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Erica Mumm Date

Sexual Orientation and Influenza Immunization among Adults in the United States

By

Erica Mumm

Master of Public Health

Global Epidemiology

Robert A. Bednarczyk, PhD

Committee Chair

Sexual Orientation and Influenza Immunization among Adults in the United States

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Erica Mumm

B.A., University of Minnesota, Morris, 2014

Thesis Committee Chair: Robert A. Bednarczyk, PhD

An abstract of

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Abstract

Sexual Orientation and Influenza Immunization among Adults in the United States

By Erica Mumm

Purpose: Sexual minority individuals have an increased vulnerability to poor health outcomes and increased barriers in access to healthcare. There is a lack of research investigating the association between sexual orientation and influenza vaccination. To our knowledge, this will be the first study to date to use national level data to investigate this association while controlling for socio-demographic factors.

Methods: We analyzed data from the 2017 National Health Interview Survey to evaluate the association between sexual orientation and seasonal influenza vaccination among adults aged 18-64 years, stratified by sex. Vaccination frequencies and proportions were calculated, and multivariate analyses for complex survey data, allowing for interaction of sexual orientation and provider type among women, was performed to adjust for appropriate socio-demographic characteristics.

Results: Gay and bisexual men were more likely to receive the influenza vaccine relative to straight men (47.6% versus 32.7%, respectively; adjusted prevalence ratio: 1.36, 95% confidence interval: 1.18, 1.57). There were no significant differences between lesbian, gay, and bisexual women and straight women after adjusting for socio-demographic factors (30.5% versus 41.6%, respectively; adjusted prevalence ratio: 0.94, 95% confidence interval: 0.74, 1.19). Among women who saw neither a general practitioner nor an obstetrician-gynecologist in the past year, sexual minority women were significantly less likely to receive the seasonal influenza vaccine than straight women (adjusted prevalence ratio: 0.61, 95% confidence interval: 0.47, 0.79).

Conclusions: Vaccination rates among sexual minority individuals remain suboptimal, particularly among sexual minority women who did not see either a general practitioner or an obstetrician-gynecologist in the past year. More research is needed to explore effective interventions that promote influenza vaccine uptake among these populations, with a focus on potential avenues for intervention, including clinics providing targeted care to sexual minorities, pharmacies, and workplace vaccination programs.

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All analyses, interpretations, and conclusions are done using NHIS data, but are the work of the authors and do not reflect the views of the NHIS or CDC.

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CHAPTER I: LITERATURE REVIEW

Seasonal Influenza

Seasonal influenza is among the leading causes of death in the United States. Influenza combined with pneumonia, a common complication of influenza, ranked as the eighth leading cause of death in the United States in 2016 (1, 2). Annual epidemics of influenza in the United States typically begin in late fall and extend into the spring. During the 2017-2018 influenza season, there were an estimated 959,000 hospitalizations and 79,400 deaths due to influenza (3). This burden was higher than any season due to the 2009 influenza pandemic, which was dominated by the novel 2009 H1N1 virus (3, 4).

Certain groups are more vulnerable to influenza and its resulting complications, including those with higher levels of exposure to the virus, such as healthcare workers, and individuals with an elevated risk of developing severe diseases, such as children, the elderly, pregnant women, and individuals with chronic conditions (2, 5). Other populations with increased vulnerability to poor health outcomes, including influenza, include members of minority groups and individuals with lower socioeconomic status and education levels (6, 7). This increase in susceptibility may be due to a phenomenon known as minority stress, in which members of minority groups experience disproportionate levels of chronic stress, as well as stress resulting from discrimination, which has a negative impact on their overall health(7). Previous research has shown that stigma in a health care setting is associated with lowered use of preventative care interventions among sexual minorities, which may be related to minority stress(8).

Influenza Vaccine

Influenza vaccines, produced annually and recommended by the Centers for Disease Control and Prevention (CDC), serve as the best method for preventing the spread of influenza(9). The influenza disease burden varies yearly depending on factors, such as the effectiveness of the vaccine, the severity of the strains in circulation, and the number of people vaccinated(10). How effective the

vaccine is at preventing the spread of influenza varies by season, depending on how well the influenza virus strains in circulation match those included in the vaccine(11). Since 2004, the effectiveness of the vaccine in preventing outpatient medical visits has fluctuated between 10-60%. During the 2017-2018 influenza season, estimates suggest that influenza vaccines reduced the possibility of contracting influenza and visiting the doctor by 38%, with 7.1 million illnesses, 109,000 hospitalizations, and 8,000 deaths prevented by the vaccine (12).

Despite this documented reduction in illness and death, annual vaccination coverage among adults for seasonal influenza continues to fall short of the Healthy People 2020 target of 70% and was particularly low for the 2017-2018 season (13, 14). The early season influenza vaccination coverage estimates among adults older than 18 years of age for the 2018-2019 influenza season was 44.9%, which is a 7.8% increase from the full season coverage for adults in the 2017-2018 influenza season (3, 13). Vaccination rates remain suboptimal even among vulnerable populations, despite targeted efforts to increase them (15, 16).

