SOCIODEMOGRAPHIC FACTORS ASSOCIATED WITH COVID-19 VACCINATION AMONG YOUNG SEXUAL AND GENDER MINORITY ADOLESCENTS IN THE DEEP SOUTH

By

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(Under the Direction of Andrea Swartzendruber)

ABSTRACT

There is a dearth of information about COVID-19 vaccination to guide prevention efforts among sexual and gender minority (SGM) adolescents, who experience inequitable healthcare access. This study assessed associations between sociodemographic factors, including having a chronic illness, and being fully vaccinated, defined as receiving two doses, among 274 SGM adolescents located in eight Deep South states. Adjusted analysis showed having a paid job (OR=2.35; 95% CI:(1.23, 4.46)) was associated with an increased likelihood of being fully vaccinated, and prior homelessness (OR= 0.43; 95% CI: (0.19, 0.95)) and living in a household receiving increased number of forms of government assistance (OR=0.66; 95% CI: (0.5, 0.87)) was associated with a decreased likelihood of being fully vaccinated. Public health officials should customize mitigation strategies towards helping homeless SGM adolescents and increase education on how vaccination is crucial for adolescents with specific chronic conditions.

INDEX WORDS: Sexual and gender minorities, LGBTQIA+, COVID-19, vaccines, adolescents

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CHAPTER 1

INTRODUCTION

1.1 Importance of COVID-19 vaccination

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes the infectious respiratory disease COVID-19.[1-3] COVID-19 has caused a worldwide pandemic since 2019. The Centers for Disease Control and Prevention (CDC) has reported over 984,000 total deaths and 80 million cases in the United States (U.S.) as of April 14th, 2022. Although children and adolescents may not be as severely affected by COVID-19 infections, the number of cases, emergency room visits, and hospital admissions for COVID-19 are increasing among young people.[4-6] Infected young people can also spread the virus to others, such as the elderly or adults with comorbidities, who can be severely affected.[2,5,7]

Since the development and the Food and Drug Administration (FDA)[8] approval of three COVID-19 specific vaccines in 2020, there is increased hope for controlling the COVID-19 pandemic.[2,9,10] In order to sufficiently control the COVID-19 pandemic, public health mitigation strategies, including vaccination, are necessary. While vaccines alone are not enough to control the pandemic, they are a crucial component in decelerating the spread of disease and reaching herd immunity.[11] Achieving high vaccination rates among children and adolescents is imperative to reducing the transmission, morbidity, and mortality of COVID-19.[2,9,10] Areas of the U.S. with low healthcare access and minoritized communities who disproportionately experience barriers to healthcare access, may require enhanced and tailored COVID-19 prevention and treatment services.

1.2 COVID-19 in the Deep South

COVID-19 cases have been constant in the [*]Southern region of the U.S. due to the South's poor health care access and high rates of comorbidities that are associated with COVID-19 infections, such as obesity, hypertension, and heart disease.[2,12] Not only does the South rank the highest in the country for comorbidities for COVID-19, the region also has historically low vaccination rates.[13] The proportion of adolescents accounting for COVID-19 cases has increased over time, consequently increasing transmission.[6,7] The combination of increased adolescent cases and low vaccination rates, poses a major dilemma for the South in contributing to its high burden of COVID-19 impacts.[6,7,12]

1.3 Brief overview of health disparities and barriers to healthcare access among SGM adolescents

Adolescents in the Deep South and sexual and gender minority (SGM) adolescents in particular are disproportionately burdened by multiple adverse health outcomes and often experience numerous barriers to healthcare.[12,14-16] SGM individuals include, but are not limited to, those who identify as lesbian, gay, bisexual, transgender, queer, intersex, and/or asexual (LGBTQIA+).[15,17,18] Minoritized adolescents, such as SGMs, people of color, and others, are disproportionately affected by the impacts of COVID-19 including closing schools, financial burdens, shutting down safe spaces, increasing anxiety and stress, lack of access to healthcare, quarantining, and isolation from friends and support systems.[15-22] The SGM community has faced incredible challenges not only in their day-to-day lives at work or school, but also when

[*] For the purpose of this paper the Southern region/ Deep South is qualified as the following states: Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee.

they need medical help or financial assistance.[14-19,23-26] Adolescents frequently experience discrimination surrounding their non-heteronormative identity, such as job discrimination, cyberbullying, social stigma, health inequalities, etc.[14] The COVID-19 global pandemic has only heightened the glaring healthcare inequalities among SGM adults and adolescents.[14-18,22,23] It is important to assess COVID-19 impacts on minoritized groups, such as SGM adolescents, because they are underserved and overlooked.[14,16,18,19,23,24,26,27]

Vaccination is a key instrument in mitigation tactics to manage the COVID-19 pandemic.[5,10,13,28-30] Because the SGM community is often overlooked and under-resourced, it is vital that we explore adolescent SGM vaccination rates for COVID-19. In order to achieve high vaccination rates among adolescents, enhanced efforts may be needed to ensure proper care and support for minoritized communities, such as SGM adolescents, who disproportionately experience barriers in accessing healthcare.[14-19,23-25]

1.4 Aims of the paper

This analysis is based on preliminary data collected as a part of the Experience of violence, Technology, Relationship, And Communication (eTRAC) study, which was led by researchers at the University of Georgia. The study involved an online quantitative survey about technology use and health to access a wide range of health-related behaviors among SGM adolescents in the Deep South. The aims of this analysis were to describe receipt of two doses of the COVID-19 vaccine and examine sociodemographic factors, including health factors that prioritize people for vaccination, in relation to full vaccination status among SGM adolescents in the Deep South. Specifically, we assessed associations between full vaccination status and sociodemographic factors such as age, gender identity, paid job status, sexual identity, race/ethnicity, school enrollment, household receipt of public assistance forms, insurance status,

foster care involvement, prior homelessness and risk factors for severe disease, including BMI and chronic illness. The findings may be helpful for informing targeted public health strategies to increase vaccine uptake among highly marginalized young people who often experience many barriers to receiving quality healthcare.

