                                  | 26.8     | 26.2   |  |
| Pregnancy intention status  |        |                                       |          |        | d  |
| Intended (Ref)  | 64.4   | 70.6                                  | 48.4     | 59.2   |  |
| Mistimed  | 21.7   | 19.5                                  | 27.1     | 24.0   |  |
| Unwanted  | 13.9   | 9.9                                   | 24.5     | 16.9   |  |
| Education   |        |                                       |          |        | d  |
| HS/GED (Ref)  | 18.5   | 12.3                                  | 19.2     | 34.4   |  |
| Less than HS  | 24.0   | 21.0                                  | 30.1     | 27.7   |  |
| Some college  | 26.7   | 26.2                                  | 31.8     | 24.5   |  |
| BA or higher  | 30.7   | 40.5                                  | 18.9     | 13.3   |  |
| N =   | 15,163 | 7120                                  | 3784     | 4259   |  |

<sup>1</sup> 1 = About one cigarette a day or less; 2 = Just a few cigarettes/day, 3 = About half a pack/day, 4 = About a pack/day, 5 = About 1 1/2 packs/day, 6 = About 2 packs/day, 7 = More than 2 packs/day.

<sup>2</sup> Heterosexual (identity, attraction, and behavior).

<sup>3</sup> Heterosexual identity + same-gender attraction (SGA) and/or behavior (WSW).

<sup>a</sup> *T*-tests indicate difference in means at *p* < 0.05 between White and Black groups.

<sup>b</sup> *T*-tests indicate difference in means at *p* < 0.05 between White and Latina groups.

<sup>c</sup> *T*-tests indicate difference in means at *p* < 0.05 between Black and Latina groups.

<sup>d</sup> Chi-square tests indicate difference in the distribution across categories at *p* < 0.05 by race-ethnicity.

large. For all racial-ethnic groups, the vast majority of pregnancies (75–83%) are to heterosexual with no same-gender attraction or behavior. The next largest group is pregnancies to heterosexual-identifying women with some same-gender attraction and/or behavior (12–19%, depending on racial-ethnic group), followed by pregnancies to women who identify as bisexual (5–8%) or lesbian (<1%). The average age at conception differed slightly (from 26 for Black women to 28 for White women). A higher percentage of pregnancies were first pregnancies for White women (compared to Black and Latina women), and a higher percentage of fourth or higher-order pregnancies were to Black and Latina women. White women had a higher percentage of pregnancies classified as intended (71%), compared to Latina (59%) or Black women (48%). Finally, educational distributions varied substantially; for 41% of pregnancies to White women, the woman had a bachelor’s degree or higher, compared to 19% for Black women and 13% of Latina women.

Table 2 presents odds ratios from logistic regression models predicting whether the mother reported smoking during the pregnancy (1 = yes, 0 = no). Results are presented for the pooled model (all

<sup>1</sup> The Stata “*suest*” and “*test*” commands are used.

**Table 2**  
Odds ratios from logistic regression models predicting whether mother smoked during pregnancy, NSFG 2006–2019 (weighted).