Disparities in Influenza Vaccine Uptake

Research on the effect of sociodemographic characteristics on influenza vaccination has focused heavily on racial and ethnic disparities (17). Studies have found that black, Hispanic/Latino, and some Asian subgroups have lower vaccination coverage than non-Hispanic whites (15, 18-20). Even as influenza vaccination coverage has increased over time, these racial disparities have remained (15, 20). Research has been conducted on interventions to improve vaccine coverage, however, there is a lack of studies on interventions that successfully target vulnerable populations to reduce inequalities. Additionally, there is a lack of research on the effect of other sociodemographic factors on influenza vaccination (17). Research on effective targeted interventions and methods of

increasing vaccination among these subpopulations is important due to the phenomenon of minority stress and a subsequent increased susceptibility to poor health outcomes (6, 7).

Despite the fact that health disparities among members of sexual minorities, including lesbian, gay, and bisexual individuals, have been well documented in recent years, the relationship between sexual orientation and influenza vaccination has not been widely studied(21-25). Studies have found evidence that gay men and older sexual minorities are more likely than heterosexual men to receive the influenza vaccination, but results have been inconclusive for younger adult women (24, 26).There was an analysis of the 2013 Health Interview Survey (NHIS) that examined unadjusted influenza vaccination coverage by sexual minority status. For pattern comparison purposes, during the 2012-2013 influenza season 32.5% of men and 38.9% of women aged 18-64 were vaccinated for influenza(27). The analysis found that 46.1% of men aged 18-64 who identified as gay received an influenza vaccine in the past year as compared to 30.9% of straight men and 36.6% of bisexual men, but it did not find any significant differences in influenza vaccine receipt by sexual orientation in women (39.1% among gay or lesbian women, 38.9% among straight women, and 31.0% among bisexual women) (24). Rates of vaccination are consistently lower among men than women, and, while gay men have been found to have higher rates of vaccination than straight men, these rates remain below targeted levels (14, 28).

Sexual Minority Health

Sexual minorities have an increased prevalence of health-risk behaviors. Recent studies have found that gay, lesbian, and bisexual individuals are more likely to be current smokers, binge drink, and use drugs than heterosexual individuals (21, 24, 29). They are also at increased risk of poor health outcomes, such as self-reported health status, disability, and chronic conditions (21-25, 30, 31). Research suggests that the negative health consequences that sexual minorities experience are

correlated with minority stress (32-34). In addition to this, sexual minorities are more likely to experience barriers in access to healthcare, such as lack of insurance or inability to afford health services (35-37). A study analyzing health care utilization among lesbian, gay, bisexual, and transgender (LGBT) individuals in New Jersey found that they were more likely to seek care for mental health and chronic conditions than for primary care or reproductive health, which could suggest potential targets for future interventions (38).

Studies have found that social support, lack of stigma in healthcare services, and disclosure of sexual orientation to primary care providers have had positive impacts on healthcare utilization and health outcomes(8, 39). Barriers that impact sexual minorities' decisions to disclose their sexual orientation to primary care providers include fear of the potential repercussions and past experiences with provider stigma (8).

Due to the complexity of health issues facing the LGBT community, individuals may benefit from an integrated care model, with a collaborative and team-based approach, however, there is a lack of research focused on LGBT specific integrated care interventions (40). LGBT community health centers can provide sexual minorities with a designated space to seek care that is free of stigma. Unfortunately, research has shown that such centers are often geographically sparse, with lower concentrations in the central US and in non-urban areas, which can indicate a lack of healthcare services competent in treating LGBT individuals and serve as a barrier to sexual minorities seeking care(41). Additionally, although these centers focus on LGBT health, they may not be a culturally competent resource for other sociodemographic factors, such as race, ethnicity, socioeconomic status, and immigration status(41). This may discourage individuals with more than one marginalized identity from seeking care in an LGBT-specific health center.

The health disparities that sexual minorities experience vary depending on other sociodemographic factors, such as gender, race, and ethnicity (42, 43). Compared to heterosexual

women, lesbian and bisexual women are disproportionately more likely to experience adverse health outcomes and barriers to care than their male counterparts (37, 42). A study examining 2008 data from the National Longitudinal Study of Adolescent Health found that sexual minority women had elevated odds of most adverse health conditions, such as asthma, depression, anxiety, and STIs, and had lower odds of having a physical or dental exam in the past year. Sexual minority men had increased odds of fewer adverse health conditions(31). A study analyzing data from the 2013 and 2014 NHIS found that lesbian women had a higher prevalence of obesity, stroke, and functional limitations, and bisexual women had a higher prevalence of an injury or poisoning, or of feeling so sad nothing could cheer them up in the past 30 days. Gay men were more likely to have hypertension or heart disease, and sexual minority men were more likely to have a functional limitation(23). The impact of sexual orientation on health experiences also differs by race. Previous studies have found that sexual minority status, female gender, and non-white race are associated with poorer health outcomes and that sexual minorities of differing genders and race may have differing levels of risk to their health status (42, 43).

Sexual Orientation and Vaccination Status

Sexual orientation and vaccination status has begun to emerge as a growing area of research, but more data is needed to fully understand the relationship. This study aims to expand upon previous literature by further investigating the association between sexual orientation and influenza vaccination. To our knowledge, this will be the first study to date to use national level data to investigate this association while controlling for socio-demographic factors.