CHAPTER 2

BACKGROUND

2.1 COVID-19 background and epidemiology

In December 2019, a novel coronavirus identified as SARS-CoV-2 was discovered in Wuhan, China.[2,3,5] SARS-CoV-2 is highly transmissible and causes an upper respiratory infection known as COVID-19, which spread across the world quickly with over 500 million cases and 6 million deaths worldwide as of April 14th, 2022.[1-3,31] COVID-19 is spread through droplet transmission and those of all ages are susceptible to infection while those with comorbidities are at a higher risk than others.[2,3,6,12,32,33] While children and adolescents may not be as severely affected by COVID-19 infections, the number of cases, emergency room visits, and hospital admissions for COVID-19 are increasing among young people.[4-6]

The CDC has age stratified data available for COVID-19 cases, deaths, and vaccination rates as of April 14th, 2022. Age group was available for 70,207,403 (98%) cases; adolescents aged 12-17 account for 5,314,606 cases.[1] Age group was available for 831,545 (99%) deaths; the number of deaths attributed by adolescents 12-17 years old is less than 700 deaths.[1] Age was available for 218,705,260 (99.9%) people fully vaccinated; adolescents aged 12-17 account for 14,867,549 (6.8%) people fully vaccinated.[1]

At the start of the pandemic many countries enacted severe mitigation measures such as implementing lockdowns, strict masking policies, social-distancing policies, and quarantine regulations for those infected.[3,34] COVID-19 escalated quickly which highlighted the weakness in many countries prevention and preparedness systems for when a pandemic occurs. The U.S.

was arguably the most prepared country for a pandemic, but their response resulted in what most people consider a failure to act due to mismanaged leadership. The U.S. has over 80 million cases and 984,744 deaths as of April 14th, 2022.[1]

The Southern region of the U.S. has maintained a gradual increase in the number of COVID-19 cases.[2,12] The CDC displays the total number of cases per state since January 21st 2020. The total number of cases for the Deep South is 17,778,210 as of April 14th, 2022.[1] The total number of COVID-19 related deaths in the Deep South is 227,305 deaths as of April 14th, 2022.[1] The Deep South accounts for 22% of cases and 23% of deaths in the U.S.

2.2 COVID-19 vaccines and vaccination rates

At the start of the COVID-19 pandemic in 2020, mitigation strategies were put in place to slow the spread of the disease, and with the breakthrough of multiple highly effective vaccines there is increased anticipation for the end of the pandemic. Administering vaccinations during a pandemic is an essential factor in reducing associated cases and deaths.[35] To date, the FDA has approved three vaccines for use in the U.S. to control COVID-19: Pfizer-BioNTech, Moderna, and Johnson & Johnson's Janssen (J&J/Janssen).[3,32,36] On December 11th 2020, the FDA issued the first emergency use authorization (EUA) for use of the Pfizer-BioNTech COVID-19 vaccine in persons aged 16 years and older.[37] Days later on December 18th 2020, the FDA issued the second EUA for use of the Moderna COVID-19 vaccine in persons aged 18 years and older.[37] Lastly on February 27th 2021, FDA issued the third EUA for use of the J&J/Janssen COVID-19 vaccine in persons aged 18 years and older.[37]

In 2021, the FDA authorized an EUA for the Pfizer-BioNTech COVID-19 vaccine to include children 5-11 years of age.[36,37] COVID-19 vaccines are free and available to everyone 5 and older (Pfizer-BioNTech specifically, 18 and older for Moderna and J&J/Janssen).[30,36,37]

Based on evidence from clinical trials in preventing laboratory-confirmed infection with the virus that causes COVID-19 among people who received two doses and had no evidence of being previously infected; the Pfizer-BioNTech COVID-19 vaccine was >90% effective, the Moderna COVID-19 vaccine was 94.1% effective, and J&J/Janssen COVID-19 vaccine was 66.3% effective.[36,37] The COVID-19 vaccine development is a major leap in medicine and an important step in ending the pandemic.[10,28,35,37,38]

The overall vaccination rate for the U.S. is 65.9% with 218,707,476 people fully vaccinated as of April 14th, 2022.[1] The majority of the vaccines administered to date, are Pfizer-BioNTech and Moderna.[36] The Mayo Clinic tracks the percentage of the population in each state that is fully vaccinated and has at least on dose. As of April 14th, 2022, the percentage of the population fully vaccinated in the Deep South states are: 50.9% for Alabama, 66.7% for Florida, 54.5% for Georgia, 53.3% for Louisiana, 51.6% for Mississippi, 60.5% for North Carolina, 56.6% for South Carolina, and 54.3% for Tennessee.[1,39] The COVID-19 vaccination rates are lower in the Deep South and in order to better manage the spread of COVID-19 we need to better understand the factors associated with high and low vaccination rates among the population.

The Mayo Clinic reports that 58.7% of adolescents ages 12-17 are fully vaccinated as of April 14th, 2022.[39] Further analysis of adolescent vaccination rate by state establishes the percentage of fully vaccinated adolescents ages 12-17 in the Deep South as the following: 34.1% for Alabama, 55.2% for Florida, 42.8% for Georgia, 38.1% for Louisiana, 37.5% for Mississippi, 50.1% for North Carolina, 44.5% for South Carolina, and 38.3% for Tennessee.[39] The vaccination rates for adolescents in the Deep South are much lower than other regions of the U.S.. We need to determine the source(s) of vaccine hesitancy among adolescents to better understand how public health officials need to address hesitancy to increase vaccination rates.