|                                   | All    |    |             | Stratified by Race-Ethnicity |      |             |      |        |              | Difference in OR across models (suest test): |                 |                 |    |     |
|-----------------------------------|--------|----|-------------|------------------------------|------|-------------|------|--------|--------------|--|-----------------|-----------------|----|-----|
|                                   | OR     | —  | [CI]        | NL White                     |      | NL Black    |      | Latina |              | White vs Black                               | White vs Latina | Black vs Latina |    |     |
|                                   |        |    |             | OR                           | [CI] | OR          | [CI] | OR     | [CI]         |  |                 |                 |    |     |
| <b>Sexual Orientation</b>         |        |    |             |                              |      |             |      |        |              |  |                 |                 |    |     |
| Heterosexual <sup>a</sup> (Ref)   |        |    |             |                              |      |             |      |        |              |  |                 |                 |    |     |
| Heterosexual-WSW/SGA <sup>b</sup> | 1.71   | ** | [1.33,2.21] | 1.47                         | **   | [1.10,1.97] | 2.13 | **     | [1.35,3.35]  | 4.36   | **              | [2.29,8.32]     | ** | ^   |
| Bisexual                          | 2.34   | ** | [1.61,3.39] | 1.89                         | **   | [1.29,2.78] | 2.64 | **     | [1.59,4.40]  | 8.21   | **              | [2.50,26.99]    | *  | ^   |
| Lesbian                           | 1.09   |    | [0.41,2.92] | 0.66                         |      | [0.20,2.14] | 4.79 | ^      | [0.98,23.45] | N/A  |                 |                 | *  | N/A |
| Age at conception                 | 1.01   |    | [0.99,1.03] | 1.02                         | *    | [1.00,1.04] | 1.00 |        | [0.97,1.04]  | 0.87   | **              | [0.80,0.96]     |    |     |
| <b>Pregnancy order</b>            |        |    |             |                              |      |             |      |        |              |  |                 |                 |    |     |
| 1st pregnancy (Ref)               |        |    |             |                              |      |             |      |        |              |  |                 |                 |    |     |
| 2nd pregnancy                     | 1.11   |    | [0.89,1.39] | 1.09                         |      | [0.84,1.41] | 1.54 | ^      | [0.98,2.43]  | 1.20   |                 | [0.59,2.43]     |    |     |
| 3rd pregnancy                     | 1.12   |    | [0.86,1.45] | 1.04                         |      | [0.76,1.42] | 1.82 | *      | [1.09,3.04]  | 1.47   |                 | [0.58,3.73]     |    |     |
| 4th or higher pregnancy           | 1.54   | ** | [1.13,2.12] | 1.23                         |      | [0.86,1.78] | 3.48 | **     | [2.01,6.04]  | 5.21   | **              | [1.66,16.35]    |    |     |
| <b>Wantedness of pregnancy</b>    |        |    |             |                              |      |             |      |        |              |  |                 |                 |    |     |
| Right time, overdue (Ref)         |        |    |             |                              |      |             |      |        |              |  |                 |                 |    |     |
| Mistimed                          | 1.30   | *  | [1.03,1.64] | 1.48                         | **   | [1.13,1.95] | 0.90 |        | [0.61,1.33]  | 0.64   |                 | [0.34,1.21]     |    |     |
| Unwanted                          | 2.06   | ** | [1.65,2.56] | 2.45                         | **   | [1.84,3.28] | 1.02 |        | [0.71,1.46]  | 1.68   | ^               | [0.97,2.94]     |    |     |
| <b>Education</b>                  |        |    |             |                              |      |             |      |        |              |  |                 |                 |    |     |
| HS/GED (Ref)                      |        |    |             |                              |      |             |      |        |              |  |                 |                 |    |     |
| Less than HS                      | 1.00   |    | [1.00,1.00] | 1.00                         |      | [1.00,1.00] | 1.00 |        | [1.00,1.00]  | 1.00   |                 | [1.00,1.00]     |    |     |
| Some college                      | 0.52   | ** | [0.39,0.69] | 0.48                         | **   | [0.35,0.66] | 0.55 | *      | [0.34,0.90]  | 1.30   |                 | [0.70,2.39]     |    |     |
| BA or higher                      | 0.08   | ** | [0.05,0.12] | 0.06                         | **   | [0.04,0.10] | 0.13 | **     | [0.04,0.41]  | 0.87   |                 | [0.16,4.75]     |    |     |
| <b>Race-Ethnicity</b>             |        |    |             |                              |      |             |      |        |              |  |                 |                 |    |     |
| NL White (Ref)                    |        |    |             |                              |      |             |      |        |              |  |                 |                 |    |     |
| NL Black                          | 0.29   | ** | [0.23,0.36] |                              |      |             |      |        |              |  |                 |                 |    |     |
| Latina                            | 0.11   | ** | [0.07,0.17] |                              |      |             |      |        |              |  |                 |                 |    |     |
| N =                               | 15,163 |    |             | 7120                         |      |             | 3784 |        |              | 4259   |                 |                 |    |     |

^ p < 0.10, \*p < 0.05, \*\*p < 0.01.

<sup>a</sup> Heterosexual (identity, attraction, and behavior).