CHAPTER II: MANUSCRIPT

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Results: Gay and bisexual men were more likely to receive the influenza vaccine relative to straight men (47.6% versus 32.7%, respectively; adjusted prevalence ratio: 1.36, 95% confidence interval: 1.18, 1.57). There were no significant differences between lesbian, gay, and bisexual women and straight women after adjusting for socio-demographic factors (30.5% versus 41.6%, respectively; adjusted prevalence ratio: 0.94, 95% confidence interval: 0.74, 1.19). Among women who saw neither a general practitioner nor an obstetrician-gynecologist in the past year, sexual minority women were significantly less likely to receive the seasonal influenza vaccine than straight women (adjusted prevalence ratio: 0.61, 95% confidence interval: 0.47, 0.79).

Conclusions: Vaccination rates among sexual minority individuals remain suboptimal, particularly among sexual minority women who did not see either a general practitioner or an obstetrician-gynecologist in the past year. More research is needed to explore effective interventions that promote influenza vaccine uptake among these populations, with a focus on potential avenues for intervention, including clinics providing targeted care to sexual minorities, pharmacies, and workplace vaccination programs.

Introduction

Seasonal influenza is among the leading causes of death in the United States. Influenza combined with pneumonia, a common complication of influenza, ranked as the eighth leading cause of death in the United States in 2016(1, 2). During the 2017-2018 flu season there were an estimated 959,000 hospitalizations and 79,400 deaths due to influenza(3). Annual vaccination coverage for seasonal influenza continues to fall short of the Health People 2020 targets (13, 14). The early season flu vaccination coverage estimates among adults older than 18 years of age for the 2018-2019 influenza season was 44.9% (3, 13).

Certain groups are more vulnerable to influenza and its resulting complications, including individuals with higher levels of vulnerability to poor health outcomes, such as members of minority groups and those with lower socioeconomic status and education levels (6, 7). This increased susceptibility may be due to a phenomenon known as minority stress, in which members of minority groups experience disproportionate levels of chronic stress, as well as stress resulting from discrimination, which has a negative impact on their overall health(7). Vaccination rates remain suboptimal even among these vulnerable populations, despite targeted efforts to increase them (15, 16).

Although research has been done on interventions to improve vaccine coverage, there is a lack of studies on interventions that successfully target vulnerable populations to reduce inequalities and a lack of research on the effect of other sociodemographic factors on influenza vaccination (17). Despite the fact that health disparities among members of sexual minorities, including lesbian, gay, and bisexual individuals, have been well documented in recent years, the relationship between sexual orientation and flu vaccination has not been widely studied(21-25).

Sexual minorities have an increased prevalence of health-risk behaviors and poor health outcomes, such as self-reported health status, disability, and chronic conditions (21-25, 30, 31). In

addition to this, sexual minorities are more likely to experience barriers in access to healthcare, such as lack of insurance or inability to afford health services (35-37). A study analyzing health care utilization among lesbian, gay, bisexual, and transgender (LGBT) individuals in New Jersey found that they were more likely to seek care for mental health and chronic conditions than for primary care or reproductive health, which could suggest potential targets for future interventions (38).

Sexual orientation and vaccination status has begun to emerge as a growing area of research, but more data is needed to fully understand the relationship. This study aims to expand upon previous literature by further investigating the association between sexual orientation and influenza vaccination. To our knowledge, this will be the first study to date to use national level data to investigate this association while controlling for socio-demographic factors.

Methods

Data Source

This analysis was conducted using publicly available data from the 2017 National Health Interview Survey (NHIS)(44). The NHIS is an annual face-to-face cross-sectional household interview survey conducted in the United States by the Centers for Disease Control and Prevention (CDC) that relies on self-reported data to collect information on a wide range of health topics. The NHIS sampling plan follows a multistage area probability design in order to representatively sample households and gain an accurate understanding of the health of civilian non-institutionalized adults in the United States.

Analytic Variables

The primary outcome variable in this analysis was self-reported receipt of the seasonal influenza vaccine in the past year. The primary exposure variable was self-reported sexual

orientation, stratified by sex. Participants were asked "How do you think of yourself?" with response options for women, including "lesbian or gay," "straight, that is, not lesbian or gay," "Bisexual," "Something else," and "I don't know the answer". Response options for men included "gay," "straight, that is, not gay," "Bisexual," "Something else," and "I don't know the answer". Participants identifying as gay, lesbian, or bisexual were collapsed into a single category for each sex, and responses of "something else" and "I don't know the answer" were excluded for this analysis. Other variables of interest included race, ethnicity, education, health insurance coverage, marital status, and age. For women, the type of healthcare provider seen in the last year was also considered as a covariate. For this analysis, we focused on differences between women who had seen a general practitioner (GP) versus an obstetrician-gynecologist (OBGYN) in the past year. We created a single provider variable categorizing women into four groups regarding their utilization of general doctors and OBGYNs: GP only, OBGYN only, GP and OBGYN, or neither GP nor OBGYN. For all variables under consideration, the answers "refused," "not ascertained" and "don't know" were excluded from analyses.

Data Analysis

Our study population was restricted to adults aged 18 to 64 years. Adults 65 years and older were excluded, given their eligibility for Medicare and subsequent differential access to health care.

Descriptive and bivariate analyses were conducted to determine demographic characteristics for the study population. Multivariate log binomial regression models were run to determine the adjusted association between sexual orientation and influenza vaccine receipt, allowing for interaction of sexual orientation and provider type among women, and adjusting for appropriate socio-demographic characteristics. All data were analyzed using SAS ® software, version [9.4] with the appropriate weighting for complex survey data(45). Multivariate regression analysis was

conducted with the weights and variance estimations indicated by the 2017 NHIS Survey Description file(46). All statistical analyses were conducted using an alpha level of 0.05.