2.3 Health disparities and barriers to healthcare access among SGM adolescents in the Deep South

SGM are individuals that fall on the LGBTQIA+ spectrum and whom do not conform to heteronormative identities.[15,17,18] The Youth Pride Association (YPA)[40] states that gender and biological sex are not the same thing, and that gender is the characteristics, feelings, and attitudes that society associates with perceived biological sex. Gender identity refers to a person's internal understanding of their own gender, and this may not be their assigned sex at birth based on anatomy. [40,41] The 2019 Youth Risk Behavior Survey[42] assessed 13,677 questionnaires and found that nationwide, 84.4% of students self-identified as heterosexual, 2.5% as gay or lesbian, and 8.7% as bisexual; 4.5% were not sure of their sexual identity.

Health disparities and barriers for SGM individuals are multifaceted and complex. Studies have found that SGM individuals are disproportionately affected by chronic health conditions, unintended sexual health outcomes, anxiety, depression, substance misuse, suicidality, sexual assault, and physical violence.[14-18,20,21,23,24,27,33,41] Literature reviews show that SGM adults are more likely to report their health as poor, have more chronic conditions such as higher rates of obesity among lesbians and bisexual women, and have higher substance abuse such as heavy alcohol consumption.[15,19,23,41,43] SGM adolescents also face increased discrimination, violence, homelessness, and other life stressors due to their sexual and gender identities.[40,41] These minority stressors have been shown to impact their access to quality healthcare.

SGM adults disproportionately experience adverse health outcomes and inadequate healthcare access due to financial struggles, stigma, and discrimination.[17,41] Healthcare barriers for SGM individuals include financial adversity and include the lack of insurance, access to

medication, access to counseling, and social support groups.[25,41] A review of health disparities for SGMs by Kates *et al*.[41] reported that in one survey of transgender individuals, nearly half (48%) of respondents postponed or went without care when they were sick because they could not afford the care.[44] Kates *et al.*[41] also reported a recent study showing that two thirds of LGBT adults had experienced some form of discrimination because of their sexual orientation or gender identity, with 30% stating that they had been physically threatened or attacked.[45]

SGM individuals have been persecuted and discriminated against throughout history depending on the societies in which those individuals live.[18,19,46] SGM individuals have poorer access to healthcare in the South, especially.[23,25,41] The intolerance, discrimination, and prejudice towards SGM individuals have persisted throughout the South exposing minoritized groups to negative attitudes and hatred. [14,17,19,23,27,43] Many states throughout the South have policies that exclude and fail to protect SGM individuals in their daily lives.[47,48] The Human Rights Campagin[48] asserts that in 2021, over 250 bills have been introduced against SGM individuals. In addition to the increasing anti-SGM policies, there is also increasing anti-SGM sentiment. The South harbors 14 anti-LGBTQ hate groups out of the 65 across America.[49] SGM Southerners will experience increased challenges in economic security, health access, and outcomes, as well as in daily life.[12,25,47]

The discrimination and stigma that SGM individuals encounter can leave devastating effects on their lives. An important aspect that public health officials should consider is how the multiple barriers to healthcare and health disparities affect SGM individuals' personal healthcare decisions, such as vaccination. Public Health organizations need to dissect the underlying causes as to why SGM individuals, especially adolescent SGM, choose to be or not be vaccinated. By ascertaining the specific causes as to why a minoritized group may not be getting vaccinated,

public health officials can create targeted vaccination efforts directed at bettering those groups in need.

2.4 COVID-19 and vaccine hesitancy among adolescents

Since the 18th century, vaccine development has been a key element in preventing diseases and preventing the further spread of diseases to others.[29,35,50] The World Health Organization (WHO)[51] reports that there are more than 20 vaccines that prevent life-threatening diseases. Vaccines have been crucial to effectively controlling many once-common childhood infectious diseases.[11,29,35,38,51] However, since the beginning of vaccine development, there has been resistance, misinformation, coincidental temporal relationships to adverse health outcomes, and mistrust in governing authorities.[28,29,50,52] Vaccine hesitancy refers to a varying collection of beliefs and behaviors around whether to accept vaccinations, ranging from complete refusal to complete acceptance for oneself or one's children.[28,29,35,53]

Hesitancy related to COVID-19 vaccination is shrouded in concerns of possible side effects (infertility, pregnancy risks, etc.), conspiracies, quickness in their creation, safety of ingredients, or the idea of natural immunity being better.[28,29,32,35,38,50,52] Differences in vaccine hesitancy among adolescents may differ based on sources of vaccine information, general fear surrounding COVID-19, their vaccine knowledge, parental control, and their sociodemographic characteristics.[7,30,53] Sources of vaccine information can include family, friends, school programs, and social media or other online sites. Misinformation engenders conspiracy theories and myths about the COVID-19 vaccines. An adolescent's general fear surrounding COVID-19 can stem from the fear of needles, fear of lost loved ones, mistrust in authority figures (doctors), or poor prior experiences with the medical system.[30,53] Adolescents' knowledge or lack of knowledge about vaccines can also shape their perception of the safety, reliability, and efficacy

of a vaccine. The less a person knows about a topic the more likely they are to reject or fear that subject – in this case the lack of knowledge surrounding the vaccines, including the vaccine production process, the efficacy and effectiveness of each vaccine (and how to differentiate the terms), the safety and side effects of the vaccines, and how they work in our bodies. A national study performed by Brandt *et al*.[7] assessed adolescents' (14-24) opinion on the COVID-19 vaccines. The major concern of adolescents was vaccine safety. The underlying source of vaccine hesitancy is education. Clear and informational vaccine education is a necessity to eliminating the fear of vaccine hesitancy and increasing vaccination uptake.[7,13,28,29,35,38,50,52,53]