<sup>b</sup> Heterosexual identity, same-gender attraction (SGA) and/or behavior (WSW).

pregnancies), as well as for the models stratified by race-ethnicity (pregnancies to White, Black, and Latina women, respectively). We highlight three key patterns. First, the pooled model with all women (column 1) indicates that Black (OR = 0.29) and Latina (OR = 0.11) women had a lower odds of smoking during pregnancy compared to White women when control variables are included in the model. This finding confirms prior literature (Drake et al., 2018; Martin et al., 2019).

Second, we find that sexual minority status is associated with a higher odds of smoking during pregnancy regardless of race-ethnicity. The stratified models indicate that for all racial-ethnic groups, those who were heterosexual had a lower odds of smoking than either women who are heterosexual-WSW/SGA or those who identify as bisexual. The results for lesbian women were inconsistent and none of these odds ratios are significant at the  $p < 0.05$  level. This is likely due to the fact that pregnancies to lesbian women represents a very small group of pregnancies ( $n = 90$ ), compared to pregnancies to bisexual women ( $n = 1019$ ) and pregnancies to heterosexual-WSW/SGA women ( $n = 2540$ ). As a consequence, it is difficult to draw firm conclusions from this sample.

Third, we find that the association between sexual orientation and smoking behavior is substantially stronger among Latina women than White and Black women. Suest tests indicated that the odds ratio for Heterosexual-WSW/SGA in the Latina model differs from that same odds ratio in the model for White women (at  $p < 0.01$ ) and in the model for Black women ( $p < 0.10$ ). We find the same pattern for the odds ratio for bisexual identity: this odds ratio is larger in the Latina model than in the White model ( $p < 0.05$ ) or in the Black model ( $p < 0.10$ ). (No odds ratio could be generated for lesbian Latina women because this was a very small subgroup with no variation in smoking behavior.)

The relationships between the three key variables are illustrated in Fig. 1, which presents predicted probabilities. This figure highlights the fact that White sexual minority women are the subgroups most likely to smoke during pregnancy: the predicted probability of smoking during the pregnancy is 0.17 for White Heterosexual-WSW/SGA and 0.21 for White bisexual women, holding control variables constant at their

means. In addition, the figure underscores the moderation effect in which sexual minority status seems to have a larger impact for Latina women, compared to their White counterparts. The predicted probability of smoking during the pregnancy is 0.02 for Latina Heterosexual-WSW/SGA and 0.06 for Latina bisexual women, compared to just 0.01 for Heterosexual Latina women. Sexual minority Latina women do not enjoy the same “protection” from smoking that their heterosexual counterparts do (even though smoking rates are low across the board for Latina women).

Table 3 presents coefficients from models predicting the amount of smoking (among smokers). We see that even among smokers, Latina bisexual women smoke substantially more cigarettes than heterosexual Latina women. Further, tests indicate that the smoking gap by sexual orientation (specifically the gap between heterosexual and bisexual women) is larger for Latinas than for White or Black women. This pattern is similar to what was observed in Table 2.

#### 4. Discussion

Recent research has identified the intersection between sexual minority status and race-ethnicity as important for health (Everett et al., 2020). However, this is still an emerging area of research, and existing studies indicate that the way sexual minority status and race come together to influence outcomes is not predictable, but rather differs depending on the outcome. Here we used data from the National Survey of Family Growth to examine how smoking during pregnancy is shaped by sexual minority status and race-ethnicity. Smoking during pregnancy is an important health measure since it impacts the health of both mothers and babies and is linked to other health indicators such as stress. The data presented here point to three notable patterns: (a) smoking during pregnancy is less common among Black and Latina women than among White women (consistent with prior research (Drake et al., 2018; Martin et al., 2019)), (b) smoking during pregnancy is more common among sexual minority women (specifically bisexual-identified women and heterosexual-identified women with