This study was determined to not be human subjects research by Emory's Institutional Review Board, as a secondary analysis of a publicly available de-identified dataset.

Results

In 2017, the NHIS completed 26,742 face-to-face cross-sectional household interview surveys. Of these, 7,334 surveys were conducted with adults aged 65 years or older, who were excluded from our analysis for a final study population of 19,408 sample adults (Figure 1). In the final study population, there were 10,368 women and 9,040 men aged 18-64.

Women

Among the women in our sample, 9,488 (weighted percent: 96.1%) identified as straight and 407 (3.9%) identified as gay, lesbian or bisexual (Table 1a). The majority of women identified as white, non-Hispanic, had private health insurance, and had seen either only a GP or both a GP and an OBGYN in the past year. The majority of straight women identified as married and the majority of gay, lesbian, and bisexual women identified as single, never married. There was a consistent distribution across education levels and age groups for all women.

Influenza vaccine coverage was 41.1% (95% CI: 39.4-42.8) among women overall, 41.6% (95% CI: 39.9-43.3) among women who identified as straight, and 30.5% (95% CI: 24.4-36.6) among women who identified as gay, lesbian, or bisexual. Vaccine coverage was consistently low across socio-demographic characteristics for both straight and sexual minority women, with lower than 50% vaccination coverage observed in all groups except among straight and sexual minority women

with graduate degrees (54.4% and 52.6%, respectively), and straight women who visited both a GP and an OBGYN in the past year (50.0%).

In unadjusted analysis, we determined that self-reported receipt of influenza vaccine was negatively and significantly associated with non-straight sexual orientation (PR= 0.735), black/African American race (PR=0.844), Hispanic ethnicity (PR=0.865), only having seen an OBGYN in the past year (PR=0.786), having seen neither a GP nor an OBGYN in the past year (PR=0.549), having Medicaid or other private insurance (PR=0.839), having no medical insurance (PR=0.505), and being single (PR=0.781). Self-reported receipt of influenza vaccine was positively and significantly associated with having seen both a GP and an OBGYN in the past year (PR=1.121), having a higher degree, and having an age greater than 29 years (PR 30-39=1.142; PR 40-49=1.123; PR 50-64=1.398). Other unadjusted associations were not found to be significant.

When controlling for primary care provider, race, ethnicity, education, health insurance coverage, marital status, and age, sexual orientation did not have a significant effect on receipt of seasonal influenza vaccination (aPR=0.94, 95% CI: 0.74, 1.19). However, among women who saw neither a GP nor an OBGYN in the past year compared to women who saw a GP, sexual minority women were significantly less likely to report receiving the seasonal influenza vaccine than straight women (aPR=0.61, 95% CI: 0.47, 0.79). All other levels of provider type were not found to be significant.

Men

Among the men in our sample, 8,353 (96.9%) identified as straight and 310 (3.1%) identified as gay and bisexual (table 1b). The majority of men identified as white , non-Hispanic , and had private health insurance. The majority of straight men identified as married and sexual minority men

identified as single. There was a consistent distribution across education levels and age groups for all men.

Influenza vaccination coverage was 33.2% (95% CI: 31.7-34.7) among men overall, 32.7% (95% CI: 31.2-34.3) among men who identified as straight, and 47.6% (95% CI: 39.6-55.7) among men who identified as gay and bisexual.

In unadjusted analysis, we determined that self-reported receipt of influenza vaccine was significantly and negatively associated with black/African American race (PR=0.751), Hispanic ethnicity (PR=0.792), having Medicaid or other public insurance (PR=0.828), not having health insurance (PR=0.355), being separated, divorced, or widowed (PR=0.810), and being single (PR=0.715). Self-reported receipt of influenza vaccine was positively and significantly associated with sexual minority status (PR=1.455), having a higher education, having other health insurance coverage (not private or public) (PR=1.322), and having an age greater than 29 years (PR 30-39=1.144; PR 40-49=1.362; PR 50-64=1.663). All other crude associations were not found to be significant.

After adjusting for race, ethnicity, education, health insurance coverage, marital status, and age, sexual minority men were significantly more likely to have received an influenza vaccine in the past year than straight men (aPR=1.36, 95% CI: 1.18, 1.57).

Discussion

In the 2017 NHIS, influenza vaccine coverage was below Heathy People 2020 goals for men and women aged 18-64, both straight and sexual minority. Key sociodemographic characteristics associated with lower influenza vaccination were race, ethnicity, provider type, health insurance, and marital status, which may lead to more complex health disparities. We determined that when controlling for primary care

provider, race, ethnicity, education, health insurance coverage, marital status, and age, that receipt of flu vaccine did not differ by among women by sexual orientation. However, we found that, among women who saw neither a GP nor an OBGYN in the past year, sexual minority women were significantly less likely to get the seasonal influenza vaccine than straight women. According to data from the CDC, 12.3% of women aged 18-64 had no usual source of health care in 2015-2016(47). This represents a substantial portion of the population who are not targeted to receive an influenza vaccine or other forms of preventative services.

Among men aged 18-64, we determined that when controlling for race, ethnicity, education, health insurance coverage, marital status, and age, sexual minority men were significantly more likely to have received the flu vaccine in the past year than straight men.