A scoping review done by AlShurman *et al*[30] examined factors associated with intentions to be vaccinated against COVID-19. The majority of studies (n = 34/48) reported a relatively high prevalence of intention to get vaccinated against COVID-19, with a range from 60% to 93% among adults aged 18-60 years old.[30] This review specifically analyzed COVID-19 vaccine intentions and determined there are three core constructs that influence the intention to get the COVID-19 vaccine: modifying factors, individual perceptions, and likelihood of action. Modifying factors include demographic factors, social influence, and vaccine recommendations. Individual perceptions include vaccine related perceptions and health-related perceptions. The likelihood of action includes perceived barriers and vaccination beliefs and attitudes. Although this study did not include adolescents, the findings provide a basis for how adolescents might be influenced and how the three constructs should be targeted to increase adolescent vaccine uptake.

Even though the CDC[32], WHO[51] and other publications[29,52,53] have demonstrated common narratives regarding vaccine misinformation/ to be inaccurate and attempted to calm the concerns, many people still have underestimated the importance of vaccinations for a variety of reasons. Young people may be vulnerable to the lies and misinformation spread from social

media cites, the news, even from the adults in their lives.[5,10,29,50,52,53] Overcoming hesitancy concerns for the COVID-19 vaccine, and other vaccines, will advance public health care and improve life for many people at risk for major health concerns and those with comorbidities.

2.5 Gaps in the literature

This paper highlights the gaps in the literature concerning SGM adolescents and their involvement with COVID-19. Several reviews[14,15,17,18,22-25] call for filling in the gap of data on SGM specifically. There is a gap in the literature for vaccination rates among SGM adolescents. The CDC still reports COVID-19 estimates for only males and females, leaving out millions of people that do not identify as just male or female. Vaccine uptake by the SGM population is understudied and underreported by many major health institutions, which emphasizes the lack of representation and multiple healthcare barriers among this population that are known to exist.[14,16-19,22,24,25] Identifying the social factors that are associated with full vaccination status will help public health policy decision makers to adjust strategies to improve COVID-19 vaccine uptake and confidence in the vaccine.[29,35,38,51-53] Public health officials may be able to use the information gained from this paper and study to guide prevention messages an efforts.

CHAPTER 3

PURPOSE AND SIGNIFICANCE

There is a lack of COVID-19 information (cases, deaths, vaccination rates, etc.) among SGM individuals[14-16,22,24,27] Minoritized communities have been unduly burdened by negative physical, mental, and socioeconomical outcomes due to disparities caused by discrimination and stigma.[14,16,17,19,21,24-27,41,43] The pandemic introduced not only a fear of developing a severe illness, but also exacerbated existing health disparities through lockdowns, isolation, and other sociopolitical events during this time period.[14-16,27] As a result, greater understanding of the impacts of COVID-19 on minoritized communities is needed.[14-16,27] Not only is there a lack of COVID-19 specific information among SGM communities, but there is also little information on how the pandemic has affected SGM adolescents in particular. This paper will contribute to filling in the gap of information on COVID-19 vaccination rates among SGM adolescents.[22]

The purpose of this study was to identify the sociodemographic factors most associated with COVID-19 vaccination among SGM adolescents living in the Deep South. This paper will offer insight on sociodemographic factors associated with vaccination status among adolescent SMG in the Deep South. The findings may be helpful for tailoring public health COVID-19 messaging and prevention efforts specifically tailored for SGM adolescents

CHAPTER 4

METHODOLOGY

4.1 Description of research design

The eTRAC study led by researchers at the University of Georgia, is a mixed methods research study about technology and health among SGM adolescents in the Deep South. A convenience sample of 274 sexual and gender minority adolescents aged 13-17 years residing in the Deep South were recruited for study participation from May - December 2021. To contact a more diverse sample and to specifically target adolescents frequenting digital platforms, which was a prime focus of this research, youth were recruited from tailored advertising on popular social media sites, primarily Facebook and Instagram.

Paid online recruitment ads automatically redirected interested users to an online screener when clicked (still image ads) or swiped up (story/video ads). Adolescents independently completed the short online screener (<2 minutes) and viewed whether they are eligible for study participation. If eligible, respondents were able to consent to participation online and fill out an enrollment form. Dual authentication processes and spam protection measures (i.e., enable reCAPTCHA, ballot box stuffing prevention, limit duplicate IP addresses) were then used to validate the unique identity of each enrollee and prevent duplicate responses, fraud, or spambot submissions. Once enrolled and validated, each participant was provided a one-time use anonymous survey link for quantitative data collection.

To be eligible for study participation, respondents must: (1) be 13-17 years old; (2) reside in Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, or

Tennessee; (3) identify as a sexual and gender minority (lesbian, gay, bisexual, transgender, queer, gender non-conforming, questioning, same gender loving, intersex, asexual, and pansexual); (4) report a previous or current romantic or sexual partner, which may include someone with whom they are talking or hooking up; and (5) consent to participate.

Mixed-methods data collection consisted of a quantitative online survey and semi-structured in-depth interviews (IDIs) conducted via Zoom (audio only) with a subset of SGM youth (n=35) purposefully sampled based on state of residence and demographic characteristics. Respondents completing the quantitative survey received a $20 e-gift card as compensation for their time and adolescents participating in the IDIs received a $30 e-gift card.