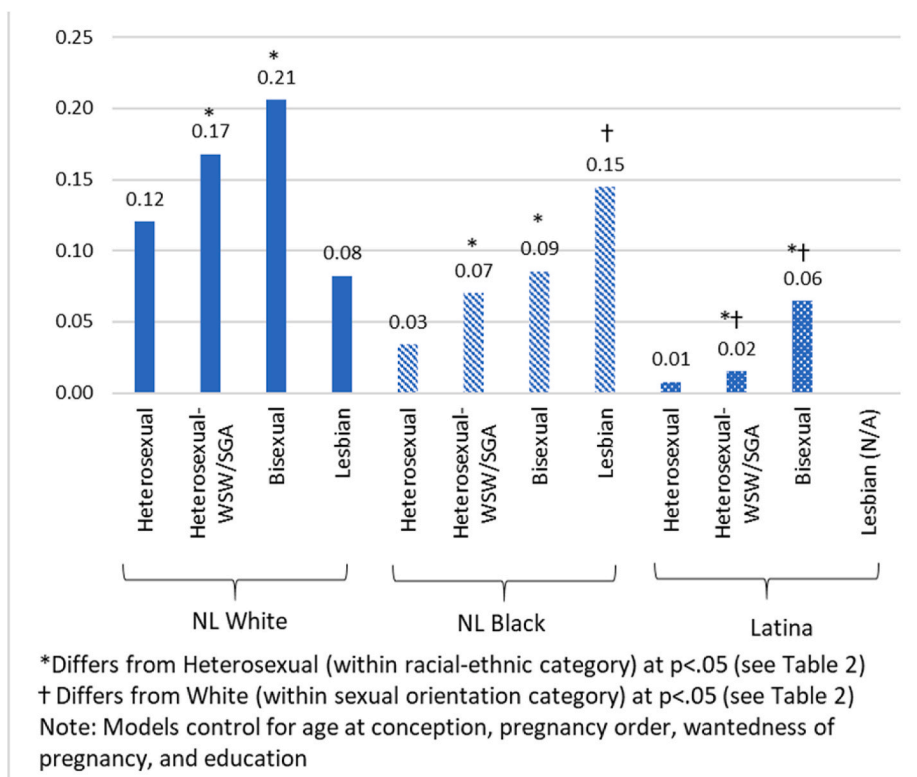


Fig. 1. Smoked during pregnancy (yes/no), predicted probability.

**Table 3**  
Coefficients from OLS regression models predicting amount of smoking (among smokers) during pregnancy, NSFG 2006–2019 (weighted).