After controlling for socio-demographic factors, there were not significant differences between sexual minority women and straight women in influenza vaccination status and sexual minority men were more likely to report receiving the flu vaccine than straight men. These findings are consistent with a 2014 study conducted by Ward et al. that examined sexual orientation and health care service utilization using unadjusted data from the 2013 NHIS and found that 46.1% of men aged 18-64 who identified as gay received an influenza vaccine in the past year as compared to 30.9% of straight men and 36.6% of bisexual men, but it did not find any significant differences in influenza vaccine receipt by sexual orientation in women (39.1% among gay or lesbian women, 38.9% among straight women, and 31.0% among bisexual women). However, in our unadjusted results we found that sexual minority women were less likely to report influenza vaccination than straight women (30.5% versus 41.6% respectively) and that sexual minority men were more likely to report influenza vaccination than straight men (47.6% versus 32.7% respectively). Between 2013 and 2017 influenza vaccination rates have largely stayed the same, with small increases among straight individuals, and significant differences among sexual minority women in our unadjusted analysis.

Rates of vaccination are consistently lower among men than women, and while gay men have been found to have higher rates of vaccination than straight men, these rates remain suboptimal. Due to the phenomenon known as minority stress, it is particularly important that vulnerable populations such as sexual minorities get vaccinated for seasonal influenza as they are more susceptible to negative health outcomes(23-25). However, sexual minorities also experience more barriers in access to healthcare, such as lack of insurance or inability to afford health services(35-37). As sexual minorities are more susceptible to negative health outcomes and more likely to experience barriers in access to care, it is increasingly important that they are targeted for influenza vaccination interventions.

Strengths

To our knowledge, this is the first study that used national level data to investigate the association between receipt of the seasonal influenza vaccine and sexual orientation while controlling for socio-demographic factors. This is also the first study to assess effect measure modification of seasonal flu vaccination by provider type for sexual minority women.

Limitations

Our study had several limitations. Although there were 19,408 individuals in our population of interest, only a small subset of individuals (3.7%) identified as a sexual minority. This sample size limited our ability to conduct a more in-depth analysis of sexual orientation and flu vaccination status. Due to small sample size, we collapsed sexual minority individuals into one sexual minority category for both sexes. Additionally, survey analysis is reliant on self-reported data, which may not accurately reflect the true sexual orientation or vaccination status of participants due to recall bias and other factors. We were also not able to definitively determine where sexual minorities are

seeking care, which would be beneficial to more effectively target interventions to improve vaccine uptake among sexual minorities.

Conclusions

Sexual minorities are particularly vulnerable to poor health outcomes and barriers in access to healthcare. Vaccination rates among all sexual minority populations remain suboptimal, particularly among sexual minority women who did not see either a GP or an OBGYN in the past year. There is a lack of research on interventions that successfully increase vaccination rates among vulnerable populations. Additionally, adult preventive care is often fragmented, and this is especially pronounced for influenza vaccination. A large portion of adults in the United States get their influenza vaccinations from a pharmacy (32.2%) or their workplace (14.9%), indicating potential avenues for intervention (48).

Limited research has shown that sexual minority individuals are most likely to access mental health services and care for chronic conditions, which could be potential avenues for intervention. Sexual minorities often face poorer health outcomes and discrimination in healthcare, something that can negatively affect quality of life. Research has been conducted on interventions to improve vaccine coverage, however, there is a lack of studies on interventions that successfully target vulnerable populations to reduce inequalities More research should be conducted to determine where to target interventions to improve sexual minority vaccination coverage and overall health.

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Tables

Table 1a. Selected characteristics of sample adult females- National Health Interview Survey, United States, 2017

	Sexual Orientation		
	Straight	**Sexual Minority**	**$\chi 2$**
	No (% vaccinated for influenza)	**No (% vaccinated for influenza)**	**p-value**
Overall (n = 9,895)	9,488 (41.6)	407 (30.5)	
Type of primary care provider			
General practitioner only (n = 3,649)	3,502 (44.2)	147 (39.0)	0.2338
OB/GYN only (n = 936)	901 (35.1)	35 (11.3)	
Both (n = 3,362)	3,234 (50.0)	128 (44.0)	
Neither (1,936)	1,840 (25.2)	96 (10.4)	
Race			
White (n = 7,739)	7,417 (41.9)	322 (35.8)	0.1865
Black/African American (n = 1,245)	1,197 (36.6)	48 (10.2)	
Other (n = 668)	651 (47.7)	17 (14.2)	
Multi-racial (n = 215)	195 (34.6)	20 (36.1)	
Ethnicity			
Non-Hispanic (n = 8,474)	8,118 (42.6)	356 (31.5)	0.3350
Hispanic (n = 1,421)	1,370 (36.7)	51 (24.8)	
Education			
No high school diploma (n = 924)	888 (35.3)	36 (17.2)	0.0155
High school diploma or GED (n = 2,066)	1,984 (37.0)	82 (25.1)	
Some college (no degree) (n = 2,057)	1,948 (38.9)	109 (29.0)	
Associates degree (n = 1,251)	1,213 (41.8)	38 (25.1)	
Bachelor's degree (n = 2,317)	2,229 (43.8)	88 (34.2)	
Graduate degree (1,280)	1,226 (54.4)	54 (52.6)	
Health Insurance Coverage			
Private (n = 6,739)	6,496 (44.9)	243 (39.9)	0.0004
Medicaid and other public (n = 1,512)	1,430 (38.9)	82 (21.3)	
Other coverage (n = 506)	487 (46.7)	19 (40.2)	
Uninsured (n = 1,107)	1,044 (23.0)	63 (9.5)	
Marital Status			
Married (n = 4,503)	4,411 (44.5)	92 (46.7)	<0.0001
Separated, divorced, or widowed (n = 2,317)	2,248 (42.8)	69 (25.3)	
Single, never married (n = 3,061)	2,817 (35.6)	244 (24.4)	
Age			
18-29 (n = 2,164)	2,002 (35.6)	162 (22.9)	<0.0001
30-39 (n = 2,185)	2,091 (40.0)	94 (30.8)	
40-49 (n = 1,935)	1,871 (38.6)	64 (45.8)	
50-64 (n = 3,611)	3,524 (48.9)	87 (38.5)	