4.2 Measures of the outcome

The main outcome of interest was full vaccination status. Respondents were asked, "Have you received the COVID-19 vaccine?" Response options included: a) No, b) Yes, the first dose only, and c) Yes, both doses (fully vaccinated). Individuals who responded that they were fully vaccinated were coded as 1 and individuals who had one dose or no doses were categorized as not being fully vaccinate and coded as 0.

4.3 Measures of the independent variables

This paper analyzed the following independent variables: age, sex assigned at birth, gender identity, sexual identity, race/ethnicity, grade level completion, household receipt of public assistance forms, paid job status, insurance status, foster care involvement, homelessness, chronic illness status, and BMI.

Age. Respondents were asked, "How old are you today?" and responded in years. Age was treated as a continuous variable in logistic modeling and a categorical variable in the frequency table (Table 2).

Sex Assigned at Birth. Respondents were asked, “What sex were you assigned at birth, on your original birth certificate?” Respondents could select: a) Male, b) Female, or Intersex.

Gender identity. Gender identity was assessed with the question: “What is your current gender identity?” Response options included: a) Male, b) Female, c) Trans male/ Trans man, d) Trans female/ trans woman, e) Genderqueer/ Gender non-conforming, and f) Different identity, please specify. Respondents were directed to select all that that apply.

First, I created a new variable to quantify the number of individuals who were transgender or cisgendered. Individuals who identified as transgender male or transgender female and those whose current gender identity differed from their sex assigned at birth were categorized as transgender and assigned a code of 1. All other individuals were categorized as cisgendered and assigned a code of 0.

Next, I created a new variable to represent individuals current gender identity. Males and trans males were categorized as “males” and coded as 1. Females and trans females were categorized as “female” and coded as 2. Individuals who identified as gender-queer or -non-conforming, a different identity, or selected multiple response options were categorized as “genderqueer or another identity” and was coded as 3. This variable was considered as a categorical variable with “female” (2) as the reference variable.

Sexual identity. Sexual identity was assessed with one question: “Which of the following best describes how you identify?” Respondents were directed to select the best fit from one of the following options: a) Straight or Heterosexual, b) Gay, c) Lesbian, d) Bisexual, e) Queer, f) Same Gender Loving, g) Asexual, h) Pansexual, i) Not Sure or Questioning, and j) Other, please specify.

Due to the small response numbers for some options, I combined and collapsed some response options together to create a new sexual identity variable. Gay, lesbian, and same gender loving were combined into one category for "gay/lesbian" and coded as 1. Individuals who identified as asexual or unsure or questioning were combined into one category as "another sexual identity" and coded as 2. The variables bisexual, queer, and pansexual were coded as is and labeled 3, 4, and 5 respectively. This variable was considered as a categorical variable with "bisexual" (3) as the reference variable.

Race. Race identity was assessed with the question, "What racial background do you identify with?" Response options included: a) American Indian or Alaskan Native, b) Asian Indian, c) Black or African American, d) Chamorro, e) Chinese, f) Filipino, g) Japanese, h) Korean, i) Native Hawaiian or Other Pacific Islander, j) Samoan, k) Vietnamese, l) White, and m) Other, please specify. Respondents were directed to select all that that apply.

Next, I created a new variable to account for singular and multiple selections. Singular selections for White and Black were left as is, coded as 1 and 2 respectively. I combined all Asian races (Asian Indian, Chinese, Filipino, Japanese, Korean, Native Hawaiian or Other Pacific Islander, Samoan, and Vietnamese) into one category, "Asian," coded as 3. Finally, I combined all singular selections for other and multiple selections into one category labeled as "Another Racial Identity" and coded as 4. This variable was considered as a categorical variable with "White" (1) as the reference variables.

Ethnicity. Hispanic ethnicity was evaluated as a yes or no question, "Are you Hispanic?" The answer yes was coded as 1 and no was coded as 0.

State. To determine where the respondents lived, they were asked, "In which state do you live?" The response options included: a) Alabama, b) Florida, c) Georgia, d) Louisiana, e)

Mississippi, f) North Carolina, g) South Carolina, h) Tennessee, or i) None of the above. If respondents selected none of the above, they were not allowed to continue the survey.

Education. Education was assessed with the question, "What is the last grade that you completed in school?" Respondents could choose one of the following: a) 6th grade or less, b) 7th grade, c) 8th grade, d) 9th grade, e) 10th grade, f) 11th grade, g) 12th grade, h) Graduated high school or GED, i) 1st year of college, j) 2nd year of college, and k) Other, please specify.

I created a new variable to collapse grade levels into middle school, high school, and other. Grades 6^{th}, 7^{th}, and 8^{th} were categorized as "middle school" and coded as 1. Grades 9^{th}, 10^{th}, 11^{th}, and 12^{th} were categorized as "high school" and coded as 2. Graduated high school or GED, 1^{st} year of college, 2^{nd} year of college, and other specified were categorized as "other" and coded as 3. This variable was considered as a categorical variable with "high school" (2) as the reference.

Foster care. Foster care involvement was assessed by a yes or no question, "Have you ever been in foster care?" The answer yes was coded as 1 and no was coded as 0.

Homelessness. To assess housing instability or homelessness, respondents were asked, "Have you ever been homeless or unsure of where you would sleep?" The answer choices were yes or no, coded as 1 or 0 respectively.

Paid Job Status. To determine the respondents' job status, they were asked a yes or no question, "Do you currently have a job you get paid for?" The answer yes was coded as 1 and no was coded as 0.