|                                   | All     |                  | Stratified by Race-Ethnicity |                |          |                |         |                  | Difference in $\beta$ across models: |                 |                 |
|-----------------------------------|---------|------------------|------------------------------|----------------|----------|----------------|---------|------------------|--------------------------------------|-----------------|-----------------|
|                                   | $\beta$ | [CI]             | NL White                     |                | NL Black |                | Latina  |                  | White vs Black                       | White vs Latina | Black vs Latina |
|                                   | $\beta$ | [CI]             | $\beta$                      | [CI]           | $\beta$  | [CI]           | $\beta$ | [CI]             |                                      |                 |                 |
| <b>Sexual Orientation</b>         |         |                  |                              |                |          |                |         |                  |                                      |                 |                 |
| Heterosexual <sup>a</sup> (Ref)   |         |                  |                              |                |          |                |         |                  |                                      |                 |                 |
| Heterosexual-WSW/SGA <sup>b</sup> | -0.10   | [-0.29,0.09]     | -0.07                        | [-0.28,0.13]   | -0.19    | [-0.56,0.18]   | 0.26    | [-0.26,0.79]     |                                      |                 |                 |
| Bisexual                          | 0.31    | [-0.19,0.81]     | 0.02                         | [-0.26,0.30]   | -0.10    | [-0.47,0.27]   | 2.73    | ** [1.05,4.41]   | **                                   | **              |                 |
| Lesbian                           | 0.29    | ^ [-0.02,0.59]   | 0.22                         | [-0.09,0.54]   | 0.27     | [-0.47,1.00]   | N/A     |                  | N/A                                  | N/A             |                 |
| Age at conception                 | 0.00    | [-0.02,0.02]     | 0.01                         | [-0.01,0.03]   | 0.01     | [-0.03,0.04]   | -0.08   | ** [-0.14,-0.03] |                                      |                 |                 |
| <b>Pregnancy order</b>            |         |                  |                              |                |          |                |         |                  |                                      |                 |                 |
| 1st pregnancy (Ref)               |         |                  |                              |                |          |                |         |                  |                                      |                 |                 |
| 2nd pregnancy                     | 0.32    | ** [0.12,0.51]   | 0.26                         | * [0.06,0.47]  | 0.20     | [-0.16,0.55]   | 1.23    | ** [0.38,2.08]   |                                      |                 |                 |
| 3rd pregnancy                     | 0.29    | ** [0.08,0.50]   | 0.22                         | ^ [-0.00,0.44] | 0.27     | [-0.11,0.66]   | 0.91    | * [0.04,1.79]    |                                      |                 |                 |
| 4th or higher pregnancy           | 0.55    | ** [0.33,0.76]   | 0.57                         | ** [0.32,0.81] | 0.38     | ^ [-0.06,0.82] | 1.62    | ** [0.90,2.35]   |                                      |                 |                 |
| <b>Wantedness of pregnancy</b>    |         |                  |                              |                |          |                |         |                  |                                      |                 |                 |
| Right time, overdue (Ref)         |         |                  |                              |                |          |                |         |                  |                                      |                 |                 |
| Mistimed                          | 0.13    | [-0.04,0.30]     | 0.10                         | [-0.09,0.30]   | 0.04     | [-0.26,0.34]   | 0.11    | [-0.59,0.81]     |                                      |                 |                 |
| Unwanted                          | 0.26    | ** [0.09,0.43]   | 0.29                         | ** [0.09,0.48] | 0.29     | * [0.00,0.58]  | -0.14   | [-0.74,0.46]     |                                      |                 |                 |
| <b>Education</b>                  |         |                  |                              |                |          |                |         |                  |                                      |                 |                 |
| HS/GED (Ref)                      |         |                  |                              |                |          |                |         |                  |                                      |                 |                 |
| Less than HS                      | 0.11    | [-0.14,0.36]     | 0.04                         | [-0.16,0.23]   | -0.04    | [-0.47,0.39]   | 0.65    | [-0.16,1.46]     |                                      |                 |                 |
| Some college                      | -0.13   | [-0.31,0.05]     | -0.15                        | [-0.35,0.05]   | -0.13    | [-0.58,0.32]   | 0.23    | [-0.38,0.85]     |                                      |                 |                 |
| BA or higher                      | -0.24   | [-0.59,0.11]     | -0.24                        | [-0.58,0.10]   | -0.45    | [-1.44,0.54]   | -0.94   | ** [-1.62,-0.26] |                                      |                 |                 |
| <b>Race-Ethnicity</b>             |         |                  |                              |                |          |                |         |                  |                                      |                 |                 |
| NL White (Ref)                    |         |                  |                              |                |          |                |         |                  |                                      |                 |                 |
| NL Black                          | -0.34   | ** [-0.53,-0.15] |                              |                |          |                |         |                  |                                      |                 |                 |
| Latina                            | 0.01    | [-1.02,1.03]     |                              |                |          |                |         |                  |                                      |                 |                 |
| Constant                          | 2.19    | ** [1.76,2.61]   | 2.07                         | ** [1.63,2.51] | 2.04     | ** [0.92,3.16] | 2.64    | ** [1.40,3.88]   |                                      |                 |                 |
| N =                               | 1984    |                  | 1387                         |                | 413      |                | 184     |                  |                                      |                 |                 |

Note: Amount of smoking: 1 = About one cigarette a day or less; 2 = Just a few cigarettes a day (2–4), 3 = About half a pack a day (5–14), 4 = About a pack a day (15–24), 5 = About 1 1/2 packs a day (25–34), 6 = About 2 packs a day (35–44), 7 = More than 2 packs a day (45 or more)<sup>a</sup> p < 0.10, \*p < 0.05, \*\*p < 0.01.

<sup>a</sup> Heterosexual (identity, attraction, and behavior).

<sup>b</sup> Heterosexual identity, same-gender attraction (SGA) and/or behavior (WSW).

some same-gender attraction or behavior) compared to heterosexual women, and this is true for all three racial-ethnic groups examined, and (c) the extent to which sexual minority status is positively associated with smoking is greater among Latina women than among White and Black women (despite lower overall rates of smoking for Latina women).