Table 1b. Selected characteristics of sample adult males- National Health Interview Survey, United States, 2017

	Sexual Orientation		
	Straight	**Gay/Bisexual**	**$\chi 2$**
	No (% vaccinated for influenza)	**No (% vaccinated for influenza)**	**p-value**
Overall (n = 8,663)	8,353 (32.7)	310 (47.6)	
Race			
White (n = 6,905)	6,651 (33.3)	254 (50.0)	0.0185
Black/African American (n = 907)	881 (25.7)	26 (17.8)	
Other (n = 634)	621 (37.2)	13 (50.1)	
Multi-racial (n = 201)	185 (36.5)	16 (59.9)	
Ethnicity			
Non-Hispanic (n = 7,487)	7,223 (34.1)	264 (48.1)	0.8091
Hispanic (n = 1,176)	1,130 (26.8)	46 (45.3)	
Education			
No high school diploma (n = 842)	827 (23.1)	15 (33.6)	0.0063
High school diploma or GED (n = 2,207)	2,149 (25.5)	58 (53.5)	
Some college (no degree) (n = 1,703)	1,621 (31.0)	82 (31.0)	
Associates degree (n = 987)	965 (30.9)	22 (42.6)	
Bachelor's degree (n = 1,902)	1,820 (39.3)	82 (50.4)	
Graduate degree (n = 1,022)	971 (50.8)	51 (62.8)	
Health Insurance Coverage			
Private (n = 6,109)	5,885 (36.1)	224 (51.3)	0.0557
Medicaid and other public (n = 854)	817 (29.9)	37 (38.2)	
Other coverage (n = 519)	503 (47.7)	16 (69.0)	
Uninsured (n = 1,144)	1,112 (13.0)	32 (15.3)	
Marital Status			
Married (n = 3,877)	3,816 (37.3)	61 (65.3)	<0.0001
Separated, divorced, or widowed (n = 1,606)	1,569 (30.8)	37 (39.8)	
Single, never married (n = 3,158)	2,947 (26.1)	211 (41.4)	
Age			
18-29 (n = 2,015)	1,914 (25.2)	101 (30.7)	0.0019
30-39 (n = 1,848)	1,790 (28.1)	58 (48.4)	
40-49 (n = 1,773)	1,728 (33.8)	45 (59.6)	
50-64 (n = 3,027)	2,921 (41.5)	106 (63.8)	

Table 2a. Bivariate and multivariate predictors of flu vaccination status among sample adult females- National Health Interview Survey, United States, 2017

	Received flu vaccine in past year N (%)	Bivariate analysis PR (95% CI)[b]	Multivariate analysis[a] aPR (95% CI)[c]
Overall (n = 10,206)	4,272 (41.1)	N/A	N/A
Sexual Orientation			
Straight (n = 9,488)	4,013 (41.6)	1	1
Lesbian/Gay/Bisexual (n = 407)	139 (30.5)	0.735 (0.609, 0.886)	0.940 (0.742, 1.191)
Type of primary care provider			
General practitioner only (n = 3,759)	1,656 (44.3)	1	1
OB/GYN only (n = 960)	357 (34.7)	0.786 (0.695, 0.888)	2.292 (0.922, 5.698)
Both (n = 3,450)	1,732 (49.6)	1.121 (1.055, 1.192)	1.175 (0.813, 1.699)
neither (n = 2,018)	523 (24.3)	0.549 (0.491, 0.612)	1.605 (0.810, 3.179)
Race			
White (n = 7,961)	3,385 (41.7)	1	1
Black/African American (n = 1,293)	472 (35.2)	0.844 (0.760, 0.937)	0.889 (0.799, 0.989)
Other (n = 698)	316 (47.1)	1.130 (1.018, 1.254)	1.161 (1.047, 1.287)
Multi-racial (n = 225)	85 (34.2)	0.820 (0.656, 1.026)	0.863 (0.696, 1.071)
Ethnicity			
Non-Hispanic (n = 8,726)	3,726 (42.1)	1	1
Hispanic (n = 1,480)	546 (36.4)	0.865 (0.798, 0.938)	1.010 (0.926, 1.102)
Education			
No high school diploma (n = 967)	347 (34.6)	1	1
High school diploma or GED (n = 2,138)	777 (36.6)	1.059 (0.928, 1.208)	0.948 (0.833, 1.080)
Some college (no degree) (n = 2,118)	810 (38.3)	1.105 (0.969, 1.262)	0.983 (0.863, 1.121)
Associates degree (n = 1,294)	561 (42.1)	1.217 (1.055, 1.404)	1.021 (0.890, 1.172)
Bachelor's degree (n = 2,385)	1,092 (43.3)	1.251 (1.107, 1.415)	1.037 (0.916, 1.173)
Graduate degree (n = 1,304)	685 (54.1)	1.563 (1.378, 1.772)	1.271 (1.117, 1.447)
Health Insurance Coverage			
Private (n = 6,914)	3,179 (44.8)	1	1
Medicaid, and other public (n = 1,584)	603 (37.6)	0.839 (0.765, 0.920)	0.981 (0.892, 1.079)
Other coverage (n = 532)	232 (45.7)	1.021 (0.898, 1.160)	1.030 (0.905, 1.173)
Uninsured (n = 1,141)	248 (22.6)	0.505 (0.439, 0.581)	0.644 (0.555, 0.747)
Marital Status			
Married (n = 4,596)	2,093 (44.5)	1	1
Separated, divorced, or widowed (n = 2,396)	1,027 (42.8)	0.963 (0.898, 1.033)	0.989 (0.922, 1.061)
Single, never married (n = 3,194)	1,143 (34.7)	0.781 (0.728, 0.838)	0.939 (0.868, 1.016)
Age			
18-29 (n = 2,231)	793 (34.7)	1	1
30-39 (n = 2,246)	847 (39.6)	1.142 (1.042, 1.251)	1.025 (0.930, 1.130)
40-49 (n = 1,991)	797 (39.0)	1.123 (1.020, 1.236)	0.976 (0.878, 1.085)
50-64 (n = 3,738)	1,835 (48.5)	1.398 (1.285, 1.522)	1.205 (1.095, 1.326)