Government assistance forms. To assess government assistance as a proxy for financial needs, respondents were asked, "In the last year, did you or anyone in your household receive any of the following?" Respondents were instructed to select all that apply from the options: a)

Welfare including TANF (Temporary Assistance to Needy Families), b) Food stamps, c) Section 8 housing, d) WIC (Women, Infants, and Children), e) Disability, f) Unemployment, g) Child support, h) I don't know, and j) None of the above. The number of responses were summed

I created a new variable to understand the number of forms each participant selected. Respondents who selected "I don't know" were recoded as missing. Respondents who selected only none were categorized as "none" and coded as 0. Respondents that selected only one form, aside from none and I don't know, were categorized as '1 form' and coded as 1. Respondents who selected only two forms were categorized as '2 forms' and coded as 2. Respondents who selected 3 or more forms were categorized as '3 or more forms' and coded as 3. This variable was treated as a continuous variable.

Insurance status. Insurance status was evaluated by asking respondents, "Do you currently have health insurance?" Respondents could choose yes, no, or I don't know coded as 1, 0, or 2 respectively.

Chronic health condition. Chronic health conditions were measured by asking respondents, "Do you have a long-term or chronic health condition, meaning a health condition lasting 6 months or more? This might include living with diabetes, asthma, heart and lung conditions, cancer, etc." Respondents could choose yes or no coded as 1 or 0 respectively.

A new variable, body mass index (BMI), was calculated using the respondent-reported height and weight and then categorized into age and sex specific percentiles from the CDC's SAS code for adolescent BMI percentiles. Following the CDC's BMI-for-age percentile growth chart, four categories were created to assess underweight, healthy weight, overweight, and obese. Underweight was classified as anyone less than the 5^{th} percentile and coded as 1. Healthy weight was classified as anyone between the 5^{th} percentile to less than the 85^{th} percentile and coded as 2.

Overweight was classified as anyone between the 85th percentile to less than the 95th percentile and coded as 3. Obesity was classified as anyone equal to or greater than the 95th percentile and coded as 4. There were two missing responses to height and weight and were not included in the calculation. BMI was treated as a categorical variable with healthy weight (2) as the reference.

4.4 Data analysis

First, I used summary statistics to describe the overall study sample. Then to assess vaccine uptake among the study sample, I created frequency tables and used the chi-square test of independence to examine the relationship between each sociodemographic variable and full vaccination status. I used the sociodemographic variables that had a significant chi-square test at the α=0.05 level in the unadjusted logistic analysis. After computing the unadjusted logistic models, I kept the variables that met the $\alpha \leq 0.05$ requirement for the adjusted logistic regression. I then used backward elimination to determine the variables with greatest significance, which led to the final adjusted model. All analyses were completed using SAS on Demand for Academics via statistical analysis software version 3.8 (Enterprise Edition) on SAS Studio.

CHAPTER 5

RESULTS

5.1 Description of the study sample

There were a total number of 274 survey respondents and the summary statistics results are presented in Table 1. The study sample had an age range of 13-17 years old with a mean age of 16 years old (SD=±0.98). The majority of the respondents were in high school (89.3%), identified as White (61.7%), and had insurance (89%). Foster care involvement and homelessness were not prominent among the study sample (5.1% and 14.6% respectively). In total, only 36 (13.1%) respondents identified as transgender. The majority of the respondents were fully vaccinated (65.7%).

5.2 Analysis of full COVID-19 vaccination frequencies among sociodemographic factors

Table 2 shows the frequency of full vaccination status among each sociodemographic variable and the corresponding chi-square and p-value. Of the 180 individuals who were fully vaccinated, there was a significant association at $\alpha=0.05$ for the following variables: age, education, race, prior homelessness, the number of government assistance forms, and having a paid job. As age increased by one-year increments, the percentage fully vaccinated also increased. There was a similar association among education level as there was for age; as education level increased, the percentage fully vaccinated also increased. The percentage fully vaccinated was highest among Asian respondents (94.4%) and lowest among those of a different racial identity (57.5%). The percentage fully vaccinated was lower among adolescents that had prior homelessness (45%). As the number of government assistance forms increased the

frequency of being fully vaccinated decreased. While having two government assistance forms showed an increase in full vaccination status, having one form or three or more forms showed a decrease in full vaccination status. Overall, comparing individuals that reported no public assistance forms to those that reported having at least one public assistance form demonstrated a decrease in the percentage of being fully vaccinated. The percentage of those fully vaccinated were higher among those with a paid job (78.3%).

The chi-square test presented no significant findings for the other sociodemographic variables as shown in Table 2. It is worth noting that transgender status, gender identity, sexual orientation, BMI, and having a chronic health condition were not significantly associated with full vaccination status. The findings in Table 2 demonstrate that there are no differences among gender identities or sexual identities and the choice to be fully vaccinated or not. Those with higher BMI percentiles, such as overweight and obesity, and were fully vaccinated were not statistically different from those in the healthy weight or underweight categories that were also fully vaccinated. Those with a chronic health condition and were fully vaccinated were not statistically different from the respondents without a chronic health condition and were fully vaccinated.

5.3 Analysis of the unadjusted logistic regression models

Findings from the unadjusted analysis are presented in Table 3. The variables with significant chi-square p-values (≤ 0.05) from Table 2 were age, education, race, prior homelessness, the number of government assistance forms, and having a paid job. For the unadjusted model, I did not include education since age is an indicator of education levels. We observed statistically significant associations between full vaccination status and the following variables: age, prior homelessness, the number of government assistance forms, and having a

paid job. Although there was a significant association between full vaccination status and one racial identity (Asian respondents compared to White respondents), race as a whole category was not statistically significant.