The finding that smoking during pregnancy is more common among sexual minority women than heterosexual women had been suggested by prior descriptive literature but not fully established (Gonzales et al., 2019; Everett et al., 2019). This study is the first to show that this relationship holds in a multivariable framework that accounts for factors such as education level and age at conception. This finding aligns with – and extends – previous research that has found higher rates of smoking among sexual minority women compared to heterosexual women (in general), and other research that has found that sexual minority women are more likely to report smoking during the pre-conception period than heterosexual women (Fallin et al., 2015; Limburg et al., 2020).

This study is the first to demonstrate that prenatal smoking is shaped jointly by sexual orientation and race-ethnicity. Two findings in particular stand out. The first is that the subgroup with the highest risk is White sexual minority women (specifically White bisexual women). The second is that, although smoking rates for Latina women are quite low, sexual minority Latina women have substantially higher rates of smoking (and smoke more cigarettes, in the case of bisexual women) compared to heterosexual Latina women. It could be that Latina sexual minority women experience more stigmatization (compared to those who are White) (Barnes & Meyer, 2012), which could result in more stress and therefore more smoking in response. We also know that smoking behavior is shaped by peer smoking behavior, and sexual minority women may have more smokers in their peer groups than heterosexual women. Greater stigmatization among Latina sexual minority women could result in more distinct peer groups (possibly due to rejection on the part of family and community members), which could lead to higher rates of smoking.

Our finding of large sexual orientation-based disparities in smoking among Latina women also highlights the role of heterogeneity, even among groups considered “low risk.” Low smoking rates among pregnant Latina women mask substantial diversity across sexual orientation subgroups: bisexual-identified Latina women are six times more likely to smoke (predicted probability = .06) than their heterosexual counterparts (predicted probability = .01). Researchers and providers alike should be careful not to “flatten” risk assessments by failing to take into account within-group variation.

There are several limitations to our study. First, we did not have a sufficient number of pregnancies to lesbian women to be able to draw robust conclusions about how race-ethnicity influences pregnancy smoking dynamics for these women. Second, we were unable to include pregnancies to trans men, or others who were excluded from the NSFG “female” dataset based on their gender. If we want to fully understand the role of gender and sexual orientation in shaping pregnancy health indicators, we need studies that include these groups. Third, there is very little information in the study that would allow us to identify the pathways connecting sexual minority status and race-ethnicity to smoking behavior. It is important that studies on childbearing and health also collect information on experiences of stress and discrimination, as well as peer behaviors. We also lack certain variables – such as partner’s gender and socioeconomic status at the time of the pregnancy – that would be helpful for clearly identifying the associations. Finally, the NSFG does not include data about preconception smoking, so we do not know how the smoking behavior of different groups of women may have responded to pregnancy.

#### 4.1. Conclusions

As the proportion of pregnancies both to sexual minority and non-White individuals grow in the U.S., it is increasingly important for researchers and clinicians to recognize how various characteristics

combine to shape risks and protective factors. The patterns shown here regarding smoking can help clinicians to better understand the specific risks experienced by their patients. Clinicians should also ensure they are providing sexuality-inclusive and gender-inclusive care to pregnant patients so that these medical interactions do not add to the stress and stigma that minority patients experience. Broader social conditions also matter for health indicators, including stress and smoking behavior. It is incumbent on all social actors to address structural factors that may create more stress for sexual minority individuals. The fact that smoking during pregnancy has the potential to be “doubly” impactful adds urgency to the task of addressing the stress and stigma that sexual minority individuals experience, both during pregnancy and more broadly.

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#### Ethical statement

The analysis was conducted using the National Survey of Family Growth (U.S.). The authors used deidentified secondary data, and additional human subjects review was not required.

#### CRedit authorship contribution statement

**Caroline Sten Hartnett:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Zackery Butler:** Writing – original draft, Writing – review & editing. **Bethany G. Everett:** Writing – original draft, Writing – review & editing.

#### Declaration of competing interest

None.

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