[a]Adjusted for all other factors presented in the table

[b]Prevalence ratio (95% confidence interval)

[c]Adjusted prevalence ratio (95% confidence interval)

Table 2ai. Interaction between sexual orientation and healthcare provider type as predictors of flu vaccination status among sample adult females- National Health Interview Survey, United States, 2017

	Straight aPR (95% CI)[b]	Sexual Minorities aPR (95% CI)[b]
Type of primary care provider		
General practitioner only (n = 3,759)	1	1
OB/GYN only (n = 960)	2.292 (0.922, 5.698)	0.802 (0.612, 1.052)
Both (n = 3,450)	1.175 (0.813, 1.699)	1.065 (0.829, 1.367)
neither (n = 2,018)	1.605 (0.810, 3.179)	0.607 (0.466, 0.791)

Table 2b. Bivariate and multivariate predictors of flu vaccination status among sample adult males- National Health Interview Survey, United States, 2017

	Received flu vaccine in past year N (%)	Bivariate analysis PR (95% CI)[b]	Multivariate analysis[a] aPR (95% CI)[c]
Overall (n = 8,883)	2,966 (33.2)	N/A	N/A
Sexual Orientation			
Straight (n = 3,353)	2,746 (32.7)	1	
Gay/Bisexual (n = 310)	142 (47.6)	1.455 (1.240, 1.708)	1.362 (1.180, 1.571)
Race			
White (n = 7,071)	2,387 (33.9)	1	1
Black/African American (n = 941)	255 (25.46)	0.751 (0.650, 0.868)	0.822 (0.712, 0.948)
Other (n = 649)	247 (37.7)	1.113 (0.986, 1.255)	1.072 (0.959, 1.199)
Multi-racial (n = 206)	74 (38.5)	1.137 (0.912, 1.417)	1.069 (0.929, 1.469)
Ethnicity			
Non-Hispanic (n = 7,678)	2,632 (34.6)	1	1
Hispanic (n = 1,205)	334 (27.4)	0.792 (0.704, 0.891)	0.963 (0.862, 1.075)
Education			
No high school diploma (n = 878)	226 (23.8)	1	1
High school diploma or GED (n = 2,264)	590 (26.3)	1.109 (0.937, 1.312)	1.015 (0.863, 1.075)
Some college (no degree) (n = 1,741)	541 (31.2)	1.315 (1.114, 1.552)	1.179 (0.996, 1.396)
Associates degree (n = 1,008)	322 (31.3)	1.316 (1.090, 1.589)	1.104 (0.920, 1.325)
Bachelor's degree (n = 1,941)	754 (39.6)	1.666 (1.426, 1.946)	1.364 (1.158, 1.606)
Graduate degree (n = 1,051)	533 (51.1)	2.153 (1.832, 2.530)	1.621 (1.370, 1.918)
Health Insurance Coverage			
Private (n = 6,255)	2,281 (36.7)	1	1
Medicaid and other public (n = 822)	289 (30.4)	0.828 (0.729, 0.940)	0.985 (0.859, 1.129)
Other coverage (n = 533)	247 (48.5)	1.322 (1.170, 1.494)	1.245 (1.086, 1.426)
Uninsured (n = 1,169)	145 (13.0)	0.355 (0.292, 0.431)	0.430 (0.352, 0.527)
Marital Status			
Married (n = 3,952)	1,495 (37.9)	1	1
Separated, divorced, or widowed (n = 1,647)	533 (30.7)	0.810 (0.724, 0.906)	0.868 (0.777, 0.971)
Single, never married (n = 3,259)	929 (27.1)	0.715 (0.653, 0.783)	0.919 (0.833, 1.015)
Age			
18-29 (n = 2,069)	541 (25.3)	1	1
30-39 (n = 1,889)	541 (29.0)	1.144 (1.012, 1.293)	1.024 (0.907, 1.157)
40-49 (n = 1,815)	592 (34.5)	1.362 (1.208, 1.535	1.190 (1.048, 1.351)
50-64 (n = 3,110)	1,292 (42.1)	1.663 (1.504, 1.840)	1.405 (1.255, 1.573)