5.4 Analysis of the final model

The results of the final model are presented in Table 4 and Figure 1. The final model included 235 observations; 39 observations were excluded due to missingness. The logistic regression model started with the variables age, prior homelessness, number of government assistance forms, and paid job status. After backward elimination at the $\alpha=0.05$ level, the final model included prior homelessness, number of government assistance forms, and paid job status. Age was removed from the final model during backward elimination; the removal of the age variable could be due to job status and age being associated. Therefore, age is accounted for in the job status variable. For every additional form increase in the number government assistance forms received, an adolescent was 34% less likely to be fully vaccinated (OR: 0.66; 95% CI: (0.5, 0.87)). Increasing government assistance forms decreased the odds of being fully vaccinated. The odds that an adolescent was fully vaccinated was 0.43 (95% CI: (0.19, 0.95)) times lower for those that have with prior experiences of homelessness compared to those who have never experienced homelessness. Prior homelessness was a significant factor in whether an adolescent in the South was fully vaccinated. The odds that an adolescent was fully vaccinated was 2.35 (95% CI: (1.23, 4.46)) times higher for those with a paid job than those without a paid job.

CHAPTER 6

DISCUSSION

The aim of this study was to describe full vaccination status against COVID-19 among SGM adolescents in the Deep South. The results of the final model provide sufficient evidence that having a paid job, prior homelessness, and increased number of government assistance forms are all significant factors associated with whether an adolescent is fully vaccinated or not. Having a paid job was associated with an increased odds of being fully vaccinated. During the pandemic several companies enforced a vaccine mandate that required employees to get vaccinated against COVID-19, which provides a potential explanation for the association between full vaccination status and having a paid job. Prior homelessness and increasing number of government assistance forms are both associated with a decreased odds of being fully vaccinated. Homeless adolescents and those with lower income may lack transportation to care, adequate information about COVID-19 vaccines, and may experience additional healthcare barriers as well.

This study has several strengths and limitations. Innovative and targeted recruitment strategies allowed us to acquire participation from a diverse sample of adolescents within a short time frame. The tailored focus of the study on SGM adolescents allows us to highlight the experience of a minoritized and highly vulnerable population. The timeliness of the findings corresponded to when the Pfizer vaccine was made available for everyone 12 and older during May-December 2021. A limitation of our study is the unknown representativeness from our findings. These results may not be generalizable to the entire population but may begin to fill the

existing gap in the literature specific to SGM adolescents. We also have limited information about respondents' motivation to be fully vaccinated, where they were vaccinated, and their sources of vaccine-related information.

Our findings suggest that there appears to be differences in vaccine uptake based on economic factors (i.e., prior homelessness and household receipt of government assistance) and therefore targeted efforts may be needed to improve vaccination accessibility for certain populations and communities. Public health officials should focus their efforts on not only aiding homeless adolescents in finding safe spaces but also aid in their healthcare. Our findings are supported by Abramovich A, *et al*.[54] study of homeless LGBTQIA+ youth in the Greater Toronto Area. They also concluded that there is a need for vaccine strategies and rollouts to prioritize and target SGM adolescents.[54]

Notably in our results we observed no significant association between risk factors for disease, having a chronic health condition and higher BMI, and the outcome of being fully vaccinated. We would have expected to have seen higher rates of vaccination for those at risk for disease, however in our sample there was no association (see Table 2). This finding highlights the disconnect of importance for SGM adolescents at priority for vaccination and being fully vaccinated. Public health officials should stress the importance of receiving vaccines, especially for those with risk factors for disease. Even though the findings of this study show that sexual and gender identity are not significantly associated with full vaccination status, minoritized groups should still be considered as vulnerable and in need of additional aid in their health education. Those that identified as genderqueer or another identity had the lowest full vaccination rate among the gender identities, which emphasizes the need for targeted and tailored vaccine efforts directed at SGM adolescents. SGM adolescents are at a higher risk for health

disparities such as violence (physical, sexual, or verbal), substance abuse, mental illness and suicidality, and chronic health conditions.[15,17,21,22,26,33,41]

Overall, the findings from this study display the need for increased public health assistance in SGM adolescents located in the Deep South. Increasing education and awareness for prioritized members of marginalized groups is necessary to enhance vaccination rates. Public health organizations should take active steps to ensure SGM adolescents that are homeless, of lower social economic status, and those at high risk of morbidity have easy access to vaccination. Inclusive and tailored prevention messaging may be warranted to achieve more optimal vaccination rates among SGM in the South.

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Table 1. Sociodemographic factors among participating sexual and gender minority adolescents in eight Deep South states.

Variable name	Total survey respondents N = 274 M(SD) or n (%)
Age (years)	16 ± 0.98
Sex Assigned at Birth	
Female	236 (86.1%)
Male	38 (13.9%)
Transgender Identity	36 (13.1%)
Gender Identity	
Male	44 (16.1%)
Female	134 (48.9%)
Genderqueer or Another Identity	96 (35.1%)
Sexual Identity	
Gay/Lesbian	50 (18.3%)
Bisexual	113 (41.2%)
Queer	34 (12.4%)
Pansexual	40 (14.6%)
Another Sexual Identity	37 (13.5%)
Racial Identity	
White	169 (61.7%)
Black or African American	47 (17.2%)
Asian	18 (6.6%)
Another Racial Identity	40 (14.6%)
Hispanic Ethnicity (yes)	46 (16.8%)
State of Residence	
Alabama	13 (4.7%)
Florida	72 (26.3%)
Georgia	53 (19.3%)
Louisiana	15 (5.5%)
Mississippi	7 (2.6%)
North Carolina	52 (18.9%)
South Carolina	30 (10.9%)
Tennessee	32 (11.7%)
Last Grade Completed[i]	
Middle School	17 (6.2%)
High School	243 (89%)
Other	13 (4.8%)

Table 1 continued. Sociodemographic factors among participating sexual and gender minority adolescents in eight Deep South states.