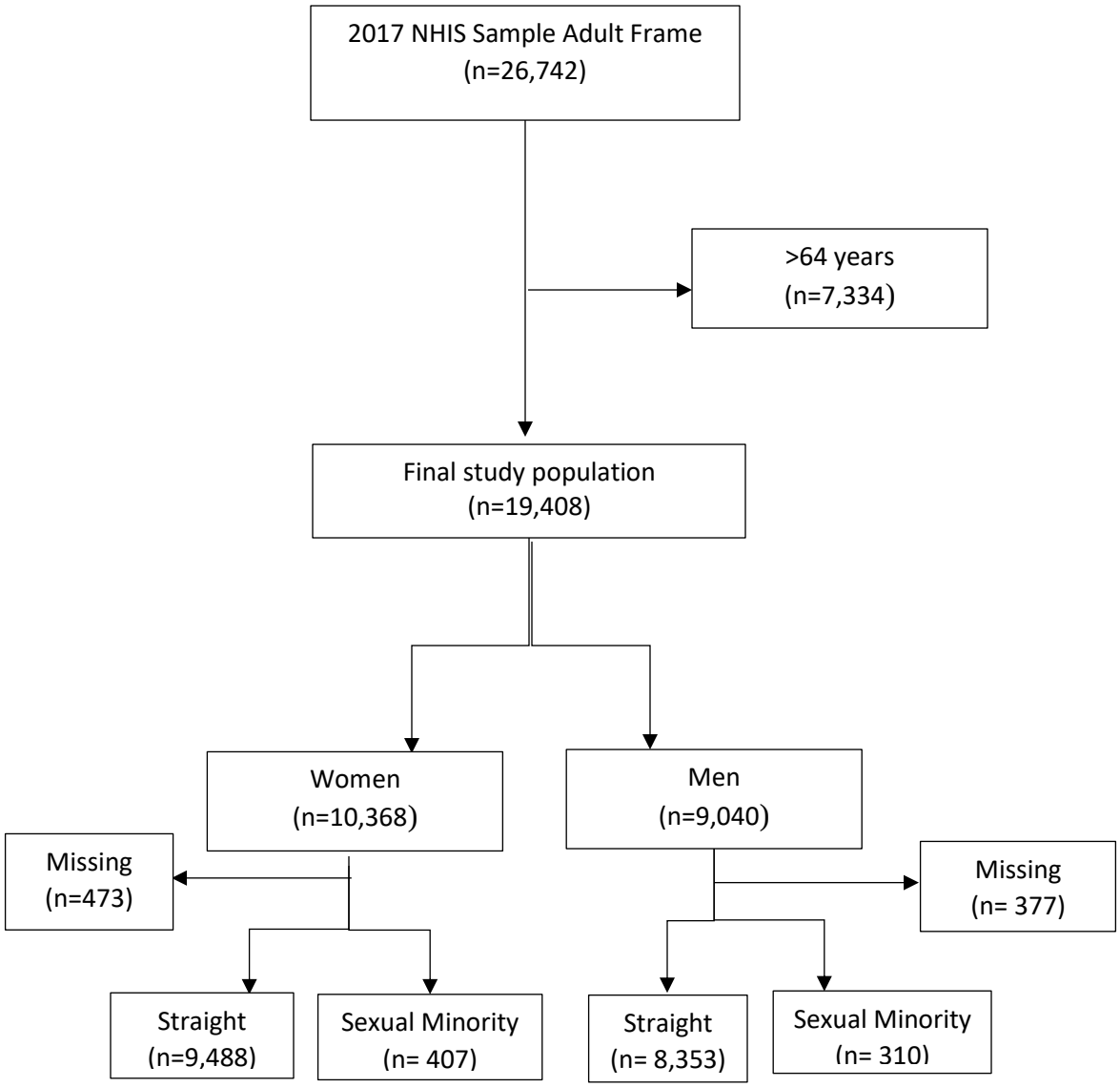
[a]Adjusted for all other factors presented in the table

[b]Prevalence ratio (95% confidence interval)

[c]Adjusted prevalence ratio (95% confidence interval)

Figure

Figure 1. Determination of Study Population



CHAPTER III: POSSIBLE FUTURE DIRECTIONS

We determined that sexual minority women were less likely to receive an influenza vaccine, public health interventions should target this population to increase availability and awareness of influenza vaccines. We found that black and uninsured women and men, and separated, divorced, or widowed men were less likely to get an influenza vaccine, independent of sexual orientation. More research is needed to investigate effective interventions to promote influenza vaccine uptake among these populations. Mobile clinics and community influenza vaccination campaigns may be effective methods to reach individuals with no health insurance.

Sexual minority women who did not see either a GP or an OBGYN in the past year were disproportionately less likely to receive an influenza vaccine. Interventions that target this subpopulation are needed, such as community awareness campaigns, as they may not be receiving information about the importance of the vaccine from other sources. Research has shown that sexual minority individuals are most likely to access mental health services and care for chronic conditions, which could be potential avenues for intervention.

However, research in this area is limited and inconclusive. As sexual minorities often face poorer health outcomes and discrimination in healthcare, something that can affect quality of life, more research should be conducted to determine where to target interventions to improve sexual minority health.