Variable name	Total survey respondents N = 274 M(SD) or n (%)
Prior Foster Care involvement	14 (5.1%)
Prior Homelessness	40 (14.6%)
Number of Government Assistance Forms[ii]	
0	112 (47.7%)
1	71 (30.2%)
2	35 (14.9%)
3+	17 (7.2%)
Have a Paid job	92 (33.6%)
Have Health Insurance[iii]	243 (89.0%)
Have a Chronic Health Condition[iv]	71 (25.9%)
BMI Categories[v]	
Obese	66 (24.3%)
Overweight	49 (18.0%)
Healthy weight	148 (54.4%)
Underweight	9 (3.3%)
Fully Vaccinated Against COVID-19[vi]	180 (65.7%)

i. One missing
ii. 39 omitted due to answering 'I don't know'
iii. One missing
iv. Includes living with diabetes, asthma, heart and lung conditions, cancer, etc.
v. Two missing
vi. Two doses are considered as fully vaccinated

Table 2. Comparison of full vaccination status by sociodemographic factors among participating sexual and gender minority adolescents in eight Deep South states.

Variable name	Not fully vaccinated	Fully vaccinated	Chi-Square value	p-value
Age			11.6502	0.0202
13	5 (100%)	0 (0%)		
14	6 (46.2%)	7 (53.85%)		
15	20 (37%)	34 (63%)		
16	29 (33%)	59 (67%)		
17	34 (29.8%)	80 (70.2%)		
Transgender Identity			1.5928	0.2069
Transgendered	9 (25%)	27 (75%)		
Cisgendered	85 (35.7%)	153 (64.3%)		
Gender identity			2.6652	0.2638
Female	42 (31.3%)	92 (68.7%)		
Male	13 (29.5%)	31 (70.5%)		
Genderqueer or Another Identity	39 (40.6%)	57 (59.4%)		
Sexual Identity			3.1952	0.5257
Gay/Lesbian	20 (40%)	30 (60%)		
Bisexual	36 (31.9%)	77 (68.1%)		
Queer	9 (26.5%)	25 (73.5%)		
Pansexual	17 (42.5%)	23 (57.5%)		
Another Sexual Identity	12 (32.4%)	25 (67.6%)		
Racial Identity			8.1258	0.0435
White	58 (34.3%)	111 (65.7%)		
Black	18 (38.3%)	29 (61.7%)		
Asian	1 (5.6%)	17 (94.4%)		
Another Racial Identity	17 (42.5%)	23 (57.5%)		
Hispanic Ethnicity			0.1722	0.6781
Yes	17 (37%)	29 (63%)		
No	77 (33.8%)	151 (66.2%)		
Last Grade Completed			6.6198	0.0365
Middle School	10 (58.8%)	7 (41.2%)		
High School	82 (33.7%)	161 (66.3%)		
Other	2 (15.4%)	11 (84.6%)		

Table 2 continued. Comparison of full vaccination status by sociodemographic factors among participating sexual and gender minority adolescents in eight Deep South states.

	Not fully vaccinated	Fully vaccinated		
Variable name			**Chi-Square value**	**p-value**
Prior Foster Care involvement	5 (35.7%)	9 (64.3%)	0.0130	0.9093
Prior Homelessness	22 (55%)	18 (45%)	8.8994	< 0.01
Number of Government Assistance Forms			16.1392	< 0.01
0	23 (20.5%)	89 (79.5%)		
1	30 (42.3%)	41 (57.7%)		
2	13 (37.1%)	22 (62.9%)		
3+	10 (58.8%)	7 (41.2%)		
Have a Paid Job Status			9.7065	< 0.01
Yes	20 (21.7%)	72 (78.3%)		
No	74 (40.7%)	108 (59.3%)		
Have Health Insurance			2.3825	0.1227
Yes	79 (32.5%)	164 (67.5%)		
No	14 (46.7%)	16 (53.3%)		
Have a Chronic Health Condition			0.5889	0.4428
Yes	27 (38%)	44 (62%)		
No	67 (33%)	136 (67%)		
BMI Categories			1.2283	0.7462
Obese	26 (39.4%)	40 (60.6%)		
Overweight	16 (32.7%)	33 (67.3%)		
Healthy weight	47 (31.8%)	101 (68.2%)		
Underweight	3 (33.3%)	6 (66.7%)		

Table 3. Unadjusted logistic models between sociodemographic factors & full vaccination status among participating sexual and gender minority adolescents in eight Deep South states.

Variable name	Unadjusted OR[i] (95% CI[ii])	p-value
Age	1.38 (1.07, 1.78)	0.0125
Racial Identity[iii]		0.1199
White	Reference	
Black	0.84 (0.43, 1.64)	0.6137
Asian	8.88 (1.15, 68.38)	0.036
Another Racial Identity	0.71 (0.35, 1.43)	0.3334
Prior Homelessness	0.36 (0.18, 0.72)	< 0.01
Number of Government Assistance Forms	0.63 (0.48, 0.82)	< 0.001
Have a Paid Job Status	2.47 (1.39, 4.39)	< 0.01

i. OR = Odds Ratio

ii. CI = Confidence Interval

iii. The p-value for race is the chi-square p-value which determines race as whole and association with the outcome.

Table 4. Adjusted logistic model between sociodemographic factors & full vaccination status among participating sexual and gender minority adolescents in eight Deep South states using backward elimination

Variable name	Adjusted OR (95% CI)	p-value
Prior Homelessness	0.43 (0.19, 0.95)	0.0364
Number of Government Assistance Forms	0.66 (0.5, 0.87)	< 0.01
Have a Paid Job Status	2.35 (1.23, 4.46)	< 0.01

Figure 1. Forrest plot of the adjusted logistic regression model after backwards elimination for sociodemographic factors among participating sexual and gender minority adolescents in eight Deep South States associated with full vaccination status.